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“IMPACT OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS ON ENVIRONMENT AND SUSTAINABILITY OF ENVIRONMENT”

Andhra Pradesh State Council of Higher Education, Hyderabad



Affiliated to Acharya Nagarjuna University, Guntur



Municipality, Chirala, Prakasam (Dist.), A.P



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DEPARTMENT OF CHEMISTRY



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Proceedings of National Seminar

On

**“IMPACT OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS ON
ENVIRONMENT AND SUSTAINABILITY OF ENVIRONMENT”**

on 16th & 17th, December, 2016.

Sponsored by

**ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION,
HYDERABAD**



Organized by

DEPARTMENT OF CHEMISTRY

Y.A GOVT. DEGREE COLLEGE FOR WOMEN

CHIRALA – 523155, ANDHRA PRADESH

(Affiliated to Acharya Nagarjuna University, Guntur)



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FORE WORD

First of all, I am very much thankful to almighty God for giving success in every step of my carrier, in giving energy and health. I would like to express my heartfelt gratitude to our beloved principal, Dr.Ch. RAMANAMMA in giving support, encouragement, and advices in all my activities relating to National Seminar on ***“Impact of Pharmaceuticals and Personal Care Products on Environment and Sustainability of Environment”*** during 16th and 17th December, 2016.

Pharmaceuticals and personal care products include numerous chemical classes. Some are used primarily to prevent or treat human and animal disease, whereas personal care products are used to improve the quality of daily life and include products such as hair colours, deodorants, tooth pastes, lipsticks, and moisturizers etc. Generally, Human use PPCPS are generally excreted and emitted into sewages system. These compounds may then be released into surface waters or enter terrestrial systems when sewage effluent is used for irrigation or where sewage sludge is applied as a fertilizer to agricultural lands. They have been detected in the natural environment across the world.

This Seminar aimed at creating awareness among Scientists, Scholars, Students, NGOs and Public through media about the impacts of PPCPs on health and environmental sustainability. So, there is a need among researches how to monitor the impacts of pharmaceuticals and personal care products and to attain Sustainability of Environment. Because of its hazardous behaviour we have chosen this topic for organizing National Seminar at Y.A. Govt. Degree College for Women, Chirala with the financial assistance given by Andhra Pradesh State Council of Higher Education, Hyderabad, for which I am very much thankful to APSCHE.

I express my sense of gratitude to **Andhra Pradesh State Council of Higher Education, Hyderabad** for giving financial assistance and thankful to **Chirala Municipality** for giving collaboration in organizing this National Seminar. I thank all my colleagues, resource persons, participants, patrons for lending their valuable and precious time, energy, and contributions to make this event grant success.

Finally, I also thank to several Private organizations who giving me financial support to make the seminar success.

Dr. T. Raja Rajeswari

Organizing Secretary

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MESSAGE

I am glad to know that the Department of Chemistry, YA Government Degree College for Women, Chirala will be hosting a National Seminar on a topic of great contemporary relevance entitled on "IMPACT OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS ON ENVIRONMENT AND SUSTAINABILITY OF ENVIRONMENT" during 16th and 17th December, 2016.

I am happy to know that the YA Government Degree College for Women is giving sound impetus to embark on such intimate issue global concern on the "IMPACT OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS ON ENVIRONMENT AND SUSTAINABILITY OF ENVIRONMENT" and to draw possible solutions to the far-fetching harmful effects affecting the humanity. The seminar will be very apt and of immense value to discuss the impact and remedial measures of pharmaceuticals and personal care products and to attain the sustainability of environment.

I appreciate and complement Dr.T. RAJA RAJESWARI, Organizing Secretary of the National Seminar for her initiative in this regard. I wish the deliberations in the seminar would bring a perfect understanding on the subject and suggest effective solutions to the problems identified in this sector. I wish the seminar a grand success.


(VICE CHANCELLOR)

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12th December, 2016

MESSAGE

I am happy to know that Y.A.Government College for Women, Chirala is organizing a Two-day National Seminar on "Impact of Pharmaceuticals and Personal Care Products on Environment and Sustainability of Environment" during 16-17 December, 2016.

Concerns have been raised over the past several years about the potential effect of PPCPs that are discharged into the environment via domestic and industrial sewage systems on human health as well as environmental health. Though substantial work had been done to determine the occurrence, effects and risks of PPCPs in the environment, there is a lot to be known to assess their impact on the environment. Considering this scenario, the topic of the Seminar chosen by the organizers is very relevant to the present day circumstances.

I hope the Seminar will pave way for meaningful discussions so as to obtain reliable and quantitative information on PPCPs concentrations and removal efficiency.

I wish the Seminar a success!

(G.NAGESWARA RAO)

COMMISSIONERATE OF COLLEGIATE EDUCATION
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JOINT DIRECTOR: Dr. N. GEETHANJALI

Date: 07-12-2016



MESSAGE

I am extremely happy to know that the Government Degree College(W), Chirala, is organising a two day APSCHE sponsored National Seminar on "IMPACT OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS ON ENVIRONMENT AND SUSTAINABILITY OF ENVIRONMENT" on 16th and 17th December, 2016.

Pharmaceuticals and personal care products (PPCPs) which contain diverse organic groups have raised significant concerns in the recent years because of their persistent impact and potential threat to ecosystem and human health. The PPCPs which are extensively used by the humans are generally excreted and emitted into the sewage system after consumption. These compounds are released into surface waters or enter the terrestrial system when sewage effluents are used for irrigation or where sewage sludge is applied as a fertilizer to agricultural land and again make their entry in to food chain causing several deleterious effects on mankind.

I am sure that this National Seminar will be a rewarding and good experience for the participants and provide them with an opportunity to interact with eminent scientists. I also hope that this would benefit and motivate the society for a safe environment.

I congratulate Dr. T. Raja Rajeswari, Organising Secretary and the Principal of the College for their good initiative to conduct the above National Seminar and I wish the organizers a great success.



(Dr. N. GEETHANJALI)

Talari Brahmaiah

B.Sc.,B.A.,B.L., Diplo in Sanitation

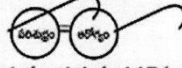
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ఒక అడుగు ముందుకు స్వచ్ఛత వైపు Date: 08-12-2016.

MESSAGE

It gives me a great pleasure to know that Dept. of Chemistry, Y.A. Govt. Degree College for Women, Chirala is going to conduct a two days National Seminar on ***"IMPACT OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS ON ENVIRONMENT AND SUSTAINABILITY OF ENVIRONMENT"*** during 16th and 17th December, 2016.

Today, the conservation, protection and improvement of human environment are major issues all over the world. Human environment consists of both physical environment and biological environment. Both physical and biological environment are inter-dependent. Industrialisation, urbanisation, explosion of population, over-exploitation of resources, disruption of natural ecological balances, destruction of a multitude of animal and plant species for economic reasons are the factors which have contributed to environmental deterioration. One country's degradation of environment degrades the global environment for all the countries. The problem of environmental pollution has acquired international dimension and India is no exception to it. The topic chosen for Seminar is very relevant for present situation, and I am sure, the deliberations at the seminar will be most useful to the society.

My sincere appreciation and congratulations to the **Dr. T. Raja Rajeswari**, Organizing Secretary, Dept. of Chemistry for taking up of efficient and responsible efforts to conduct this useful National Seminar. I extend my best wishes for the success of the seminar.

(T. BRAHMAIAH) 8/12/16.

Dr. CH. RAMANAMMA

Principal

Y.A.Govt College for Women, Chirala



From the Desk of Principal

Our Planet is unique in several ways; this unique planet is threatened by modern man's greedy and ugly activities in the name of the technological development, industrialization, agricultural and urban expansion. The protection and improvement of human environment is a major issue, which is linked the economical development and well being of the humanity. In view of this both development and environmental protection are considered as top priority at both National and International levels. In the name of the development man is dumping a variety of pollutants, in the planet like organic pollutants, inorganic pollutants, pathogenic pollutants and hazardous radiation etc. The Theme of the present National seminar is focused on the "Impact of Pharmaceuticals and Personal Care Products on Environment and Sustainability of Environment" of Pharmaceuticals and Personal Care Products (PPCPs) are of group of chemicals used as ingredients and components in products that are extensively used worldwide. They are use in human and veterinary therapeutic drugs, as growth promoting agents in animal husbandry, and in personal health, cosmetic and cleaning products. After the intended usage, therapeutic drugs, such s antibiotics, non steroidal anti inflammatory drugs and other prescription or oven the counter medicines can leave the human body unchanged or partially metabolized, inputting residues into the municipal wastewater treatment then allows discharges to deliver PPCPs residues to receiving waters.

Waste by-Products, such as manures and sewage sludges can also introduce a variety of veterinary pharmaceutical residues into the environment through their land-application. PPCPs are frequently detected in aquatic environment as result of the consistent input from both human and animal sources. The worst-case scenario environment risk assessment suggests the potential risks of several compounds of PPCPs for sensitive species. I am glad that the Dr. T. Raja Rajeswari, organizing secretary has chosen such an important and widely debated concept for the national seminar.

I also appreciated Dr. T Raja Rajeswari, dept of chemistry for organizing this two day national seminar for the first time n our college. I believe that the two days' event with expert interactions of scientists, scholars, lecturers and students will definitely provide to emerge with constructive conclusions for the eco sustainable development.


(Dr. Ch. RAMANAMMA)

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ENDOCRINE DISRUPTING CHEMICALS AND THE IMPORTANCE OF THEIR ANALYSIS

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The presence of Endocrine-disrupting chemicals (EDCs) in various foods has been increasing rapidly in recent years. Exposures to known EDCs are relatively high in contaminated environments in which industrial chemicals leach into soil and water; are taken up by microorganisms, algae, and plants; and move into the animal kingdom as animals eat the plants, and bigger animals eat the smaller animals. Animals at the top of the food chain, including humans, have the highest concentrations of such environmental chemicals in their tissues. Along with evidence on the impact of these chemicals on human health, there is a growing body of literature that suggests that relying upon traditional scientific methods for assessing the human health impact of chemicals is inadequate when assessing EDCs and such methods, in fact, may result in dangerous and faulty policy. EDCs are defined by the Endocrine Society as: "an exogenous [non-natural] chemical, or mixture of chemicals, that interferes with any aspect of hormone action." Hormones are natural chemicals produced in cells within endocrine glands, which are located throughout the body.

Hormones play a very important role in every individual and the research has proven that as an individual develops, the changing hormonal needs of each organ require hormones to be present in the required amounts. Endocrine system has critical role in many important biological functions as majority of hormones or signaling chemicals are originated from the endocrine gland. The exogenous chemical often disrupt the metabolism of the endocrine glands and hamper the synthesis of various vital hormones. Although the change in the metabolic process is not seen immediately, it will show a critical effect during the long run leading to certain metabolic and genetic disorders which may become fatal.

Exposure to the EDC may occur through various ways. It may occur through the air due to contamination with industrial, vehicular and domestic pollution, through food due to contamination, through unpurified ground and river waters, water collected from ponds and lakes which are located nearby some industries. Majority of the educated population take the necessary precautions such as installation of water purification equipment in the houses, purchasing organic or non contaminated foods, thereby avoiding the exposure to these chemicals up to some extent. However, it is not possible to escape completely from this problem. Biomonitoring shows nearly all human beings have a chemical burden based on detectable levels of EDCs in blood, urine, placenta and body tissues such as adipose tissue. The major EDCs that are commonly found in humans are DDT and other chlorinated pesticides, organophosphorus pesticides, bisphenol A, phthalates, pharmaceuticals and personal care products, and flame retardants.

Over the course of research from the last several years a large amount of data is available on the exposure of wildlife species, epidemiological data of humans, cell culture data and animal models provide information about the effect of EDCs on the biological changes of living things. It is very difficult to assess the cause of certain diseases during these days due to potential exposure to these endocrine disrupting chemicals. The endocrinologists are now focusing more on the effect of



endocrine disrupting chemicals on various diseases that are not traceable to any bacterial or viral infections, or genetic disorders.

The presence of EDCs is increasing in the world due to increase in the production of chemicals in various forms. Due to increase of industries, the industrial wastes, effluents and gases left in to the environment are contaminating the environmental resources such as water, air and soil. The domestic wastes that are left in to drainages which again flows to contaminate streamline flows such as lakes and rivers. The domestic wastes contain several chemicals such as pharmaceutical wastes, plastic wastes, soaps, beauty creams, and other cosmetics which leach through the soil and contaminate the water resources. As the water cycle is a continuous process, there is a chance of exposure to the EDC at every point of time in day to day life.

The major problems reported due to the effect of EDCs are cryptorchidism, hypospadias, testicular cancer, early female puberty, leukaemia, brain cancer and neurobehavioral disorders such as Parkinson's disease, paralysis and stroke. Apart from that, the effect of EDCs is very significant in pregnant woman leading to various birth followed by neonatal disorders. Hence, the American Chemical Society issued a policy statement on testing of endocrine disruption recommending expanded education and research, updated testing protocols and the development of safer alternatives to EDCs. A number of international and Global health organizations such as World Health Organization (WHO), United Nations Environment Programme (UNEP) have also taken up the initiatives to control the production of EDCs. As the global scientific and medical community continues to express concern over EDCs and their harmful effects on human health, public policies should be grounded in the latest available scientific evidence.

The human endocrine system consists of a series of glands that are distributed throughout the body. Each gland produces one or more vital hormones. The major endocrine glands are represented in Figure 1. The hormones secreted by endocrine glands bind to several receptors triggering a response such as production of another hormone, a change in metabolism, a behavioural response, depending on the specific hormone and its target. Because of the endocrine system's critical role in so many important biological and physiological functions, impairments in any part of the endocrine system can lead to disease or death.

Some of the very well known endocrine disruptors are DDT, chlorpyrifos, atrazine, 2,4-D, glyphosate, lead, phthalates, cadmium, bisphenol A, phenol, brominated flame retardants, polychlorobiphenyls, triclosan, and perfluorochemicals. The organophosphorus and carbamate pesticides also inhibit the enzyme acetylcholinesterase which also effects the function of several endocrine glands leading to either paralysis or carcinoma.

As the exposure to the EDCs can be in any form it is very necessary to monitor our surroundings for the possible presence of these chemicals. The majority of the EDCs may enter our body from the contaminated food or water, contact with skin, inhalation, intravenous due to some cuts and ruptures, application to skin, transfer from mother to child during birth, and mother's milk.

Hence, it is very important to monitor these EDCs present in various substances that have potential exposure to human life. Currently there are a large number of projects sponsored all over the world for monitoring of the EDCs in the rural an urban areas within those countries. Globally, WHO and UNEP are encouraging the analytical studies on the exposure of the EDCs and their effects on various endocrine glands. Although it was suspected that the EDCs have significant effect on various diseases, the information has yet to be proved authentically.

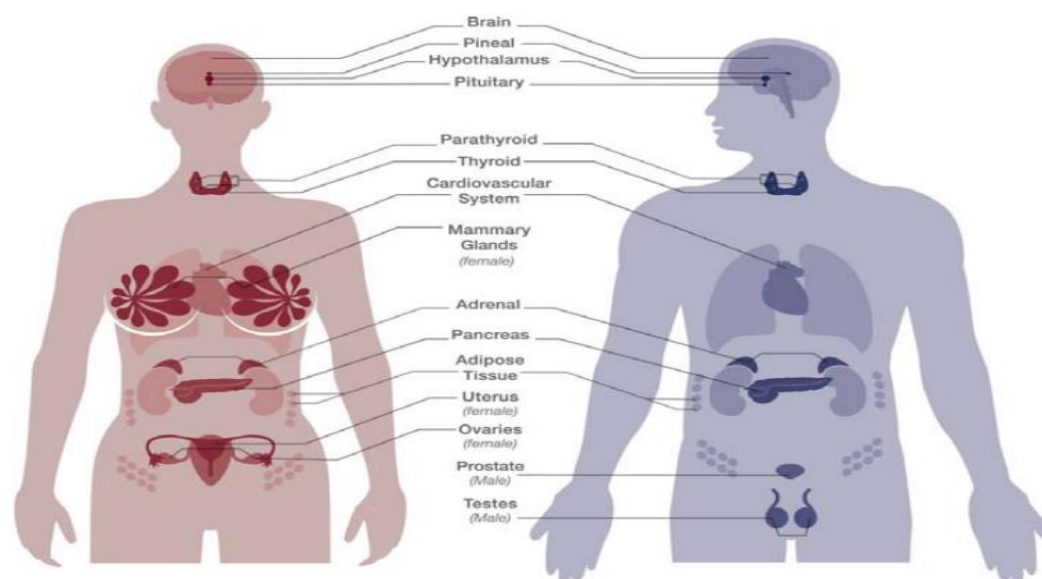


Figure 1: Human endocrine glands

Several analytical techniques were used for monitoring of endocrine disruptors present in various matrices. The analysis needs a proper sample preparation for the extraction the EDCs that are generally present in very trace levels followed by sensitive detection, identification and quantification techniques. The chromatographic equipment such as gas chromatography with electron capture detection, high performance liquid chromatography coupled to ultraviolet and photodiode array detections. These techniques have their specific disadvantages such as poor response to certain chemicals, not useful for structural identification and assessment of quantity in parts per billion levels. The detection, identification and quantification parameters can be enhanced by hyphenating the chromatographic equipment with the mass spectrometers. Hence, the analytical techniques like GC-MS and LC-MS can provide, sensitive and specific detections, identification and quantification in parts per trillion levels. As there is increasing demand for the newer analytical technologies for rapid identification and quantification of EDCs from various matrices is necessary.

Reference:

This article was written based on the report "Introduction to Endocrine Disrupting Chemicals" published by Endocrine Society (<http://endocrine.org>) in 2014.



ENVIRONMENT AND HUMAN HEALTH

INVITED TALK

Prof. E.U.B. REDDI

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No doubt the chemists and chemicals are responsible for the worldly comforts. But at the same time it is an undisputable fact that they are responsible for today's environmental problems and planetary perils. Hence, they are taking the blame of dirty chemists and nasty chemicals. Presently more than 7 million chemicals are put to use by man.

To prove the toxicity each chemical has to be subjected to half a dozen tests Viz., 1) *Mutagenicity*, 2) *Ecotoxicity*, 3) *Acute toxicity*, 4) *Chronic toxicity*, 5) *Environmental fate* and 6) *Developmental or Reproductive toxicity*. So far, 200 chemicals have satisfied the above tests including environment and human health, thereby proving the fact that our ignorance exceeds our knowledge on impacts of chemicals. Time and money are the vital constraints. For example testing for cancers, 100 chemicals in combination of 3 could require 1, 62,000 tests. It costs more than 2 lakh US \$ per a chemical.

Recent advancements in analytical chemistry have been helping to diagnose the causes and understand the consequences of pollution problems, health hurdles and environmental problems. Nowadays the role of analytical chemists is more in view of the emergence of nano-technologies, deteriorating environment and unethical trade resorting to adulteration. In fact, the contributions of the analytical chemists are making the present day scientists to think green, plan green and act green thereby shaping them as green chemists.

But if we go back into the history, Hippocrates (460BC-377BC) – the father of medicine had rightly diagnosed the link between the environment and human health. According to him, to know the health of any population one has to look at the air they breathe, the water they drink and the places they live. According to present day understanding 80% of sickness world over is due to poisoned environment. WHO has estimated that 13 million lives every year can be saved worldwide, if environment is cleaned.

About 50 incidents which happen in our day to day life are analyzed for the causes and consequences in order to create awareness among the public.

Burning of solid waste and city air pollution in India

Nowadays burning of solid waste has become uncontrolled. About 0.3kgs of solid waste/head is produced in India. It amounts to 33.6 million tons/year. If 5% of it (1.68 million tons) is burned it releases 1.18 million tons of pollution. Burning of one ton garbage releases SPM 0.098 tons, SO₂ 0.072 tons, VOC 0.136 tons, NO₂ 0.018 tons and CO 0.380 tons. It causes coughing, wheezing, chest pain, shortness of breath and cancers.

One match box may save something to municipalities but it shaves a lot to public in the name of pollution and health costs.

Warn-out tires create mosquito menace. If burned they create severe air pollution.

Water sitting in waste tires breeds mosquitoes and diseases. Each tire can produce 10,000 to one million mosquitoes during a breeding season.



Plastic burning - Reduced sex desires

Nearly 75 chlorinated hydrocarbon compounds including deadly Dioxins and Furans are formed. They mimic sex hormones. Reduced sperm counts feminization and reduced sex desires are common. It is now considered as chemical castration.

Cooking fuel smoke – 4th place in killers list

Women and children are the worst victims of cooking fuel smoke. In the killers' list, first, second, third and fourth positions are occupied by tobacco use, alcohol use, accidents and cooking fuel smoke. Cooking fuel smoke contain mostly SPM, CO, SO₂, NO_x, HC and Dioxins and cause cataract, lung cancer, bronchitis and asthma. Providing good Ventilation and lighting to the kitchens, and using fuel efficient domestic cook stoves like **ASTRA** which is 44% effective against ordinary ones with 6-9% are the practical solutions.

Cigarette smoke contains nearly 4,700 chemicals.

For every cigarette smoking 8 minutes of life is off. As far as the cancer threats are concerned, nicotine is a lesser threat. Nearly 90% of smoking related cancers are due to radioactivity in cigarettes in form of Polonium-210; Lead-210. Uranium of phosphate fertilizers is the source. Tobacco smoking –Lung cancer: A person smoking one and half packs a day receives a radiation dose to lung equal to 300 x-rays films of chest per year. Even filter cigarettes are no safe. They filter benzopyrene & nitroamine but not the radiations.

Teflon coated cookware can sicken people with polymer fume fever

PFOAs (per fluoro octanoic acids) in fumes are known carcinogens. DuPont was fined \$10.25 million for hiding this information. He is going to withdraw them by 2012. Chest tightness, breathing troubles, headache, chills, and sore throat are the prominent symptoms. Cast iron cookware is a good alternative – cheap, heats evenly and adds iron to the diet.

Eating silver foil covered sweets, pan and fruits for strength by the rich is a myth. Silver cannot be digested. Highly toxic and carcinogenic metals viz., Nickel, Lead, Chromium and Cadmium are found in the silver foil. Further the leather bag used to make silver foils will be most unhygienic and with full of germs.

Threats in carrying food items in polythene bags

Cadmium and lead are used as binders and heat stabilizers. They leach out quickly and contaminate the foods, if hot foods like coffee, tea, sambar, rasam are packed.

Urban cattle are dying because of plastic bags ingestion for residual foods

In a recent postmortem study veterinary doctors found more than 40 kg of polythene bags in the stomach of a dead cow.

Food that Kill – Vultures are dwindling. Chicken eaters are facing kidney problems

Diclofenac used by veterinary doctors to treat animals is responsible for the death of vultures. Antimicrobial feed additives used in poultry can kill a person by spoiling kidney.

Diet sodas

These are linked with heart diseases and diabetes because soda drinkers are generally more sedentary, does less exercise and eat less fiber.

Mad Cow Disease

England's economy depends on beef exports. To promote quick growth of cattle for beef production, the meat of dead sheep and cattle are processed and fed to cattle those are purely vegetarian. Thus herbivores are made carnivores and cannibals. When the meat of infected sheep



with PRION is fed, the cows develop BSE (Bovine Spongiform Encephalopathy = Mad Cow Disease) and become mad. If the mad cow meat is eaten, the humans develop CJD (Creutzfeldt Jacob Disease = brain damage, psychiatric).

Truth behind Napoleon's Death

Emperor Napoleon of France died in 1821 while in exile. Postmortem results indicated Arsenic poisoning. Colouring of the wall paper used in his quarter contained high amounts of arsenic. In damp mouldy condition arsenic might have created deadly gas which took his life.

Minamata disease (Dancing cats)

Methyl mercury caused Minamata disease by poisoning marine food web in Minamata bay of Japan. Cats eating poisoned fish of Minamata bay were seen dancing in the streets and finally collapsing and dying. People eating such fish were showing symptoms of blindness, brain damage, paralysis and neurological problems. 300 deaths and 20,000 victims were recorded.

Biomagnifications

There are people who still believe in the concept of 'dilution is the solution to pollution'. But biomagnifications studies have proved it as an illusion. For example DDT has biomagnified by six crore twenty lakhs times in an aquatic food chain (DDT concentration in ppm in a food chain - river water 0.000002, phytoplankton 0.0025, zooplankton 0.123, small fish 1.04, big fish 4.83, sea gull eggs 124.00 ppm). Thus dilution paradigm has become boomerang paradigm.

Skeletal and dental fluorosis

Fluoride level exceeding 2 ppm in drinking water results in skeletal fluorosis (knock knee syndrome) and dental fluorosis. Tamarind using areas lack fluorosis. Tartaric acid leaches fluoride from the body through urine. Ragi diet rich with calcium nullifies fluorosis. Lime coated pots remove fluoride from water.

Arsenic pollution

Arsenic enters the body through water and it forms false leprostatic white patches on the skin. It creates a serious sociological problem for black complexioned teenage girls.

Blue baby syndrome due to nitrate pollution

Nitrate of the water will be converted to nitrite in the alimentary canal by bacteria. It leads to methemoglobinemia in children. Oxygen carrying will be affected. This leads to development of blue coloration to babies. Hence, it is called as 'blue baby syndrome'.

Bottled mineral water – costly psychological gain

Tests find bottled water no cleaner than tap water. Popular brands contain mixtures of fertilizer, and chemicals. Further tooth decay and health risks are seen in bottled water.

Vehicular pollution - Air quality worse inside AC cars - Risk of CO poisoning

Heat and ultraviolet (UV) light can trigger the release of a number of chemicals inside the car and they are linked to birth defects, premature births, impaired learning and liver toxicity. Among other serious health problems, polybrominated diphenyl ethers (or PBDEs, often used as fire retardants) and phthalates (chemicals used to soften plastics) are the primary culprits. CO levels are more inside the car rather than outside. CO poisoning is attributed to the death of kids and pets in parked, window glasses closed idling AC cars.



Endosulfan - Poison from the sky

It is a banned pesticide in developing nations because it is carcinogenic. In Kerala, Endosulfan, a cousin of DDT, is sprayed aerially over cashew nut plantations to control pests. Deformities in children are very common because of this.

Wrong prioritization

Europeans alone spend \$50 billion on cigarette smoking. If \$40 billion is diverted, the most serious problems such as public health, sanitation, education and water problems world over can be solved.

Breast cancer cases are increasing!

Cosmetics, pesticides, dyes, drugs, gasoline (diesel exhaust gas) have been shown to cause breast cancer in animals. 90% of the breast cancer cases are because of cosmetics.

No chemical is safe is a universal adage. Common soap and shampoo ingredients were linked to cancer in laboratory mice. Hence, avoid or minimize usage of chemicals in daily life.

The cell phone radiation may cause brain tumors

Cell phones, satellites, cell phone towers and radio towers all emit radiation on the exact same frequency as a microwave oven. This electrical pollution is in your home, your car, your workplace, your shopping mall - anywhere that these devices are present, they are emitting radiation. Headset protects from radiation is a myth. Cows grazing near cell towers are more likely to experience still births, spontaneous abortions, birth defects and behavioural problems. Less than 2000 hrs exposure in a decade period will be safe. If exceeds, risk of brain tumor is high. Heat generated can cause tumors and acoustic neuroma.

No Dirty Gold

Producing 1 gold ring generates at least 20 tons of mine waste. Valentine Day sales create 34 million metric tons of waste worldwide. Gold mines create mercury and arsenic pollution. Jewelry making, pose health risks to makers with cadmium and cyanide.

Itai-Itai (ouch-ouch) Disease - Cadmium poisoning

It is characterized with extreme joint pains. It is linked to irrigation water contaminated with Cadmium from metal mine wastes. Cd enters into humans through rice that is grown on these contaminated waters. Cd mimics the human hormone estrogen. Other symptoms are early puberty, breast cancer and renal failure.

Yusho Disease - gum disease

Cooking oils (rice brawn) were contaminated with Poly Chlorinated Biphenyls (PCBs) in Yusho, Japan 1968. By eating such PCB contaminated oils 2000 people were effected with swollen gums & other gum diseases, enamel & dental caries, headache, fatigue, pains in the joints and painful acne like eruptions, dermal & Ocular lesions, irregular menstrual cycles, intellectual impairment in children, altered immune responses, dark brown hyper pigmentation etc. PCBs are fat soluble. Hence, accumulate in organisms and act as endocrine disrupters. A similar one in Taiwan in 1979 was named as Yu-Cheng disease.

Sick building syndrome owing to luxurious lifestyles

Poorly vented indoor air of apartments contaminated by moulds, carbon monoxide, nitrogen oxides, formaldehyde, and other toxic chemicals released by carpets, insulation, plastics, paints and building materials cause headaches, allergies and chronic fatigue. This type of suffering by people living in apartment is called "sick building syndrome".



Toxins in makeup cosmetics, scents and perfumes

Hair dyes, soaps, shampoos, lipsticks, other cosmetics, scents and perfumes generally contain toluene which is a proven carcinogen and neurotoxin. Many mimic the sex hormones. About 500 chemicals, without performing toxicity tests, are used in cosmetics. To stop microbial growth, preservatives are added to cosmetics. Some of them are carcinogenic. Out of 711 lipstick products analyzed 28% contained carcinogens viz., toluene, nylon, ferric oxides, polyethylene, titanium oxide etc.

Naphthalene usage - in houses

Earlier, naphthalene balls were thought to be non carcinogenic polycyclic aromatic hydrocarbon (PAH). Recently naphthalene was proved as a potential carcinogen.

Ugly face of Talcum powders

Talc is a mineral. It is as bad as asbestos. Talc rocks are mined and powdered. It causes tumors. Several thousand infants die due to lung cancer because of inhaling minute particles of powder. Powder when applied to private parts it goes to ovaries and cause ovarian cancer.

Mosquito coil burning

Allethrin - a pyrethroid insecticide is the major ingredient of mosquito coils. It is a potent lung carcinogen. It also produces RSPM, PAHs, aldehydes and ketones, and brings about asthma, allergies, breathing problems and lung cancers. Subjected to smoke of one mosquito-coil is same as that of inhaling 75-137 cigarettes smoke. Hence, use of mosquito nets is the best solution.

Radon risk is more to cellar and ground floor inhabitants

It is a decay product of Uranium. It is a colourless and odourless gas, occur in soil and rock and it escapes through fractures and pores in walls. Inhabitants of cellar and ground floor are exposed to radon. It being a radioactive it causes cancers.

Even plastic milk bottles are not safe - risk of heart diseases, diabetes and reproductive disorders

BPA (Bisphenol A) is used to make hard plastic including polycarbonate plastic baby bottles. An estrogen like compound used in making plastic is causing serious reproductive disorders heart diseases and diabetes.

Disposable plastic tea cups are linked to skin cancer and cataract by causing ozone hole

CFC molecules released while making one tea cup can eat 100 trillion ozone molecules in the stratosphere. By avoiding usage of plastics you too can help in healing the ozone hole.

A major route of pesticides entry into the bodies of south Indians is red chilly powder

Adulteration of chilly powder with red brick powder, sudan red dye, saw dust and contaminated by pesticides and fungicides are the chilling facts about red chilly powder.

Morning walks and health risks

During winter nights thermal inversions set in. As a result air pollution accumulates on the ground and the walkers will be inhaling high quantum of toxins. Evening times before sunsets will be relatively good because of thermal gradients & turbulences. It helps in D vitamin synthesis.

Adulterated toddy

To meet the demand and also to increase the potency, chloral hydrate and other sedative drugs viz., diazepam (valium), phenobarbitone and alprazolam and saccharin, as sweetener, are added. Chloral hydrate was attributed in the death of Marilyn Monroe!

Toxic-ripeners - Forbidden fruits



Fruits are artificially ripened using calcium carbide- a toxic-ripeners. Fruits naturally ripen by gaseous plant hormone called ethylene. Calcium carbide acts as ripener by producing acetylene an analogue of ethylene. It is commonly used for welding process. It is chiefly imported from China, Taiwan and South Africa (250gms costs Rs15/-). It was a branded carcinogen. Further, there is no approval from World Health Organization. On wetting it produces acetylene gas that can turn into fire and explosion hazard. If entire lot is found evenly in ripen colour, then suspect the use of toxic ripeners.

Milking using hormonal (BGH) injections to cattle

Synthetic hormone Bovine growth hormones (BGH) are injected to boost milk production. Hormone residue in milk/meat can cause early puberty in girls/ increases the risk of breast, colon and prostate cancers. Recent rise in twin births was linked to BGH.

Synthetic milk

Ingredients used to prepare synthetic milk are urea, sodium bicarbonate, liquid detergent, a little sugar, vegetable oil or ground nuts, and water. The composition itself is hazardous and cause several health problems.

Cheap non-permissible toxic food colourants

Lead chromate is used as a substitute for turmeric. Metanil yellow dye is used to get deep yellow colour to besan or gram flour, pulses, laddoo, burfi, jalebi, papad etc. Rhodamin-B is used to get rich deep pink colour. Malachite green dye is used to get nice green colour to aniseed (after food tit bit). The common after-effects of prolonged use of synthetic colours were allergy, hyperacidity, asthma, kidney and liver damage, development of tumor and cancer. Therefore, public should prefer sweets manufactured from genuine/ pure and safe use of edible colours only. Generally, consumption of coloured sweets should be discouraged.

Lead paints on crockery and burning candles that contain lead

Lead is a toxic metal. Lead deposits in the bones as it has greater affinity with calcium. It creates serious neurological problems. Painted crockery items and paraffin candles act as sources of lead. Hence, while purchasing crockery items and paraffin candles avoid lead.

Asbestosis

Asbestos is a mined material. It is used as roofing, insulating and fire retardant material in spite of banning. Pulmonary fibrosis, caused by asbestos inhalation, is called asbestosis. Lung cancers are prevalent. Pneumoconiosis is a typical occupational health hazard of workers working in asbestos mining and manufacturing industries.

Male poverty with tight jean pants and laptops

High body temperature is unfavorable to sperm production, hence the arrangement of sagging scrotal sacs in the males. But wearing tight jean pants make the testicles adhere to the body and maintain body temperatures, thereby negating the advantage of sagging scrotal sacs. Laptop which releases waste heat on the laps also acts as one of the reasons for losing fertility by males. For every one degree rise, 40% sperm count is reduced.

Cell phone radiation affects sperm production and function

Men, beware of cell phone radiation. Using a hands-free device with a cell phone may affect your fertility, if you keep your phone close to the testicles.

Sickness through extra polished silky rice



Coarse grains are excessively polished and made as silky rice which totally devoid vitamins. By eating this rice excessively, people are becoming the victims of diabetes and heart diseases. Total crew members died because of eating polished rice diet continuously for several months during their voyage. This historical episode led to naming of vitamins first time. Later the b-complex deficiency was identified as reason. Brown rice is a healthier alternative to white rice.

Head acts as a mobile dustbin as well as the source of infection

Your head receives dirt and germs while moving in the outdoor environment through impaction and sedimentation. Thereby, acting as a mobile dustbin and as well as a source of infection. Combs act as carriers of germs. To avoid this threat, clean the combs regularly; wash hands after combing hair; take head bath every day and wear hats/caps.

Reducing infection

Maintain good hygiene by washing hands regularly. Cover your mouth and nose while coughing or sneezing. Sneezed droplets travel in air at 100 mph. Avoid large crowds.

Beware! Cockroaches in the domestic environment can harm you

They carry bacteria and viruses and cause diseases such as hepatitis, polio, typhoid, plague and allergy. 60% of the Americans suffer from asthma triggered by live or dead cockroaches. Offer mix of dhal and cement in powder form to control cockroaches.

Bugs on bucks

Stop licking fingers while counting currency notes or to turn a page in a book. Otherwise you will be contributing and receiving germs from the notes simultaneously. This unhygienic habit makes you and others vulnerable to infections and skin allergies.

Acts on pollution prevention are too many, but, there is no action

Cost of pollution in India is >34,000 crores of rupees. Now people those who burn urban wastes and those who cut trees are rarely or lightly punished. If we look into the history way back 1273, King Edward I of England threatened to hang anyone found burning coal in London, because of the acrid smoke it produces.

Owing to, dumping of toxic chemicals in the environment, and myopic, malicious and greedy deeds of humans, 'health for all by 2000 AD' set by WHO has become an unrealized dream. Switching over from 1) dirty technology (chemical technology) to clean technology (biotechnology), 2) intensive farming to organic and sustainable farming, 3) eating extra polished white rice to organically cultivated whole grains and more greens will ensure health security and fulfill the dream of WHO in coming days.



**NEWER SAMPLE PREPARATION APPROACHES FOR THE
QUANTITATIVE DETERMINATION OF PHARMACEUTICALS AND
PERSONAL CARE PRODUCTS IN THE MATRICES OF
ENVIRONMENTAL, PHARMACEUTICAL AND BIOLOGICAL INTEREST**

INVITED TALK

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Micropollutants are chemicals such as personal care products, pesticides, pharmaceuticals, polyaromatic hydrocarbons, phthalate etc are posing threat to human health due to their adverse biological effects at low concentrations. Pharmaceuticals and Personal Care Products (PPCPs) are used for personal health, cosmetic purposes and to boost growth or health of live stock. The European Union has considered pharmaceutical residues in water and soil as “priority substances” and their annual usage has increased from 2 billion to 3.9 billion from 1999 to 2009 in the US itself (Source: Wikipedia). The human individual activity and/or residues from manufacturing industries, veterinary use and hospital biomedical waste are considered to be main reasons for their penetration into the environment. The personal care products such as synthetic fragrances and antibacterial ingredients mainly found in hand washes and toothpaste (e.g., triclosan), domestic cleaning products (e.g., surfactants) and synthetic steroids (e.g., estrogens, androgens). The detection and quantitation of these PPCPs in various matrices is a challenge to the analytical chemists as they need rapid, cost-effective and sensitive methods. The analysis needs careful sample preparation to extract and pre-concentrate the analytes in order to avoid co-extraction of interfering substances before instrumental analysis. In this talk, I would mainly focusing on the development of various analytical methods using dispersive liquid-liquid microextraction (DLLME), solid-phase extraction, molecularly imprinted polymers (MIPs) and their applications in various matrices. These analytical methods are rapid, cost-effective, sensitive and environmental friendly for the quantitative determination of PPCPs in the matrices of food, biological and environmental interest. These approaches can eliminate the use of large volume of organic solvents for extraction and pre-concentration of PPCPs from the matrices of food, biological and environmental interest and also improves the precision and accuracy of the analysis.

Keywords: Microextraction, Molecularly Imprinted Polymers, Dispersive liquid-liquid microextraction, Injector Port Silylation



ORGANIC SYNTHESIS: A POWERFUL TOOL FOR DRUG DISCOVERY

Focused topic: Novel Chiral Ligands development for Organo/Organo metallic catalysis

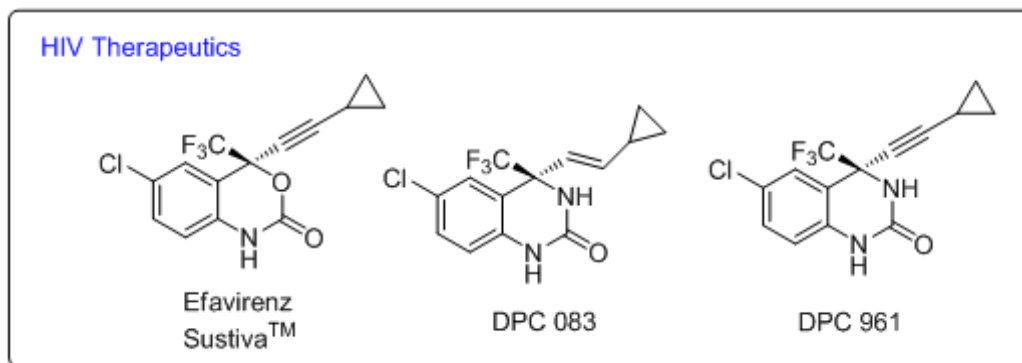
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Target Molecules for the treatment of HIV/AIDS:

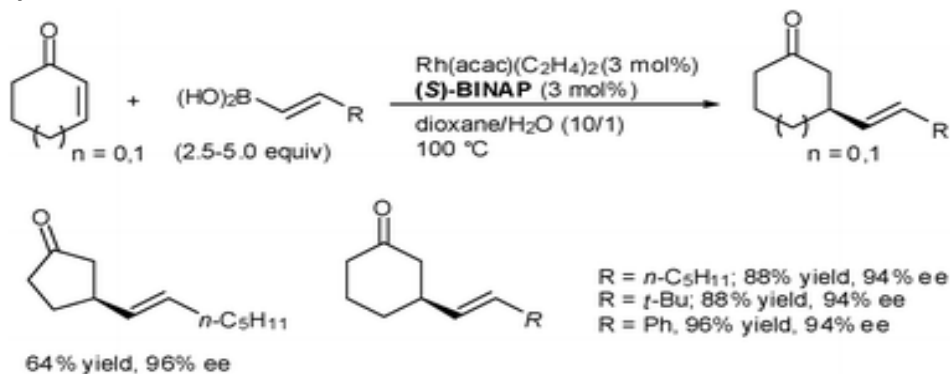
INVITED TALK



Synthetic method development

Chiral ligands are essential for controlling the reactivity and selectivity of reactions catalyzed by transition metals. Access to large phosphine ligand libraries has become an essential tool for the application of metal-catalyzed reactions industrially, but these existing libraries are not well suited to new catalytic methods based on non-precious metals (for example, Ni, Cu and Fe). The development of the requisite nitrogen- and oxygen-based ligand libraries lags far behind that of the phosphines and the development of new libraries is anticipated to be time consuming. Here we show that this process can be dramatically accelerated by mining for new ligands in a typical pharmaceutical compound library that is rich in heterocycles. Using this approach, we were able to screen a structurally diverse set of compounds with minimal synthetic effort and identify several new ligand classes for Palladium and Rh-catalysed reactions. These new ligands gave improved yields for challenging cross couplings of pharmaceutically relevant substrates compared with those of those of previously published ligands.

Metal catalyzed reactions:





Privileged Chiral Phosphine Ligands:

<p>Biaryl</p> <p>TunePhos CnTunePhos (n = 1 to 6)</p> <p>o-BIPHEP</p>	<p>Ferrocene</p> <p>Me-f-KetalPhos</p> <p>f-Binaphane</p>	<p>Phospholane</p> <p>PennPhos</p> <p>Binaphane</p>	<p>DIOP Type</p> <p>BICP</p> <p>DIOP*</p>
<p>P-Chiral</p> <p>TangPhos</p>	<p>Other Classes</p> <p>o-BINAPO</p> <p>FAP</p> <p>PN</p>		

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ENVIRONMENTAL IMPACT OF CHEMICALS FROM PHARMACEUTICALS AND PERSONAL CARE PRODUCTS

INVITED TALK

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ABSTRACT

Pharmaceutical and personal care products illustrate the immediate, intimate, and inseparable connection of the actions and activities of the individual with the environment. The importance and significance of the individual in directly contributing to the combined load of synthetic chemicals in the environment has been greatly underappreciated. The continuing, escalating advances in design of new drugs will undoubtedly add to the spectrum of questions regarding the environmental significance of these compounds.

Pharmaceuticals as well as several chemicals used in personal care products, are biologically active compounds that are designed to interact with specific pathways and processes in target humans and animals. Concerns have therefore been raised about the potential effects of active PPCPs in the environment on human and environmental health; over the past 15 years, a substantial amount of work has been done to determine the occurrence, fate, effects, and risks of PPCPs in the environment.



INTEGRATED WASTEWATER REUSE MANAGEMENT FOR SUSTAINABLE AGRICULTURE DEVELOPMENT: A GREEN TECHNOLOGY APPROACH

INVITED TALK

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Introduction

Water pollution is one of the most important environmental problems in the world. It is recognised that water, is a key resource for life and development. In developing countries, fast-growing urban populations are demanding more fresh water and food. The UN recommends a minimum of 50 litres of water per person per day to drink, wash and cook. Water scarcity and climate change form a dual challenge to food and environmental security. Sustaining water availability for agriculture in the near future presents a great challenge and opportunity for the communities in the developing countries. They must play a fundamental role in creating and maintaining access to and availability of this scarce resource for present and future generations. This would effectively improve agricultural productivity and overall economic growth. Adequate water supplies to meet basic human needs are essential to maintain and enhance the welfare of all the inhabitants.

Importance of the Research: Most of the industries consuming large volume of water to produce various products. Simultaneously, it releases equal volume of wastewater into the environment. It creates additional problems to human beings as well as to sustainable environment. More dangerously, the ground water is also contaminated and thereby reduces the accessibility of potable drinking water to the consumers. Wastewater is becoming an increasingly important source of water for irrigation and aquaculture practices.

The demands of growing urban communities for both food and water require the agricultural sector not only to increase food production but also to reduce its use of natural water resources. Due to the lack of comprehensive wastewater management, a major portion of the wastewater pollutes natural water bodies. As the demand for water increases, making more efficient use of water becomes very important. Water re-use should be seriously considered before water availability and demand. Recycling of wastewater by using a novel green technology an "environmentally sound technology" is an excellent option.

Health risk: Wastewater may contain toxic chemicals which are harmful to the growth and development of plants. Microorganisms which are harmful to agricultural workers, consumers and when eaten by animals, may in turn infect the people who eat the contaminated meat. Among wastewater-related infections, diarrhoeal diseases are the top cause of death among children in the developing world. Health risks in relation to the level of contamination, a proper wastewater control measures should be adopted based on the guidelines of WHO. Re-use requires careful planning, monitoring, suitable treatment, appropriate legislation and implementation and quality standards.

Objectives of the research:

Major objectives are:

- Development of a new nanobiocarbon for the treatment of industrial waste water.



- Reuse of wastewater for sustainable food production.
- Evaluation of this Eco-friendly green technology for sustainable agricultural development.

Methodology:

- Preparation of biocarbon
- Physico – Chemical analysis of wastewater
- Treatment of industrial wastewater
- Cultivation of *Setariaglauca* - Fodder grass

Preparation of biocarbon:

- Biomaterial - Marigold (*Tagetes* spp. - Asteraceae)
- Biomaterial and acid ratio is 1:1.8
- Oven operating temperature is 160 ± 5 °C
- Biocarbon drying temperature is 120 ± 5 °C
- Particle size: 90 & 120 μ m.

Physico – Chemical analysis of wastewater:

- Collection of CETP gray water.
- Determination of parameters such as pH, alkalinity, SS, TDS, EC, DO, BOD and COD.
- Analysis of heavy metals mainly for Cr, Pb, and Ni using AAS.

Treatment of industrial wastewater:

- Preliminary treatment with screening for the removal any dirt materials.
- Continuous batch biosorption process with pre-defined equilibrium data.
- Process operating temperature 28 ± 2 °C.
- Biocarbon dose 2.5g/100 mL.
- Effective contact time is 120 min.
- Equilibrium speed is 250 rpm.

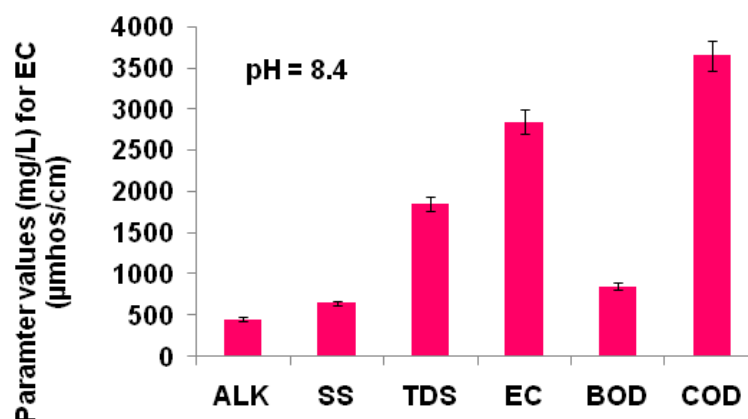
Cultivation of fodder grass:

- The development of *Setariaglauca*(Poaceae), a good fodder grass was used in this study.
- It is also called as Cat tail millet.
- The growth of this fodder grass was evaluated in pot experimental study.
- Mainly, length of shoot and leaves of grass was taken for its growth with limited agricultural period.
- The soil quality (mainly essential nutritional aspects) was also taken care for growth of fodder grass.

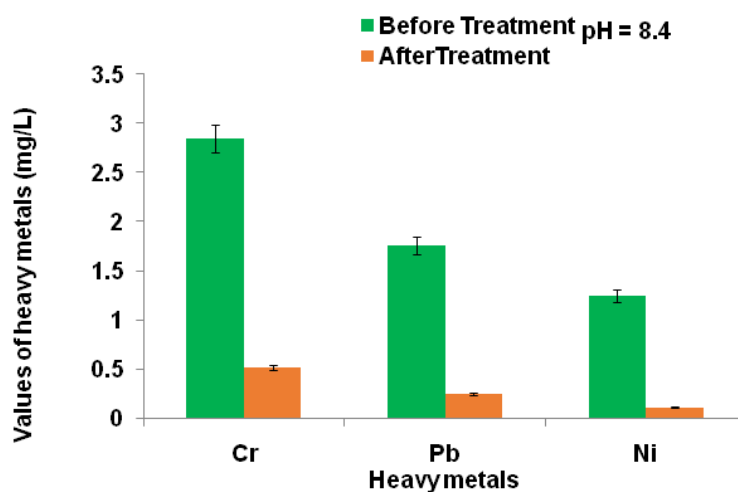
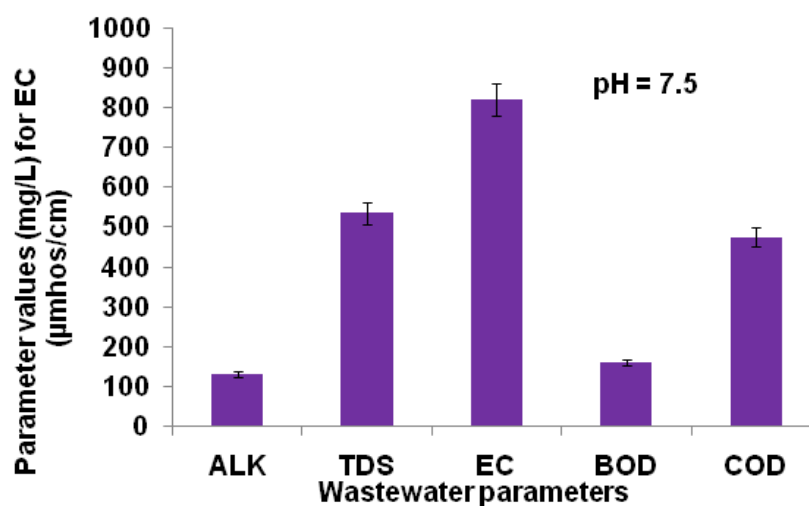
Results and Discussion:

- Analysis of raw wastewater.
- Analysis of treated wastewater.
- Important results of treated wastewater.
- Growth characteristics of

Setariaglauca – Fodder grass



Wastewater parameters





Important Results of treated wastewater:

- The main pollution parameter such as COD and BOD is reduced to 86.98 and 81.17% respectively.
- Alkalinity of the wastewater is reduced to 70.32% and making the water suitable for crop irrigation. Relatively, the level of TDS is good in wastewater.
- After the treatment process, the concentration of heavy metals such as Cr (81.75%), Pb (85.79%) and Ni (90.40%) are well reduced and are within the agricultural quality of wastewater.

Policy implication:

The baseline data from the treatment of industrial wastewater and the cultivation of the fodder grass using the treated wastewater is a model trial. This technology can be scientifically used for the irrigation of various crops and leafy vegetables.

Conclusions: The following conclusions are derived from the results.

- The Nano biocarbon technology is an efficient and economically sound technology for the treatment of industrial wastewater.
- It does not produce any major secondary effluent and sludge. Re-use of water can help to maximize the use of limited water resources.
- The yield of selected fodder grass is very good.
- Wastewater re-use can contribute to sustainable agricultural development.



HAZARDS IN COSMETICS & PERSONAL CARE PRODUCTS

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Abstract

With development of technology, globalization and urbanization use of cosmetics and personal care products has shown a steep rise as they make an appearance presentable and life comfortable. New products with modified features are dumping into the markets every day. Most of these contain very harmful chemicals which are dangerous to human health and environment. Many countries donot have strict laws and regulations for manufacturing these. This lead to flood of various brands in local stores, supermarkets, and malls. Awareness about the hazards of these products is also scanty. Most of these products do not carry labels showing exact composition of chemicals and their percentage used in them. This confuses even an educated consumer in selecting safer brands of cosmetics and personal care products. Research activities in this field also are very less.

Introduction

When we talk about pollution we discuss only about environmental hazards like air pollution, water pollution etc but hardly give importance to the pollutants we dump in our house. Right from the chemicals we use at the day break in the form of toothpaste and mouth wash to the mosquito repellants at nights, we fill our houses, work places and surrounding with very harmful and dangerous products. U.S researchers have identified 10,500 chemicals that are used as cosmetic ingredients are carcinogens, pesticides, reproductive toxins, endocrine disruptors, plasticizers, degreasers and surfactants surveys have indicated that most of the consumers hardly notice "buyer beware" column on the products or notice the list of chemicals used in them. Many chemicals in perfumes, body sprays and skin lotions are directly applied to the skin and they come into contact with sensitive tissues, organs and glands. Many chemicals are flushed down the drain to contaminate water and aquatic systems.

Discussion:

The common chemicals we come across in our personal care products are

- **Diethyl pthalate:** It is used as a cosmetic fragrance mixtures to make the scent linger. These pthalates are endocrine disrupters which reduce the sperm count in men and reproductive defects in developing male fetus (when the mother is exposed during pregnancy). These chemicals also increase obesity and insulin resistance in men. In children toys, there are traces of pthalates and these are sucked or chewed by infants.
- **BHA & BHT:** These compounds are used as moisturizers and makeup preservatives. They also act as endocrine disruptors and cause cancer. They affect fish and other wild eye.
- **P-Phenyl lene diammine:** This is used in hair dye and other columes. It is a potential cancer causing agent contaminated with heavy metals and toxic to the brain.
- **DEA, Cocamide DEA and lauramide DEA :** It is used in creamy foaming products in moisturizers and shampoos. This is also a cancer-causing agent.



- **Dibutyl Pthalate** : It is used as plasticizer in nail care products. It is an endocrine disruptor and reproductive toxicant.
- **Formaldehyde releasing preservatives DMDMhydantoin, diazolidinyl urea, imidazolidinyl Urea, methenamine, quaternium-15 and sodium hydroxyl methyl glycinate**: The above chemicals slowly release formaldehyde which is a cancer-causing substance.
- **Paraben, methyl paraben, butyl paraben and propyl paraben**: This is used as preservative in cosmetics. This is an endocrine disrupter and interfere with male reproductive functions.
- **Parfun** : These are fragrance chemicals used in cosmetics. Some of these trigger allergies and asthma. Some cause cancer and neuro toxicity and some are harmful to aquatic and wild life.
- **PEG's**: They are used as cream bases and are cancer causing substances.
- **Petroleums**: They are in hair products to produce shine and as moisturizers in lip balms, lipsticks. They contain polycyclic, aromatic & hydrocarbons which are carcinogenic in nature.
- **Siloxane**: Cyclohexa siloxane, cyclopenta siloxane, cyclo hexa siloxane & cyclo methicone: These are used for softening, smoothening and moistening in cosmetics. They are mostly reproductive toxins.
- **Sodium lauryl sulphate**: They are contaminated with 1,4 dioxane and are used in shampoos, cleaners, and bubble bath. They are cancer causing substances.
- **Triclosan**: This is used as antibacterial cosmetic such as toothpastes, cleansers, and antiperspirants. They are endocrine disruptors may lead to antibiotic resistance to bacteria. This chemical irritates skin and eyes and very toxic to aquatic animals.

Surveys of the above products show that nearly 80% of the personal care products contain one or more of the above harmful chemicals. It was found that women are more exposed to these chemicals than men. Most of the consumers do not check the harmful effects printed on the products. It was also observed that many companies do not show the ingredients present in these products; companies only display the product category present in it and not exactly the chemicals used in it. For example, for fragrance in cosmetics 'parfum' is actually is used. The product category represents nearly 3,000 chemicals. So, exact chemical composition of the perfume used in the ingredient is not displayed.

Surveys also show that many personal care products contain drugs. Research activities in this area are very limited and awareness among the public is very low. Catchy advertisements and attractive packings are luring the public.

Government regulations on the production of these products have been confirmed only to records. Strict vigilance on these products and quality assurance tests does not give any assurance & safety to the consumers. Most of the chemical ingredients in cosmetics have never been tested for their effects on human health and environment. The laws governing these products contain many loopholes.

Conclusion

Surveys suggest that there is high level toxic content in cosmetics & personal care products. These chemicals are not mentioned on the labels or containers. So, governments must take adequate care to identify these chemicals through research activity and suggest alternative products that are less harmful.

Laws should be strengthened so that products should be completely verified and checked before they are released into the market.



Manufacturers should relieve all the ingredients their chemical position and percentage amounts so that consumer will be able to judge the products which are suitable for them.

Terms like unscented, fragrance free should be prohibited. Antibacterial products should be banned as there is prevalence of antibiotic resistance bacteria. Terms like natural, nature, bio or organic should be scrutinized properly because they also contain these hazardous chemicals and these words mislead the consumers.

Last but not the least awareness should be spread in public about the hazards present in the cosmetics and people should be encouraged to opt for the products with shorter ingredient list and buy fewer personal products.



ENDOCRINE DISRUPTERS – A ROLE IN HUMAN HEALTH?

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ABSTRACT

This introductory overview starts with defining endocrine disrupters and briefly describes their underlying mechanisms of action. Then, some examples of endocrine disrupters are presented together with the types of human health effects that have been suggested to be linked to exposure to such chemicals. Thereafter, basic elements in risk assessment of exposure to endocrine disrupters are discussed, pointing to the central role of potency and exposure characterization in such assessments. It is concluded that the current state of the science has not provided a clear evidence for a causal link between exposure to endocrine disrupters and human reproductive health, neuroendocrine function and behavior, or hormonally influenced human cancers.

Keywords: Endocrine Disruptors, Risks, Human Health and Environment.

Introduction

During the last decade there has been much interest and concern related to endocrine disrupters among scientists, regulators and public interest groups. An important question to answer is whether exposure to chemicals displaying endocrine disrupter activity in various test systems, play a role in human health. By definition, an endocrine disrupter is an exogenous substance or a mixture that alters function(s) of the endocrine system and consequently causes adverse health effects in an intact organism, or its progeny, or (sub)populations (1). It is important to distinguish this from a potential endocrine disrupter, which is an exogenous substance or mixture that possesses properties that might be expected to lead to endocrine disruption in an intact organism, or its progeny, or (sub)populations (1). Such potential endocrine disrupters are typically identified from receptor binding assays and various cellular systems. The basis for concerns relating to human exposure to potential endocrine disrupters comes from a number of observations. It is clear that adverse effects pertaining to endocrine functions have been observed in certain wildlife, fish and ecosystems exposed to high doses of chemicals with endocrine disrupter activity (2). There are obvious increases in certain endocrine-related human diseases such as breast cancer and testicular cancer (3). Potential disrupters such as DDT metabolites, alkyl phenols, bisphenol A and phthalates have caused changes in the function of endocrine systems when administered at high doses in experiments with laboratory animals (1). Offspring of women administered the synthetic estrogen diethylstilbestrol (DES) have developed serious health effects such as vaginal cancer (4).

Mechanisms of action

Exposure to xenobiotics including plant chemicals may perturb endocrine systems in a number of ways (1). Many endocrine disrupters interact directly with hormone receptors, whereas some cause indirect activation of hormone receptors, e.g. via receptor phosphorylation. Some receptors interact with each other, such as through 'cross-talk' between the estrogen and the growth factor receptors. In other situations, endocrine disrupting chemicals may interact with multiple receptors. It is well known that inhibition of hormone synthesis and hormone transport, as well as alteration in hormone metabolism can affect endocrine systems.



Skakkebaek and co-workers (5) have postulated that a common syndrome, testicular dysgenesis, underlies several of the clinical manifestations of male reproductive toxicity due to *in utero* exposure to endocrine disruptors. Through interaction of environmental and genetic factors, disturbed Sertoli cell function may lead to decreased germ cell differentiation resulting in reduced semen quality and testicular cancer. Such interacting factors could also lead to decreased Leydig cell function leading to hypospadias and testicular maldescent.

Examples of endocrine disruptors

A large number of chemicals have been studied for possible endocrine disrupting effects in a number of test systems (1). Some candidate endocrine disruptors emanating from such studies are presented in Table 1.

Table 1. Some candidate endocrine disruptors.

Compound	Occurrence/Use
Phytestrogens	Naturally occurring in nutritional supplements
Phthalates	Softener in plastics
Chlorinated dioxins and furans	Environmental contaminants from high-temperature processes involving organic matter and chlorine
PCBs	Environmental contaminants from previous use in transformers, appliances and building materials
DDT/metabolites	Environmental contaminant, formerly used as a pesticide
Alkyl phenols and – ethoxylates	Detergents, emulsifiers, wetters, dispersants, coatings, spermicides
Bisphenol A	Epoxy and polycarbonate resins, plastic stabiliser
Tributyltin	Biocide
Parabens	Preservatives in cosmetics and toiletries

A number of human health effects have been suggested to be linked to exposure to endocrine disrupting chemicals (1), including:

- Reproductive effects
 - Declined sperm quality
 - Impaired fertility and increased spontaneous abortion
 - Declining sex ratios
 - Increases in developmental abnormalities such as hypospadias and cryptorchidism
- Endometriosis
- Precocious puberty
- Neural function
- Immune function
- Cancer
 - Breast cancer
 - Endometrial cancer
 - Testicular cancer
 - Prostate cancer
 - Thyroid cancer



Risk assessment of exposure to endocrine disruptors

When assessing the potential risks to humans from exposure to potential endocrine disruptors, two central parameters must be taken into consideration, namely the potency of the chemical and the exposure to such a chemical. The potency of various endocrine disruptors vary widely, such as is evident from tests using the rodent uterotrophic assay and comparing the outcome with the synthetic estrogen ethinylestradiol (Table 2).

Table 2. Comparative potency of xenoestrogens in the rodent uterotrophic assay (adapted from 6 and 7).

Substance	Relative potency EE = 1,000,000
Synthetic estrogens	
Diethylstilbestrol (DES)	3,000,000
Ethinylestradiol (EE)	1,000,000
Natural estrogens	
Estrone	250,000
Phytoestrogens	
Coumestrol	1,250
Genistein	37
Consumer chemicals	
Nonylphenol	10
Isobutylparaben	4.1
Bisphenol A	2.5

In order to assess the exposure to endocrine disruptors it is necessary to know the levels of the substance in exposure media and the volumes of such media inhaled and consumed. In addition, exposure could be dermal through direct contact with the skin. Further, it is essential to clarify whether the exposure is constant or variable and regularly or occasionally, and whether it occurs during particular periods of the life span. In addition, it is important to identify special population groups who may be especially sensitive to the exposure in question.

There are several limitations in exposure assessment of endocrine disruptors. Absence of adequate exposure data are often the weakest link in determining whether observed adverse effects are related to endocrine disruptors. Also, data on magnitude and trends of human exposure are many times limited. Information on exposure during critical development periods are generally lacking. Further, existing data are primarily for various environmental media (air, food, water) rather than the most relevant internal exposure (levels in blood and tissues). Such exposure information is essential to adequately evaluate exposure response relationships in epidemiology and to use these relationships to produce credible risk estimates.

Conclusions

At present, currently available data are inadequate to conclude that human reproductive health has been adversely affected by exposure to endocrine disrupting chemicals. Human and animal studies clearly indicate that prenatal exposure to certain endocrine disruptors can have adverse effects on neurological development, neuroendocrine function, and behavior. However, a causal role for endocrine disruptors in neurobehavioral dysfunction cannot be deduced



from available human data. The current state of the science has not provided a clear evidence for a causal link between exposure to endocrine disruptors and hormonally influenced human cancers.

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HORMONE THERAPY FOR BREAST CANCER

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ABSTRACT

Hormones are substances that function as chemical messengers in the body. They affect the actions of cells and tissues at various locations in the body, often reaching their targets through the bloodstream. The hormones estrogen and progesterone are produced by the ovaries in premenopausal women and by some other tissues, including fat and skin, in both premenopausal and postmenopausal women. Estrogen promotes the development and maintenance of female sex characteristics and the growth of long bones. Progesterone plays a role in the menstrual cycle and pregnancy. Estrogen and progesterone can also promote the growth of some breast cancers, which are called hormone-sensitive (or hormone-dependent) breast cancers.

Keywords: Hormones, Estrogen, Progesterone, Premenopausal, Postmenopausal, Breast Cancers, Hormone-Sensitive.

Introduction:

Hormone-sensitive breast cancer cells contain proteins known as hormone receptors that become activated when hormones bind to them. The activated receptors cause changes in the expression of specific genes, which can lead to the stimulation of cell growth. To determine whether breast cancer cells contain hormone receptors, doctors test samples of tumor tissue that have been removed by surgery. If the tumor cells contain estrogen receptors, the cancer is called estrogen receptor-positive (ER-positive), estrogen-sensitive, or estrogen-responsive. Similarly, if the tumor cells contain progesterone receptors, the cancer is called progesterone receptor-positive (PR- or PgR-positive). Approximately 70 percent of breast cancers are ER-positive. Most ER-positive breast cancers are also PR-positive [1].

Breast cancers that lack estrogen receptors are called estrogen receptor-negative (ER-negative). These tumors are estrogen-insensitive, meaning that they do not use estrogen to grow. Breast tumors that lack progesterone receptors are called progesterone receptor-negative (PR- or PgR-negative). Hormone therapy (also called hormonal therapy, hormone treatment, or endocrine therapy) slows or stops the growth of hormone-sensitive tumors by blocking the body's ability to produce hormones or by interfering with hormone action. Tumors that are hormone-insensitive do not respond to hormone therapy. Hormone therapy for breast cancer is not the same as menopausal hormone therapy or female hormone replacement therapy, in which hormones are given to reduce the symptoms of menopause.

Results and Discussion

Several strategies have been developed to treat hormone-sensitive breast cancer, including the following:

Blocking ovarian function: Because the ovaries are the main source of estrogen in premenopausal women, estrogen levels in these women can be reduced by eliminating or suppressing ovarian function. Blocking ovarian function is called ovarian ablation. Ovarian ablation



can be done surgically in an operation to remove the ovaries (called oophorectomy) or by treatment with radiation. This type of ovarian ablation is usually permanent. Alternatively, ovarian function can be suppressed temporarily by treatment with drugs called gonadotropin-releasing hormone (GnRH) agonists, which are also known as luteinizing hormone-releasing hormone (LH-RH) agonists. These medicines interfere with signals from the pituitary gland that stimulate the ovaries to produce estrogen. Examples of ovarian suppression drugs that have been approved by Food and Drug Administration (FDA) are goserelin (Zoladex®) and leuprolide (Lupron®).

Blocking estrogen production: Drugs called aromatase inhibitors can be used to block the activity of an enzyme called aromatase, which the body uses to make estrogen in the ovaries and in other tissues. Aromatase inhibitors are used primarily in postmenopausal women because the ovaries in premenopausal women produce too much aromatase for the inhibitors to block effectively. However, these drugs can be used in premenopausal women if they are given together with a drug that suppresses ovarian function. Examples of aromatase inhibitors approved by the FDA are anastrozole (Arimidex®) and letrozole (Femara®), both of which temporarily inactivate aromatase, and exemestane (Aromasin®), which permanently inactivates the enzyme.

Blocking estrogen's effects: Several types of drugs interfere with estrogen's ability to stimulate the growth of breast cancer cells:

- **Selective estrogen receptor modulators (SERMs)** bind to estrogen receptors, preventing estrogen from binding. Examples of SERMs approved by the FDA are tamoxifen (Nolvadex®), raloxifene (Evista®), and toremifene (Fareston®). Tamoxifen has been used for more than 30 years to treat hormone receptor-positive breast cancer. Because SERMs bind to estrogen receptors, they can potentially not only block estrogen activity (i.e., serve as estrogen antagonists) but also mimic estrogen effects (i.e., serve as estrogen agonists). Most SERMs behave as estrogen antagonists in some tissues and as estrogen agonists in other tissues. For example, tamoxifen blocks the effects of estrogen in breast tissue but acts like estrogen in the uterus and bone.
- **Other antiestrogen drugs**, such as fulvestrant (Faslodex®), work in a somewhat different way to block estrogen's effects. Like SERMs, fulvestrant attaches to the estrogen receptor and functions as an estrogen antagonist. However, unlike SERMs, fulvestrant has no estrogen agonist effects. It is a pure antiestrogen. In addition, when fulvestrant binds to the estrogen receptor, the receptor is targeted for destruction.
 - **How is hormone therapy used to treat breast cancer?**
 - There are three main ways that hormone therapy is used to treat hormone-sensitive breast cancer:
 - **Adjuvant therapy for early-stage breast cancer:** Research has shown that women treated for early-stage ER-positive breast cancer benefit from receiving at least 5 years of adjuvant hormone therapy [2]. Adjuvant therapy is treatment given after the main treatment (surgery, in the case of early-stage breast cancer) to increase the likelihood of a cure.
 - Adjuvant therapy may include radiation therapy and some combination of chemotherapy, hormone therapy, and targeted therapy. Tamoxifen has been approved by the FDA for adjuvant hormone treatment of premenopausal and postmenopausal women (and men) with ER-positive early-stage breast cancer, and anastrozole and letrozole have been approved for this use in postmenopausal women.



- A third aromatase inhibitor, exemestane, is approved for adjuvant treatment of early-stage breast cancer in postmenopausal women who have received tamoxifen previously.
- Until recently, most women who received adjuvant hormone therapy to reduce the chance of a breast cancer recurrence took tamoxifen every day for 5 years. However, with the advent of newer hormone therapies, some of which have been compared with tamoxifen in clinical trials, additional approaches to hormone therapy have become common [3–5]. For example, some women may take an aromatase inhibitor every day for 5 years, instead of tamoxifen. Other women may receive additional treatment with an aromatase inhibitor after 5 years of tamoxifen. Finally, some women may switch to an aromatase inhibitor after 2 or 3 years of tamoxifen, for a total of 5 or more years of hormone therapy.
- Decisions about the type and duration of adjuvant hormone therapy must be made on an individual basis. This complicated decision-making process is best carried out by talking with an oncologist, a doctor who specializes in cancer treatment.
- **Treatment of metastatic breast cancer:** Several types of hormone therapy are approved to treat hormone-sensitive breast cancer that is metastatic (has spread to other parts of the body).
- Studies have shown that tamoxifen is effective in treating women and men with metastatic breast cancer. Toremifene is also approved for this use. The antiestrogen fulvestrant can be used in postmenopausal women with metastatic ER-positive breast cancer after treatment with other antiestrogens.
- The aromatase inhibitors anastrozole and letrozole can be given to postmenopausal women as initial therapy for metastatic hormone-sensitive breast cancer. These two drugs, as well as the aromatase inhibitor exemestane, can also be used to treat postmenopausal women with advanced breast cancer whose disease has worsened after treatment with tamoxifen.

Can hormone therapy be used to prevent breast cancer?

- Yes. Most early breast cancers are ER-positive, and clinical trials have studied whether hormone therapy can be used to prevent breast cancer in women who are at increased risk of getting the disease. A large NCI-sponsored randomized clinical trial called the Breast Cancer Prevention Trial found that tamoxifen, taken for 5 years, reduced the risk of developing invasive breast cancer by about 50 percent in postmenopausal women who were at increased risk of getting the disease. A subsequent large randomized trial, the Study of Tamoxifen and Raloxifene found that 5 years of raloxifene reduces breast cancer risk in such women by about 38 percent.
- As a result of these trials, both tamoxifen and raloxifene have been approved by the FDA to reduce the risk of developing breast cancer in women at high risk of the disease. Tamoxifen is approved for use regardless of menopausal status. Raloxifene is approved for use only in postmenopausal women.
- The aromatase inhibitor exemestane has also been found to reduce the risk of breast cancer in postmenopausal women at increased risk of the disease. After 3 years of follow-up in another randomized trial, women who took exemestane were 65 percent less likely than those who took a placebo to develop breast cancer.
- **Side effects:**



Tamoxifen

- Risk of blood clots, especially in the lungs and legs
- Stroke
- Cataracts
- Endometrial and uterine cancers
- Bone loss in premenopausal women
- Mood swings, depression, and loss of libido
- In men: headaches, nausea, vomiting, skin rash, impotence, and decreased sexual interest

Raloxifene

- Risk of blood clots, especially in the lungs and legs
- Stroke in certain subgroups

Ovarian suppression

- Bone loss
- Mood swings, depression, and loss of libido

Aromatase inhibitors

- Risk of heart attack, angina, heart failure, and hypercholesterolemia
- Bone loss
- Joint pain
- Mood swings and depression

Fulvestrant

- Gastrointestinal symptoms
- Loss of strength
- Pain

Conclusion: Experts suggest that even though breast cancer can be treated by hormone therapy effectively, it has side effects. The side effects of hormone therapy depend largely on the specific drug or the type of treatment. The benefits and risks of taking hormone therapy should be carefully weighed for each woman. Hot flashes, night sweats, and vaginal dryness are common side effects of hormone therapy. Hormone therapy also disrupts the menstrual cycle in premenopausal women.

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INDIGENOUS ADSORBENTS FOR THE REMOVAL OF PHARMACY WASTES IN WATERS-A REVIEW

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Abstract

Trace amount of pharmaceuticals in drinking water for longer duration may cause substantial undesirable effects to human health and aquatic life, though concentrations of pharmaceuticals detected in drinking water are several orders of inferior magnitude than the minimum therapeutic dose. Several pharmaceutical production facilities were found to be sources of much higher environmental concentrations than those caused by the applications of drugs. The question is how is this pharmaceutical waste disposed? Proper management of hazardous waste is highly complex and needs methods different from those used for disposal of biomedical waste. Presently, those who handle drugs in hospitals do not receive appropriate training in hazardous waste management during their academic studies, and those who do receive such training (environment personnel) may not be familiar with active ingredients in various pharmaceutical formulations. Till date, researchers have acknowledged many human and veterinary pharmaceutical compounds at serious concentrations in drinking water resources and they are a major contributor to environmental pollution. Emphasis is also given on pharmacist role in proper disposal of unwanted and expired medicine makes a significant impact on the environment as well as it prevents accident, poisoning and intentional violence. So, it will lead to the welfare of society and trudge towards goal health for all.

Traditionally, pharmaceuticals were not considered as environmental pollutants, but at present they constitute a group of great concern among emerging contaminants (ECs). Pharmaceuticals were designed to cause a physiological response and their presence in the environment may affect non-target individuals and species, which has raised alarms for possible impacts on human health (3). In this context, research on the adsorptive removal of ECs and, namely, pharmaceuticals from water has largely increased in the last years. However, most of the published works report the adsorption of this sort of pollutants onto different adsorbents from distilled or ultrapure water but not from real wastewater. However, a main issue for the applicability of any adsorbent in tertiary treatment is the study of its utilization for pharmaceuticals adsorption from real wastewater.

Activated carbon Adsorption is present in many natural, physical, biological, and chemical systems, and is widely used in Pharmaceutical industry applications. Activated carbon has been proposed to be an adsorbent for the removal of Pharmacy wastes from water due to its unique physical chemical properties such as porosity and large specific surface area in addition to the availability and maturity of adsorption technology. Generally, activated carbon is applied at the polishing step for the removal of refractory compounds and precursors of disinfection by products in water treatment. The removal of pharmaceuticals by adsorption on commonly efficient adsorbents is one of the most promising techniques because of its convenience when applied in current water



treatment processes. To date, several reports related to the adsorption of pharmaceuticals onto natural materials or components of natural materials.

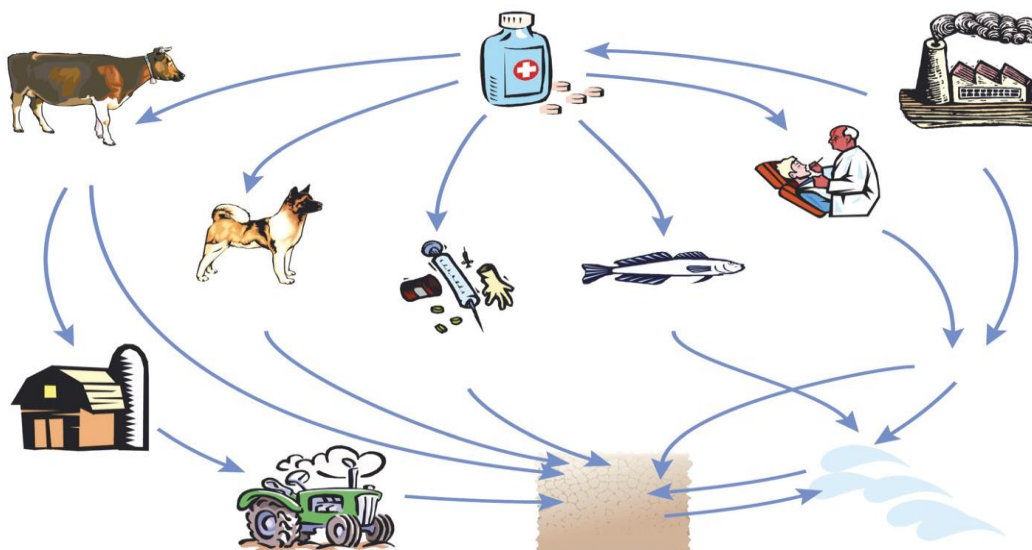
This work aimed to assess the utilization of various activated carbon materials indigenously prepared from bio materials for the removal of pharmaceuticals from wastewater by comparing their adsorption capacities

Keywords: Natural Plant Adsorbents, Antibiotics, Dyes, Activated Carbons, Contaminants, Pharmaceutical Wastewater, Treatment Process.

Introduction

we have been noticing many environment pollutants such as Pharmaceutical outcomes leading to degrade the natural resources especially water and soil such as pesticides , bioactive chemicals, industrial intermediates, municipal STPs, polar PhACs clofibric acid, carbamazepine, 4-chloro-2-nitrophenol, antibiotics as contaminants from pharmaceuticals, primidone or iodinated contrast agents , drugs and biologics, diagnostic agents, fragrances, sun-screen agents, collectively termed PPCPs which are used endless in the environment showing impact on Ecosystem and on life. This present review is how we can remove all above mentioned waste and polluting contaminants obtained from various sectors especially from pharmaceuticals using natural adsorbents, dyes, activated carbons, using many methods.

Sources of pollutants



Removal Methods and their Efficiency

In this review Activated carbon prepared from tea leaves and burnt wood also can be used for removal of above mentioned contaminants such as. Antibiotics present in waste water as an outcome source from pharmaceuticals and run off from cattle shed contaminate the water. For the treatment of these deadly antibiotics several methods have been employed. In these antibiotics, there are a variety of classes present namely Macrolide, Quinolone, Sulfonamide, Tetracycline, Trimethoprim, Lincosamide, etc. The removal efficiency varies differently for different classes of antibiotics this water contains some acute percentages of antibiotics traces they are removed by some methods at each stage with reference are mentioned. Waste water treatment plant is. Anaerobically digested sludge then undergone Photocatalysis + Ozonation respectively then



Ozonation is carried out and then followed by Ozonation and Adsorption a then Nanofiltration and the sample is sent to Membrane Bioreactors and Reverse Osmosis and the sample is chlorinated. Till this stage > 90 % of antibiotics are removed from the waste water, with reference to Adams et al., (2002).then Photo - Fenton 100 % Trovó et al. (2008); Elmolla and Chaudhuri (2009 a, b) Combination of Fenton oxidation with two-stage reverse osmosis99.7 % Zhang et al., (2006) then Adsorption on granular activated carbon95 % Putra et al., (2009) Adsorption on bentonite 88 Reverse osmosisand then Nano filtration> 90 % Kosutic et al. Removal using metallic iron 100 % Ghauch et al., (2009). Clarification + Chlorination+GAC filtration 47 %, 92%, 100 %Stackelberg et al., (2007) Coagulation/Flocculation/Sedimentation + Rapid sandfiltration and Granular activated carbon filtration + Ozonation30 %, ~ 10 %,16 % = 56 %Vieno et al., (2007). Adsorption on zeolite is coupled with ozonation80 %, 100 % Ötöker and Akmeahmet-Balcioğlu (2005). Ion exchange ~ 90 % Choi et al., (2007) finally undergoes Electrochemical oxidation and then antibiotics are removed in this method.

Conclusion

Since decades, overusage of antibiotics has employed in many treatments in recovering of human beings from many number of diseases from minor to i.e., cough and cold to cancer, has been an ever-increasing source of pollutants in all aspects showing harmful effects. These are persistent and resistant to biodegradation and thus go on accumulating in the environment. Thus, a variety of removal or degradation processes are employed to solve this problem. toxicity is currently on “environmental endocrine disruptor” which induces childhood cancer and functional disorders of endocrine glands. Alternative methods to control pollution are physiochemical and bioremediation solutions, using green solvents, recycling pharmawaste by adopting governed acts. so in this waste water treatment process we can remove antibiotics especially from contaminated water along with fluorides nitrates and excess of ion concentrations

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PHARMACEUTICS FROM ALGAE

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ABSTRACT

Ever since the ancient times in China, kelp has been considered an elixir of longevity because it is rich in iodine and potassium that can help treat goiter and prevent high blood pressure. In fact, *Digeneasimplex* Agardh is often used as an ascaricide for children. In recent years, some research studies have shown that algae can reduce fever, diminish inflammation, and prevent cancer and thrombus. It has been proven that algae have antibacterial, ecobolic, hemostatic and diuretic properties. Phyco-colloids extracted from algae is often used to treat injuries. It is also an ingredient in medicines used to treat ulcer, to help enhance the formation of connective tissue, to treat hemostasia, to help lower cholesterol levels and lower blood pressure.

Key Words: Algae, Pharmaceuticals, Polyphenols, Beverages, Hemostacia, Fibers.

Prologue: Algae are diverse group of autotrophic organisms which ranges from unicellular to multicellular forms(1). They are primary producers, which is a source of many nutrients and it has high protein content(2). The most complex marine forms are called seaweeds. Blue green algae, red algae, green algae assigned higher contents of dietary fibres. Certain beverages are prepared from sea algae. Mainly marine algae have been used as food and medicine for many centuries. Algae are used as one of important medical source due to its antioxidant, anticancer, antiviral properties (3). Therapeutic properties of algae are used for promotion of health.

Antimicrobials, Antivirals & Antifungals, Microalgae, such as *Ochromonas* sp., *Prymnesium* and a number of blue Green algae produce toxins that may have potential pharmaceutical applications (4). Various strains of Cyanobacteria are known to produce intracellular and extracellular metabolites with diverse biological activities such as antibacterial, antifungal and antiviral activity (5). The biological activities of the algae may be attributed to the presence of volatile compounds, some phenols, free fatty acids and their oxidized derivatives). There are numerous reports of macroalgae derived compounds that have a broad range of biological activities, such as antibiotic, antiviral, anti- neoplastic, antifouling, anti-inflammatory, cytotoxic and antimetabolic (Naqvi et al., 1980). In the past few decades, macroalgae have been widely recognized as producers of a broad range of bioactive metabolites (6). Such antimicrobial properties enable macroalgae to be used as natural preservatives in the cosmetic industry. The highest percentage of antimicrobial activity was found in Phaeophyceae (84%), followed by Rhodophyceae (67%) and Chlorophyceae (44%). () Red and brown macroalgae extracts show significant potential as anti-pathogenic agents for use in fish aquaculture.

Neuroprotective Products: Both microalgae and macroalgae are neuroprotective agents and promote nerve cell survival. Among the various microalgal species, *Spirulina* is most commonly referred as a neuroprotective agent. *Spirulina platensis* may be useful in the development of novel treatments for neurodegenerative disorders such as Alzheimer's or Parkinson diseases. *Spirulina maxima* is found to partially prevent MPTP (1-methyl-4-phenyl-1,2,3,6 tetrahydropyridine)



neurotoxicity and oxidative stress, suggesting it could be a possible alternative in experimental therapy(7). Several macroalgae are found to possess therapeutic potential for combating neurodegenerative diseases associated with neuroinflammation. A marine macroalgae, *Ulva conglobata*, a marine algae (McHugh, 2003) has neuroprotective effects in murine hippocampal and microglial cells

Human Therapeutic Proteins: Pharmaceutical companies could substantially reduce the expense of costly treatments for cancer and other diseases produced from mammalian or bacterial cells by growing human therapeutic proteins in algae. Microalgae usually find extensive use as therapeutic and diagnostic proteins. Expression of recombinant proteins in green algal chloroplast holds substantial promise as a platform for the production of human therapeutic proteins(7). The percentage of human proteins produced in their algal cultures is comparable to the fraction produced by mammalian cell cultures and much better than that produced by bacterial systems. *Chlamydomonas reinhardtii*, a green alga in a study confirmed that diverse human therapeutic proteins could be produced

Algae can be used to produce VEGF (Vascular Endothelial Growth Factor) for treating emphysema. HMGB1 (High Mobility Group Protein B1) which activates immune cells. Domain 14 of human fibronectin. Domain 10 of human fibronectin used to increase the accumulation of other proteins. Human proinsulin could be produced by algae(8), but only at lower levels.

Algal chemistry has interested many researchers in order to develop new drugs, as algae include compounds with functional groups which are characteristic (Timothy, 2008) from this particular source. Researchers have been able to produce an exciting class of anti-cancer drugs originally isolated from blue-green algae. A compound named cryptophycin 1 has been isolated from blue-green algae which hold significant promise as an anti-cancer drug(9). Microalgae produce incredibly potent alkaloidal neurotoxins such as saxitoxin and polyketide neurotoxins such as the brevetoxins for use as anticancer drugs. The alkaloids found in marine macroalgae present special interest because of their pharmacological activities. These alkaloids in macroalgae are largely focused on finding drugs for cancer treatment(11).

Some inventions made by scientists from algae are(12,13,14,15):

Chlorophyta

Enteromorpha Can be used to treat hemorrhoids, parasitic disease, goiter, asthma, coughing and bronchitis; they reduce fever.

Ulva: to treat goiter; reduce fever, ease pain, induce urination

Codium; to treat urinary diseases, treat edema, expel

Acetabularia Can be used to treat urinary diseases and edema

Phaeophyta

Laminaria; to treat goiter, urinary diseases;

Sargassum to treat cervical lymphadenitis, edema; diminishes inflammation reduces fever; induces urination; contains iodine and potassium

Rhodophyta

Porphyra; to treat goiter, bronchitis, tonsillitis and cough *Gelidium*; a Laxative; to treat tracheitis, gastric diseases and hemorrhoids; can be used to extract agar *Pterocladia* Laxative; to treat tracheitis, gastric disease and hemorrhoids; as an agar extract; can be used to make coating for pills *Gracilaria*; to treat goiter, edema, urinary diseases, can prevent ulcer; as an agar extract and make



coating for pills Centroceras; to treat gastro-intestinal intolerance Chondria; Ascaricide Grateloupia; Ascaricide; lowers blood pressure Gloeopeltis; to treat goitre, tonsillitis and bronchitis; prevents high blood pressure

Epilogue: The algae are taxonomically diverse, largely productive, biologically active, and chemically unique offering a great scope for discovery of new anticancer drugs. The marine floras belonging to polyphenols and sulphated polysaccharides are rich in medicinally chemical potent predominantly. While a mixture of different species or combinations with other food opens up, their use in feed can also compensate the usage of other foods which are in first position. The cultivation of algae population with so many medicinal benefits need to be promoted and improved using modern techniques. In addition to the health advantages, algae offer economic benefits. Medical compounds grown today in plants and animals have three disadvantages: development time, growth time and compound density. A vaccine grown in cow's milk may take a decade to develop. Cows start producing milk in two years, so production time is long. The target compound in milk is low – often less than 1% – which means farmers must produce tons of milk to make the vaccine. Compounds produced in algae offer a development time of weeks rather than years. Growth time is days versus months. Compound density may be 5% or higher in dry weight algae, which means medicine production is faster and less expensive. The present paper deals with a note on algae as medicine.

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CAD EXTENDED TO CALCULATION OF POLLUTION EFFECTS IN DRUG DESIGN

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ABSTRACT

Computer Aided Design – CAD is defined the use of Information Technology (IT) in the design process. A lot of research work in computer science applications in chemistry results the CAD system in drug design. Pharmaceutical pollution is the area in which the research is required related to the computer technology and use of computer applications to reduce the pollution. A CAD system consists of IT hardware, specialized software in the area of drug design and peripherals which in certain applications are quite specialized. The core of a CAD system is the software, which makes use of graphics for drug representation, databases for storing the drug models and drives the peripherals for drug presentation.

Similarly, CAD system can extend to calculation of pollution effects in drug design. The CAD system Consists of additional software, which makes use of calculation of pollutants, makes use of graphics for pollution representation in drug, etc. Another large database (expert system) is required for storing the information related to chemical pollutants used in pharmaceuticals, pollution effects in various chemical compositions in drugs, positive and negative consequences of pollution effects with available models and drives the peripherals for drug or pharmaceutical presentation. The development and drastic use of CAD for pollution control in drug design can reduce the misuse of pollutants in pharmaceutical industry. This will become the best tool for pollution control board and Drug control board.

Key words: Computer aided design – CAD- IT- drug design –Extended CAD- pollution calculation – databases –expert systems – reduce pollutants - in pharmaceutical industry.

1. INTRODUCTION

Computer plays an important role in all fields. There is no exception for Pharmaceutical research too. CAD system in drug design is a application which is the result of lot of research work in pharmaceuticals. Computer Aided Design – CAD is defined the use of Information Technology (IT) in the design process. A CAD system consists of IT hardware, specialized software in the area of drug design and peripherals which in certain applications are quite specialized. The core of a CAD system is the software, which makes use of graphics for drug representation, databases for storing the drug models and drives the peripherals for drug presentation.

Pharmaceutical pollution is the area in which the research is required related to the computer technology and use of computer applications to reduce or control the pollution. It can extend the CAD in drug design is also capable to calculate pharmaceutical pollution. Then, The CAD system Consists of additional software, which makes use of calculation of pollutants, makes use of graphics for pollution representation in drug, etc. Another large database (expert system) is required for storing the information related to chemical pollutants used in pharmaceuticals, pollution effects in various chemical compositions in drugs, positive and negative consequences of pollution effects with available models and drives the peripherals for drug or pharmaceutical presentation. An expert system is a computer program that represents and reasons with knowledge of some specialist



subject with a view to solving problems or giving advice. Expert system derives from the research discipline of Artificial intelligence (AI) a branch of computer science concerned with the design and implementation of programs which are capable of emulating human cognitive skills such as problem solving, visual perception and language understanding. This technology can be applied to the calculation of pollution in pharmaceuticals.

2. AN EXTENSION OF EXPERT SYSTEM TO IDENTIFY THE POLLUTION USING CAD IN DRUG DESIGN:

CAD in drug design includes the expert system, is used to identify the Pharmaceutical pollution. This expert system consists of Knowledge Base, Inference Engine, User Interface, User, and Domain Expert.

2.1 KNOWLEDGE BASE: Knowledge Base contains the problem-solving expertise to control pharmaceutical pollution. Domain expert contributes the data related to the pollutants in drug affects of pollution, list of banned drugs and their effects, pollutants due to various combinations etc. Knowledge engineer elicits the expertise and encodes it into knowledge base.

2.2 INFERENCE ENGINE: Design of inference engine is a computer program that applies the problem solving knowledge by using the rule based decisions and decision trees. IE is a program, which performs the reasoning based on the questions and answering on the problem solving to perform a task.

2.3 USER INTERFACE: This is a phase to build the program that request query or information from user and send output or advise back. Here design of input and output screens are required to get queries and display the advice on the pharmaceutical pollution.

The Expert system can be able to perform the task of identifying the pollution in pharmaceuticals and their effects at the time of drug design itself.

3. CAD INCLUDING EXPERT SYSTEM FOR POLLUTION CONTROL SYSTEM

The following pseudo code is a part of expert system to identify the pollutants in drugs.

3.1 PSEUDO CODE

PROCEDURE-1:

This procedure (or) Pseudo code is to find pollutants in chemicals using expert system:

Read n chemicals in a drug

Repeat to check each chemical for its pollution

{

If chemical is pollutant {

 Read n alternatives

 Check for less or no polluted alternatives {

 If alternative is highly polluted

 {

 Again, check for other pollutants recursively

 Until get the less pollutant from the knowledge base}

 Else

 {

 Use the alt chemical

 }

 }

Else



```
{  
    Use the chemical  
}  
}
```

PROCEDURE-2:

This procedure or Pseudo code is to find combination of pollutants in pharmaceuticals using expert system:

Read m elements in drug array

Then copy drug array elements to temp array n=m

Repeat to read drug elements from 1 to n in temp var i

```
{  
    Repeat to read temp array element with var n=i+1  
    {  
        Compare drug array with temp array for combination pollutants in using  
        knowledge base until all elements in drug array completed.  
  
        If any pollution identified  
        {  
            Display message "pollution occurred"  
        }  
        Else{  
            Go to next}  
    }  
}
```

4.CONCUSIONS

CAD extended to calculation of pollution effects in drug design consists of expert system can control the pharmaceutical pollution by replacing the highly effective pollutants with less effective or not harmful chemicals. This study can extend to calculate the pollutants in pesticides which can result the pollution free soil and food.

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ANALYTICAL TECHNIQUES FOR THE EXTRACTION OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS

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ABSTRACT

Pharmaceuticals and personal care products (PPCPs) which contain diverse organic groups, such as antibiotics, antimicrobials agents, antipsychotics, antidepressants, antianxiety drugs, beta-blockers, hormones, synthetic agents, etc., have raised significant concerns in the recently years because of their persistent input and potential threat to ecological environment and human health. We present a comprehensive overview of recent developments in analytical chemistry for the most environmentally important groups of chemicals i.e. PPCPs. As they are in very low concentrations in the environmental samples being in complex matrices demanding extensive extraction procedures which were very specific and sensitive. Methods therefore need to be able to detect the targeted compounds at these trace levels. In this context, we discussed about different types of sensitive extraction procedures in determining the Pharmaceuticals and personal care products in environmental samples at trace levels.

Keywords: Pharmaceuticals, Personal Care Products, Extraction techniques and Environmental Samples.

INTRODUCTION

During the last decade, the focus of environmental research has been partly turned from the conventional priority pollutants such as Pharmaceuticals and personal care products. PPCPs include numerous chemical classes. Pharmaceuticals are used primarily to prevent or treat human and animal disease, whereas personal care products are used to improve the quality of daily life and include products such as moisturizers, lipsticks, shampoos, hair colours, deodorants and toothpaste. Human use PPCPs are generally excreted and emitted into the sewage system following use. The compounds may then be released into surface waters or enter terrestrial system when sewage effluents are used for irrigation or where sewage sludge is applied as a fertilizer to agricultural land.

[1,2]

Veterinary pharmaceuticals are released into the environment either by directly, from use in aquaculture and the treatment of pasture animals, or indirectly during the land application of manure and slurry from livestock facilities. [3] PPCPs are detected in the natural environment across the world. [4] Many PPCPs have been detected in a variety of hydrological, climate and land-use settings and some can persist in the environment for months to years. [5]

Generally, pharmaceuticals as well as several chemicals used in personal care products are biologically active compounds that are designed to interact with specific pathways and processes in target humans and animals. Concerns have therefore been raised about the potential effects of active PPCPs in the environment on human and environmental health; over the past 15 years, a substantial amount of work has been done to determine the occurrence, fate and effects.



PRIORITIZATION OF PPCPs

Currently, more than 4,000 pharmaceuticals are in use and several types of chemicals were using in personal care products. Several methods have been proposed for and applied to human pharmaceuticals^[6] and veterinary medicines. Responses such as histological changes, behavioural effects, bio chemical responses, and up- or down-regulation of genes have been observed in organisms exposed to PPCPs^[7-9]. Aquatic and terrestrial systems will be exposed to a complex mixture of PPCPs and other contaminants.

PATHWAYS OF EXPOSURES

PPCPs can enter the environment by several pathways. PPCPs considers releases to surface waters from waste water treatment systems, aquaculture facilities and runoff from fields, as well as releases to soils during bio-solids and manure applications.

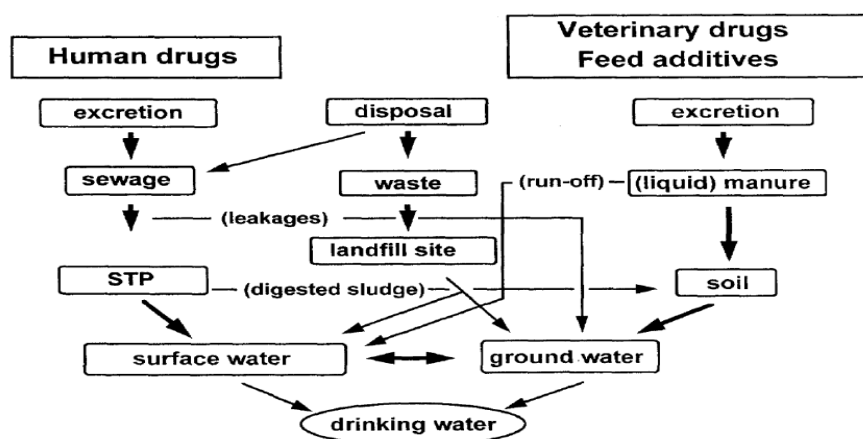


Figure 1: Pathways of Pharmaceuticals and personal care products

Other exposure pathways exist including emissions from manufacturing sites, disposal of unused medicines to landfills, runoff of veterinary medicines from hard surfaces in farmyards, irrigation with waste water, disposal of carcasses of treated animals and off label emissions.

HUMAN EXPOSURES

Humans can be exposed to PPCPs mainly through daily use of personal care products, inhalation and dietary intake. More than 80% of the investigated daily personal care products, including Tooth pastes, Hair care products, Body washes, Soaps, Skin lotions and makeup, contained synthetic musks with total contents as high as 1.02 mg. g⁻¹.^[10]

PPCPs, were found in kinds of human samples, i.e., human milk, blood and urine. Synthetic musks existed in the human milk samples from the mothers living in Chengdu of south west china, with concentration of < 1.4-16.5 ng. g⁻¹ lipid weight.^[10]

IN SOIL

They can be introduced into soil through sludge land application or landfill, use of livestock wastes as fertilizers and reclaimed water irrigation. Pollutants in soil may be accumulated in plants or migrate through soil in act or transformed and reach ground water, finally resulting in pollution to the drinking water source. Veterinary antibiotics existed in the soil from organic vegetable farmland fertilized with livestock wastes.

DIFFERENT TYPES OF EXTRACTION METHODS

The rapid and sensitive methods for extracting the pharmaceuticals and personal care products from different environmental matrices are discussed below.



- Microwave-Assisted extraction** : Patil & Shettigar (2010) ^[11] reported an innovative, microwave-assisted solvent-extraction technology known as Microwave-Assisted Processing (MAP). In this method, a small amount of freeze-dried sample was weighed into a glass bottle and supplied with small amount of extractant i.e. solvent. Then, the bottle was tightly sealed and placed in a household microwave oven, in front of the magnetron, for extraction at 500W for 5-6mins. Finally, the resulting supernatant was passed through a 0.20µm filter paper and the filtrate is then evaporated under nitrogen stream to final volume of 200µl. Then the extracted sample can be analysed by using chromatographic techniques like GC-MS or LC-MS etc. ^[12]

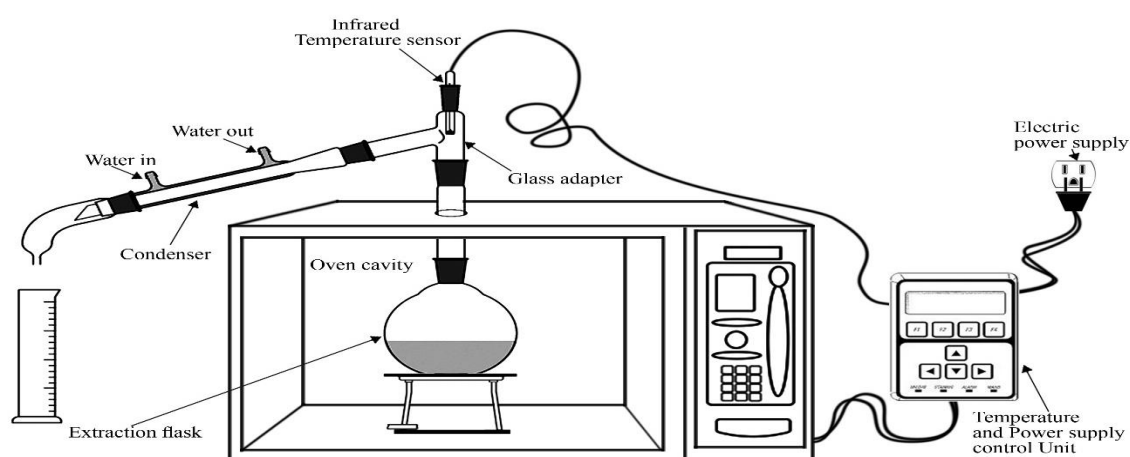


Figure 2: Microwave-Assisted extraction apparatus

- Solid phase extraction** : Solid phase extraction (SPE) is a more rapid, modern alternative to liquid-liquid extraction. This involves sorption of solutes from a liquid medium onto a solid adsorbent by the same mechanisms by which molecules are retained on chromatographic stationary phases.

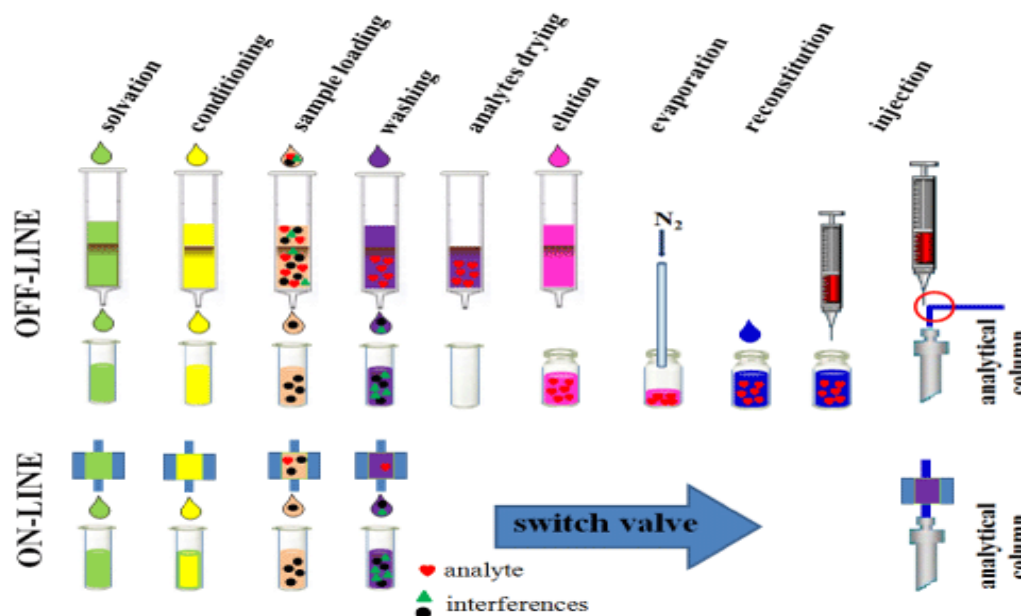


Figure 3: Solid phase extraction apparatus



These adsorbents, like chromatographic media, come in the form of beads or resins that can be used in column or in batch form. They are often used in the commercially available form of syringes packed with medium (typically a few hundred milligrams to a few grams) through which the sample can be gently forced with the plunger or by vacuum. Solid phase extraction media include reverse phase, normal phase, and ion-exchange media. This is method for sample purification that separates and concentrates the analyte from solution of crude extracts by adsorption onto a disposable solid-phase cartridge. The analyte is normally retained on the stationary phase, washed and then evaluated with different mobile phase. If an aqueous extract is passed down a column containing reverse phase packing material, everything that is fairly non-polar will bind, whereas everything polar will pass through.

3. Solid phase micro extraction (SPME)

SPME is a method used to both extract and concentrate organic compounds in which a fibre needle attachment which has been chemically coated with a fused silica equivalent to a GC liquid phase, is dipped directly into liquid samples, or exposed to the headspace vapours from liquid or solid samples. Because SPME has only recently been developed, there are few reports of its use with real environmental samples, and we must wait for the results of future investigation before recommending use. However, the fact that organic compounds can be analysed easily and quickly without using any solvents suggests that this is the direction in which the next generation of analytical methods should proceed.

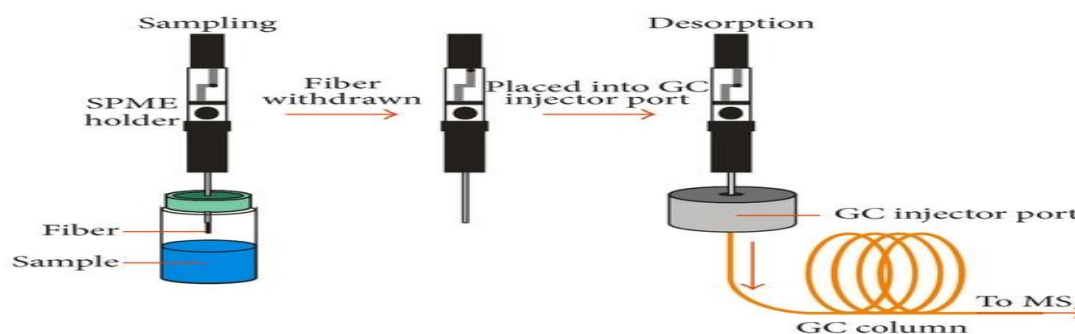


Figure 4: Solid phase micro extraction

4. Ultrasonic extraction

Ultrasonic extraction uses ultrasonic vibrations to extract samples with polar solvents in an ultrasonic bath. The extracted supernatant was clean-up by using solid phase extraction method. This is often used for chemical extraction from solid samples because of its simplicity.

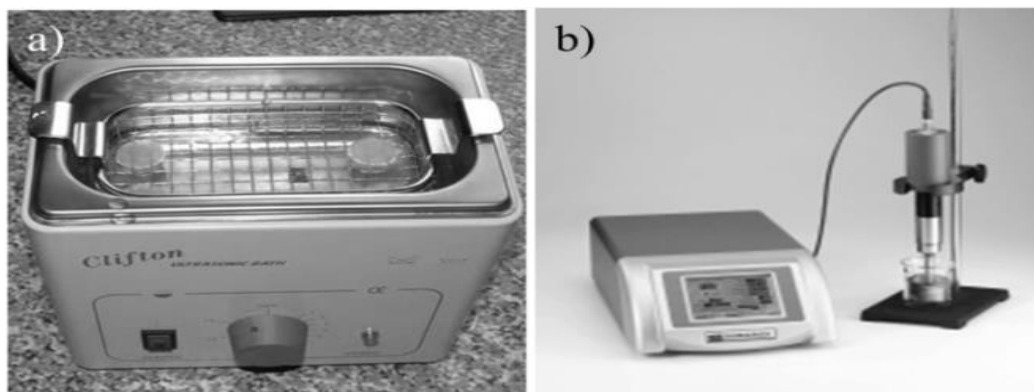


Figure 5: Ultrasonication apparatus



- 5. Supercritical Fluid Extraction (SFE) :** This is the most technologically advanced extraction system. The gases such as CO₂ and N₂O become fluid when temperature and pressure reach a critical point which was called as the supercritical phase. In this supercritical fluid extraction (SFE), this fluid is used to extract target substances in solid samples. This is a relatively new method which has recently begun to be applied extensively. Instruments connecting the SFE apparatus and on line Gas Chromatography have been developed in which the series of steps from extraction to analysis have been automated. In this the sample is placed in an extraction chamber through which the supercritical fluid is forced, the target substances are extracted from the samples and trapped in vials by small amounts of methanol or ODS resin. The amount of organic solvent used is much smaller than soxhlet extraction. The fluids used for SFE include CO₂, N₂O, SF₆, methanol, and water. The fluid used is chosen to meet the analytical purpose. The most commonly used is CO₂. However, supercritical CO₂ is very non-polar, so modifiers are added to improve extraction efficiency for polar compounds. Modifiers for CO₂ include methanol, dichloromethane, acetonitrile, water etc. Modifiers are mixed with the CO₂ using a pump, or spiked directly into the samples.

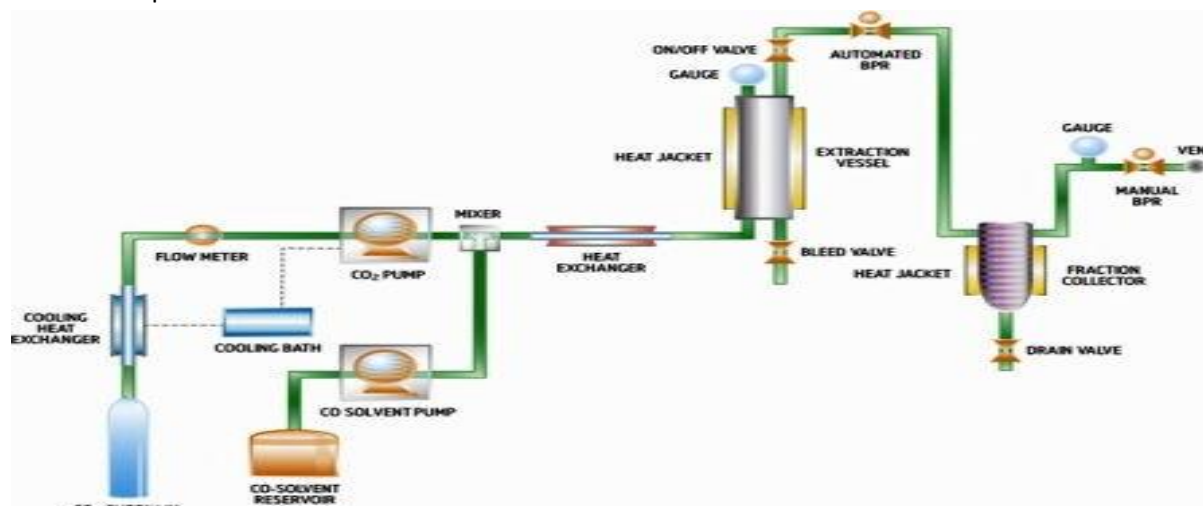


Figure 6: Supercritical Fluid Extraction

CONCLUSION

There is severe lack of information about other environmental media contamination status of PPCPs, such as surface, ground drinking water sources, wildlife and human body burden. There is a need to be investigated about the PPCPs pollution status in all over our country and the world. Most of the studies available which were mainly focused on the occurrence of PPCPs. Here we discussed about different types of extractions methods to determine the PPCPs which gives rapid and sensitive results in the analysis. The control technologies of PPCPs were needed to be investigated and toxicity studies need to be conducted in the future for the assessments of their potential ecological and health risks. A systematic study is needed to determine the benefits of different management and mitigation options and any societal and environmental costs associated with a particular option in different regions of the world.

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IMPACT OF HAZARDOUS EFFECTS OF PERSONAL CARE PRODUCTS ON HUMAN HEALTH

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Abstract

In our daily life most of the people, from the teens to the adults are using cosmetics and other personal care products. In most of these products the ingredients used have a serious effect on the human health. The ingredients can be segmented as preservatives and fragrances. Beware of the toxic ingredients found in your personal care products! It is suggested that consumers need to know about the ingredients and also the side effects they result in. From the moral point of view, the manufacturing companies of these products have to ensure the safety of their own products. But in reality it is not happening. The companies have more a profit-motto than concern for human health. It is said that these products are often filled with synthetic and hazardous chemicals.

Keywords: Hazardous materials, cosmetics, personal care, side effects.

Introduction

Basically, the word 'cosmetics' refers to those products used to care for and also clean the human skin and thus make it more glowing. The very purpose of using cosmetics is to maintain the body in a good condition and protect it from the effects of the environment and aging processes, change the appearance, and make the body smell nicer. Here chemicals are used as preservatives and fragrances are added to enhance their shelf-life and also to ensure a good odor to the users. Preservatives (the usual term for 'biocides' used in cosmetics) are chemical compounds which are meant to prevent the growth of microorganisms. They are intended to clean the products and to prevent contamination by consumers while in use.

Let's look at some of the hazardous ingredients in cosmetics:-

1. Petroleum based products: Petrolatum, mineral oil, paraffin, paraffin oil, paraffin wax.

Uses: Used in shampoos, hair relaxers, anti-ageing creams, mascaras, perfumes, foundations, lipsticks, and lip balms.

Hazardous effect: Commonly used as cosmetic ingredients are by-products of and derived from crude oil, which have potential carcinogenic effects.

2. Sodium Lauryl Sulphate/ Ammonium Lauryl Sulphate:

Uses: Found in shampoo, bath and shower products and toothpaste for developing foam. Used to de-grease engines, in car washes and garbage floor cleaners, as an emulsifying and foaming agent. 90% of foaming products contain this ingredient.

Hazardous effect: Cause damage to the liver, lungs, immune system, and nervous system; disorders to reproductive system, severe irritation to skin

3. Phthalates:

Uses: Found in perfumes, hairsprays, nail polishes, skin moisturizers.

Hazardous effect: Cause effect on the reproductive system, hormone disruptions

4. Parabens: Derived from petroleum.



Uses: Found in deodorants, moisturizers and in some food items.

Hazardous effect: Affects estrogen levels.

5. Hydroquinone:

Uses: Found in skin lightening products and moisturizers.

Hazardous effect: Carcinogen, neurotoxin and skin sensitizer. Causes Ochronosis

6. Lead acetate:

Uses: Found in hair dyes and cleansers.

Hazardouseffect: Toxic to the human reproductive system.

7. Triclosan:

Uses: Found in liquid soaps, deodorants, mouthwashes, toothpastes.

Hazardous effect: Forms cancer causing dioxins.

8. Toluene:

Uses: Found in nail polish.

Hazardous effect: Skin irritant, toxic to eyes, blood, liver, kidneys and skin.

9. Propylene Glycol:

Uses: Used in shampoo, body lotion, deodorant, sun lotion, makeup and color cosmetics.

Hazardous effect: Causes skin irritation

10. Benzyl Dimethyl Stearyl Ammonium Chloride:

Uses: Used in lipstick, lotions, hair coloring and conditioners.

Hazardouseffect: Skin irritation and effect on eyes.

11. Lanolin: Obtained from Sheep's wool.

Uses: Used in eye care products, makeup products, lotions and creams.

Hazardous effect: Causes skin rashes, redness, nausea and vomiting.

12. Mercury:

Uses: Used in skin lightening cream.

Hazardouseffect: Risk of neurotoxicity and nephritic syndromes.

Beware of these harmful cosmetics! Instead we can go for natural products because they are harmless.

Let us look at the use of some of the natural products:

1. Coconut Oil: It is one of the most versatile skin (and food) natural ingredients. It strengthens underlying epidermal tissue, removes dead skin cells, and protects us from sunburns. It is antibacterial, antiviral, antifungal and antioxidant. It is proved that it can fight against chronic skin diseases characterized by defects in the epidermal barrier function and cutaneous inflammation, including Atopic Dermatitis (AD).

So, use coconut oil on both your skin and hair to help cleanse, moisturize, remove makeup, heal wounds or scars and prevent razor burn quicker. If it is used internally it is beneficial for your looks. It contains antibacterial and anti-inflammatory properties, and loads of healthy fats that help nourish your gut and increase immune function.

Healthy skin is just like any other organ in your body: It continuously needs oxygen and nutrients to be brought to the cells. The toxins need to be washed away. Therefore, for optimal skin health coconut oil caring for hormonal and digestive function is crucial.

2. Tea Tree Oil: Tea tree (*Melaleuca alternifolia*) has been used for hundreds of years in Australia to fight breakouts, redness and inflammation on the skin. This oil is usually well-tolerated and



protects from the nasty side effects when combined with carrier oil when applied directly to skin. Its uses include working as a natural anti-inflammatory, anti-bacterial, antimicrobial and anti-fungal. Its phytochemicals make it a versatile and popular natural skin care essential oil.

Tea tree's volatile essential oils are extracted from about 230 different plant species, almost all of which are native to Australia. The primary active ingredients reducing harmful bacteria include terpene hydrocarbons, monoterpenes and sesquiterpenes. There are more than 100 different chemical components and volatile hydrocarbons in it which are aromatic and capable of traveling through air, pores of the skin and mucus membranes to provide healing benefits. That is why tea tree oil is a key part of the best home remedies for acne.

3. Apple Cider Vinegar: It is an extremely versatile and inexpensive natural skin care product. This oil helps kill pathogens (like bacteria), clear skin problems caused by gut issues, cleanse the skin and stop acne, and also provide antifungal properties.

The use of ACV for skin problems dates way back to Hippocrates (460-377 BC), "the father of modern medicine". He is a believer in the use of anti-fungal ACV and raw honey for cleaning ulcerations and treating skin sores.

It also contains highly beneficial acetic acid and certain minerals like potassium and magnesium that make it a detoxifying agent when consumed internally. It boosts up liver function and helps balance of bacteria in the gut.

4. Raw Honey: Raw honey is one of the best natural sources of nutrients, enzymes, vitamins and skin-boosting acids. It contains antiseptic qualities. It reduces breakouts, moisturizes and encourages wound healing, fights allergies or rashes and reduces scars. Raw honey is unheated, unprocessed and unpasteurized unlike most honeys available in the market. Unprocessed raw honey is always preferable.

As an antimicrobial, honey can act as a dressing-up for wounds and burns. It is also included in treatments used to heal bacterial infections, dandruff, diaper dermatitis, psoriasis and the like.

Honey is a great homemade natural skin care product. It functions as an acne cure. It can be used in facial cleansers for all skin types. Take half a teaspoon, warm it between hands and spread it on face gently. Leave it for 10 minutes then rinse with warm water and pat dry. For dry winter skin, try adding two cups of honey to a bath, soak yourself for 15 minutes, and then add one cup of baking soda for the final 15 minutes of bath.

5. Sea Salt: Sea salt comprises tons of minerals and nutrients like magnesium, calcium, sodium and potassium. Use real Himalayan or Celtic sea salts in homemade facial masks, toners and scrubs using coconut oil, lavender essential oil and raw honey. The salt is so anti-inflammatory that it can soothe skin and calm breakouts, remove dead skin cells and irritation, balance oil production, and help the skin retain moisture levels.

Make your own homemade scrub by mixing two teaspoons of sea salt with four teaspoons of raw honey, and apply the mix evenly to clean skin, rub it gently and let it stand for 15 minutes and rinse.

6. Avocado: It is an ultra-moisturizing fatty fruit with vitamins A, D and E which are able to penetrate the skin. It helps soothe sunburnt skin, boost up collagen production and treat age spots.

It also works to reduce inflammation of the skin when applied topically and does the same internally when eaten. Use 'Homemade Avocado Face Mask' with fresh avocado combined with essential oils, honey or carrier oil to replenish hydration and leave skin feeling dewy.



7. Lemon Essential Oil: With its strong antibacterial constituents capable of reducing even fatally dangerous bacteria strains, lemon essential oil can be used to diminish acne breakouts caused by high levels of bacteria stuck in pores. It is also useful for fading scars and age spots. It can exfoliate skin, brighten and lighten skin, tone oily skin and can also fight wrinkles.

Lemon oil is one such versatile essential oil to have on hand. It can be used as a teeth whitener, laundry freshener, cellulite cream, face wash and household cleaner. Mix it with carrier oil like jojoba oil and massage into troubled areas of skin. You can also use it on your hair to boost up shine and to remove residue.

8. Argan Oil: Argan oil is native to Morocco and has been used there for generations. It is so healing because it's rich in vitamins A and E, various antioxidants, omega-6 fatty acids and linoleic acid. It is not only great for gently moisturizing skin, but it also boosts up the shine and health of your hair.

Apply a small amount of Argan oil directly to normal or troubled skin twice daily to help heal irritations such as acne, bug bites, eczema and psoriasis.

9. Aloe Vera: Most people associate Aloe Vera benefits with healing sunburns. But it also contains bacteria-fighting and soothing ingredients that fight inflammation, redness and itching. For hundreds of years Aloe has been used to treat skin diseases, infections and also as a natural treatment for fungal diseases in traditional Chinese medicine.

Recent research results suggest that Aloe Vera is effective for burns and wound healing, but surprisingly it also detoxifies you from the inside out. When taken orally, Aloe can even decrease the number and size of tumors and parasites in the liver, spleen and bone marrow.

Aloe Vera plants produce two substances used for medicine: the **gel** found in the cells in the center of the leaf, and the **latex** that's obtained from the cells just beneath the leaves' skin. These can be used as a natural skin care remedy for burns, frostbite, psoriasis and cold sores.

Aloe Vera is the most biologically active form of the *Aloe barbadensis* species and holds more than 75 potentially active ingredients including anti-inflammatories, vitamins, minerals, saccharides, amino acids, fatty acids, enzymes, lignin and salicylic acids. Its anti-microbial and antifungal properties make it a "photodynamic therapy" for healing skin.

10. Jojoba Oil: It is one of the most widely used carrier oils. It is a moisturizer. It can help heal burns, sores, scars, dermatitis, acne psoriasis and wrinkles. Native to the southern U.S and Mexico, this oil has been used to treat acne, psoriasis, sunburn and chapped skin for generations. It's also used to reduce balding because it encourages hair re-growth, soothes the skin and unclogs hair follicles.

This oil is unique in its containing polyunsaturated wax. As a wax, jojoba oil is especially useful for protecting the skin, providing moisture control, and soothing the skin and hair.

11. Almond Oil: Most of us know about the many nutrition benefits of almonds. It not only smells great, but has anti-inflammatory, antiviral, antibacterial and antiseptic properties. It makes great carrier oil for essential oils to naturally treat skin rashes, acne or dryness. So we can try it in homemade washes, masks or lotions.

12. Shea Butter: It has been used as a natural skin care product in Africa for hundreds of years. It is still largely cultivated and shipped around. It makes an excellent moisturizing option for dry skin types. It is inexpensive and effective at reducing flaking, redness or peeling. Try it in a 'Homemade Skin Care Butter' mixed with your favorite essential oils like frankincense, eucalyptus or bergamot oil or with lavender oil and mint in your homemade lip balm.



13. Castor Oil: Used to cleanse skin, castor oil is actually a “drying oil.” For facial cleansing, you only need to use a very small amount, about a teaspoon of castor oil, mixed into in 1/4 cup of some other oil like coconut or almond. Rub into your face and massage, and then rinse with warm water to carry away impurities.

Conclusion

Many natural ingredients are incorporated into products for the beauty purposes. They improve the quality of human life in terms of disease prevention, health maintenance, beauty enhancement and also building the self-esteem.

The cosmetics industry is to be regulated formulating some basic guidelines. As the industry keeps expanding, and the related authority keeps reviewing the safety of beauty ingredients and products, the consumers should also play their role by keeping themselves updated with knowledge and be aware of the presence of ingredients in the products used.

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EFFECTS OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN SURFACE & GROUND WATER

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Abstract

The environmental effect of pharmaceuticals and personal care products (PPCPs) is largely speculative. PPCPs are substances used by individuals for personal health care or cosmetic reasons and these products used in agribusiness to boost the health of livestock. During the last three decades, the impact of chemical pollution has focused almost exclusively on the conventional "priority" pollutants, especially those are acutely toxic/carcinogenic pesticides and industrial intermediates displaying persistence in the environment. Pharmaceuticals and personal care products (PPCPs) include numerous chemical classes. Pharmaceuticals are used primarily to prevent or treat human and animal diseases, whereas personal care products are used to improve the quality of daily life which including products like moisturizers, lipsticks, shampoos, hair colours, deodorants, and toothpastes. PCPs are main concern for potential ecological and environmental impacts because they may be active at extremely low concentrations & are wide spread and continuously released in large quantities which have unpredictable biochemical interactions when mixed, and at times may concentrate in the food chain and especially affect aquatic organisms. There are many ways for these drugs and personal care products to enter into ground water and surface water, which include water that we drink and use for recreation. Which shown effect on human beings. Federal guidelines for safe disposal of medicines aim to prevent unintentional poisonings, misuse, and diversion of discarded drugs, and to keep drugs within engineered landfills, instead of into the water supply.

Keywords: PPCPS, priority, Pharmaceuticals, Aquatic organisms, Surface water, Ground water

INTRODUCTION

Like organic food, many people are now looking towards organic cosmetics. However, the lack of appropriate standards for organic cosmetics has enabled many manufacturers to take advantage of the situation and mislead consumers. The definition of organic should be modified for organic body care products with a different set of standards. Therefore, many cosmetics in which the active ingredients are strong chemicals can be labeled as organic with minor modifications in the less active ingredients, or adding them with mild organic agents. Floral waters and water extracts and infusions from botanical products are listed as the prime organic contents in most of these supposedly organic cosmetics. However, on the contrary, they hardly have anything in them. Floral waters are hydrosols that are basically water byproducts obtained during the distillation of essential oils. There is hardly an iota of essential oil in the actual floral waters. Many companies chemicals which are not good for health. However, the manufacturers manage to label their products as organic because the current rules enable them to do so. Some companies go a step further in misleading the consumers. When you purchase organic cosmetics, you intend to buy the cosmetic products that have ingredients made from organic means without the use of any chemicals. However, there are



companies that will label their product organic, referring to the scientific meaning of organic, that is, something containing carbon in it for all of these reasons, it is very important for us to know the composition of various cosmetics. Pharmaceutical and personal care products (PPCPs) have been found in surface & ground water worldwide. The level of removal has been found to vary widely depending on the chemical, the operating conditions, and the treatment technologies. Variable removal of PPCPs has led to detection of these compounds in the aquatic environment.

Pharmaceuticals and personal care products (PPCPs) are a diverse group of chemicals including:

- all human and veterinary drugs
- dietary supplements
- topical agents such as cosmetics and sunscreens
- laundry and cleaning products
- fragrances and all the "inert" ingredients that are part of these products

Pharmaceuticals and personal care products are introduced to the surface & ground water as in a variety of ways, including:

- bathing or swimming
- discharge from municipal sewage systems or private septic systems
- leaching from landfills
- excretion by humans and domestic animals
- runoff from confined animal feeding operations
- discharge of raw sewage from storm overflow events, cruise ships, and some rural homes directly into surface water
- accidental discharges to a groundwater recharge area
- loss from aquaculture
- spray-drift from antibiotics used on food crops.

Sources of PPCPs in groundwater

PPCPs in groundwater can be closely related to human activities as most of the compounds are synthetic products that do not occur in nature. Only a few PPCPs such as caffeine, which can be produced by over 60 plant species, have natural sources.

PPCPs in the underground environment

PPCPs have been measured underground including in soils, sediments, and groundwater. The primary processes involved include adsorption, migration, and degradation. For instance, chemicals in soil surface may transfer downward to the lower layer, and then into the saturated and unsaturated zones. Laws et al. showed that although reduced by natural attenuation in soil, pharmaceuticals might still reach the groundwater. The fate of PPCPs during the movement and change in the subsurface environment is influenced mainly by the environmental factors and the physicochemical properties of the chemicals.

PPCPs contaminated surface water

The most important sources of PPCPs in the aquatic environment. Generally, household PPCPs can enter the sewer system after excretion from the body or washing-off by tap water via sinks or toilets. Only limited removal has been identified during primary treatment at sewage treatment plants (STPs) due to the limited adsorption to sludge. As for the biological treatment process, variable removal efficiencies were achieved, and PPCPs in the final effluent may be at different levels. For example, Salgado et al. reported that diclofenac showed low degradation (less



than 25%), whereas ibuprofen and ketoprofen were degraded to a much higher extent (more than 75%), Recently, some indicator PPCPs, such as carbamazepine, have been used as markers to trace the wastewater-surface water and surface-underground water exchange processes.

Managed aquifer recharge (MAR), referring to the use of surface water, as well as reclaimed water to artificially recharge the aquifer system, is also an important potential source of PPCPs into groundwater, particularly when the residence times are short, and where wastewater treatment is poorly regulated. Riverbank filtration and well injection are frequently adopted as MAR processes. Bradley and co-workers examined the potential transport processes of several effluent-derived pharmaceutical contaminants from surface water to shallow groundwater compartments during riverbank filtration and found the infiltration of effluent-contaminated surface-water could result in the occurrence of PPCPs, such as carbamazepine and sulfamethoxazole, in groundwater along the stream bank at concentrations of greater than 20 ng/L. A study regarding the removal of selected PPCPs during groundwater recharge where secondary or tertiary treated wastewater was used showed that caffeine, diclofenac, ibuprofen, ketoprofen, naproxen and gemfibrozil were efficiently removed after retention times of less than 6 months, whereas carbamazepine and primidone could be hardly reduced and persisted in the recharged groundwater with retention times of up to 8 years. These findings indicated that cautions must be taken when recharging the aquifer system with wastewater effluents. The wastewater effluents utilized should undergo advanced treatment processes which could either efficiently remove the residue PPCPs, or largely enhance the biodegradability of the recalcitrant PPCPs. The biodegradable metabolites of recalcitrant PPCPs are prone to be eliminated during the residence time of riverbank filtration.

Implications of PPCPs Occurrence in Surface &ground water

The compounds in surface and ground water their discharge in aquatic environment and shown effect on algae invertebrates fish bacteria. besides concern over the toxicological effect on non-target species. The investigations provided information on the general health status of the pharmaceutical-exposed fish, and allowed a differential diagnosis of harmful effects caused by these human pharmaceuticals in non-target species.

Future perspectives

- Although various PPCPs have been detected in groundwater over the past few years, further improvements to analytical methods are needed to detect more compounds. Special attention should be given to the transformation products of PPCPs commonly found in the groundwater.
- As it is difficult to remove PPCPs in groundwater once contaminated, it is necessary to identify the source of PPCPs in groundwater and control the release from the source. Some PPCPs were proposed to be indicators for emission sources, however, further methodology optimization and validation are still needed.
- Regulation of PPCPs in groundwater is necessary especially where groundwater is a source water for drinking water. To establish guideline values for PPCPs in groundwater, better understanding of their occurrence, distribution, behavior, potential toxicity, and risks needs further study before deciding on these values.

Conclusion

Despite rising concerns about the presence of pharmaceuticals in surface and ground water, more research is needed to determine the risks to human health from chronic low level exposures to



individual and mixture of pharmaceutical substances. More information is also needed to guide decisions about which pharmaceuticals should be prioritized and regulated. In addition, research to advance drinking water treatment technology is required as current drinking water treatment processes are not able to remove pharmaceuticals to non-detectable levels.

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AN OVER VIEW OF ENVIRONMENTAL IMPACT ASSESSMENT OF CHEMICAL INDUSTRIES

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ABSTRACT

Most of the chemical industries are capable of adversely and even irreversibly impacting the environment. Many of the reactants as well as the products and the by-products of chemical industries are potentially hazardous or toxic or carcinogenic or corrosive or inflammable or explosive. Different types of chemicals are manufactured or synthesized by chemical conversion or transformation. Most of the chemical reactions require energy for boilers, chilling or distillation equipment etc. Chemicals such as pesticides, pharmaceuticals, laboratory chemicals and reagents, detergents, bulk drugs, drug intermediates etc. are routinely produced and extensively used. Apart from consumption of different types of energy resources, raw materials and reactants, Chemical industries often contribute to pollution of air, water and soil. They are also prone to accidents such as the Bhopal gas tragedy. In view of the above, before any chemicals unit is established, the probable impacts of the chemical plant on air, water, flora, fauna, society and economy are carefully evaluated and submitted for prior environmental clearance in the form of Environmental Impact Assessment Report.

The basic objectives of the Environmental Impact Assessment Report is to collect the baseline data on the quality of air, water, soil; status of flora and fauna and the socioeconomic conditions of the people in the area of impact. This is followed by the prediction of environmental impacts of the proposed industry on air, water, soil, flora, fauna and the local inhabitants. Material balance as in case of a chemical equation where the reactants and products will have the same number of atoms; water balance etc. have to be verified. In order to ensure that the final ground level concentrations of different air pollutants are within the National Ambient Air Quality (NAAQ) standards, suitable technology and air pollution control equipment has to be chosen. Effluent Treatment Plant (ETP) for waste water treatment and disposal facility has to be created. Rules pertaining to storage and handling of hazardous chemical have to be identified. Green Chemistry, Green Technology and Cleaner Production Strategies should be given due importance. Finally, there shall be a commitment from the top brass for continuous improvement of Environment.

Keywords: Chemicals, Impacts, Environment, Chemical Industries.

INTRODUCTION

The frightening memories of Bhopal gas tragedy (Methyl Iso cyanide gas) are still fresh in our memory though we have forgotten many of the smaller accidents that claimed only a few lives. What happened in the Jeedimetla industrial area of Hyderabad is known to locals and many of the environmental activists. These are a few local examples to prove the point that chemical industries could be disastrous. But yet we need them. Just because they are bad, we cannot avoid them. At the same time, we need a strategy to confirm, minimize, reduce and control the adverse and negative impacts of chemical industries. In order to ensure that a chemical industry does not cause irreversible harm or damage to different components of the environment, EIA is undertaken. EIA is



an exercise undertaken to assess the status of environment (baseline data) and to predict the impacts (due to additionality) prior to the establishment of the industry.

An environmental impact assessment (EIA) is an assessment of the possible positive or negative impacts that a proposed project may have on the environment, together consisting of the natural, social and economic aspects. The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts to decide whether to proceed with the project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as "the process of identifying predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to major decisions being taken and commitments made.

The ministry of Environment and Forests, Government of India has notified the rules, regulations, procedures and protocols for the EIA of different projects and activities. For any chemical industry of significant pollution potential, for the assessment of Environmental impacts, detailed project report (DPR) information regarding the location of the site, extent of land, environmental setting of the site, land use and land cover of the area, existence of ecologically sensitive areas such as Wildlife Sanctuaries, National Parks, Biosphere reserves, Rivers, perennial water bodies, densely populated areas, areas with high rise buildings etc are the essential considerations. Proper site selection is key to the success of the industry.

Based on the EIA requirements, a check list of items that need to be addressed has to be prepared and data collected as per the standard procedures. For prediction of impacts, standard methods such as the checklist method, Leopold Matrix Method, Overlays, Net working etc have to be followed. Emissions to atmosphere are calculated based on standard scientific methods. For instance, based on the calorific value, carbon content, inert matter and sulphur content, quantity of coal consumed; production of fly as, botton ash, Carbon dioxide, sulphur dioxide are calculated. Based on the SO₂ production and or suspended particulate matter production, the height of the stack is determined. Similarly the quantity of water required for various applications; the amount of waste water generated; characteristics of waste water are to be estimated and each drop of water must be accounted for in the form of water balance. The inputs and outputs of all materials have to be balanced. Final concentrations of ground level emissions, characteristics of treated and untreated water; zero discharge of water if feasible; water management etc are to be considered. At the end of the exercise, it should be clear to make a decision whether the chemical industry could be established with manageable impacts.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The key elements of EIA are:

1. Description of the project:

- Description of actual project, project site and its environmental setting.
- Possible impacts during construction, operations and decommissioning.
- For each component, all of the sources of environmental disturbance are to be listed.
- For each component all the inputs (Raw materials, energy etc) and outputs (products and byproducts) must be listed.
- Examination of alternatives that have been considered-alternatives with regard to site, technology, raw materials, products etc.

2. Description of the environment



- All aspects of the environment that may be effected by the development have to be listed. This work is best carried out with the help of local experts in different specializations.

3. Description of the significant effects on the environment

- The word significant is crucial here as the definitions can vary and hence significant needs to be defined.
- The most frequent method used here is use of the Leopold matrix.
- The matrix is a tool used in the systematic examinations of potential interactions.
- Risk assessment

4. Mitigation

- This is where EIA is most useful.
- Once the impacts has been identified and quantified, it will be obvious where and when the impacts will be greatest.
- Using this information ways to avoid negative impacts should be developed.
- Best working with the developer with this section as they know the project best
- In case of Chemical factories, air pollution control (APC) equipment and Effluent Treatment Plant (ETP), thick greenbelt is essential.
- Disaster mitigation and management, Emergency preparedness, Mock drills.

5. Non-technical summary (EIS)

- The EIA will be in the public domain and be used in the decision making process
- It is important that the information is available to the public
- This section is a summary that does not include jargon or complicated diagrams
- It should be understood by the informed lay-man.

6. Lack of know-how/technical difficulties

- This section is to advise any areas of weakness in knowledge
- It can be used to focus areas of future research
- Some developers see the EIA as a starting block for good environmental management.

The team of the consultant chosen for the purpose of preparation of EIA report is expected to be familiar with the environmental implications of the chemical industry. Depending upon what it consumes and produces; how much it consumes and produces; where it produces and markets; who uses or consumes and finally how it is disposed; is prepared for the EIA study. The general environmental impacts of any chemical unit that produces the same product and the same quantity and by the same process are more or less same irrespective of the area. But depending upon the environmental setting and environmental sensitivity, the overall impacts could vary. Thus the consultant has to carefully analyze the situation and prepare a sit specific, location specific, are specific and activity specific EIA report but not just a copy of another project. The format and framework of EIA report is also specified by the M.O.E.&F. Based on the data collected, a draft EIA report is prepared and submitted to the Pollution Control Board for organizing a public hearing.

PUBLIC HEARING OR PUBLIC CONSULTATION:

As per the procedure Public Hearing shall be arranged in a systematic time bound and transparent manner ensuring widest possible public participation and the project site or in its close proximity by the concerned State Pollution Control Board (SPCB). The applicant shall make a request through a simple letter to the Member Secretary of the SPCB in whose jurisdiction the project is located to arrange the public hearing within the prescribed statutory period. In case the projects is



covering more than one district or State or Union Territory in which the project is located hearing as per the procedure.

The applicant shall enclose with the letter of request at least 10 hard copies and an equivalent number of soft copies of the draft EIA report with the generic structure outlined by the MOE & F, summary of the Environmental Impact Assessment Report in English and in the official language of the state/local language prepared strictly in accordance with the terms of reference communicated after scoping. Simultaneously, the applicant shall arrange to forward copies of the above draft EIA report along with the summary of EIA report to the following authorities or offices, within whose jurisdiction the project is located:

- a) District Magistrate/District Collector/Deputy commissioner
- b) Zilla Parishad or Municipal Corporation or Panchayats
- c) District Industries Office
- d) Urban Local Bodies (ULBs)
- e) Concerned Regional Office of the Ministry of Environment and Forests.

On receiving the draft Environmental Impact Assessment Report, the Above-mentioned authorities except the Regional Office of MoEF, shall arrange to widely publicize it within their respective jurisdictions requesting the interested persons to send their comments to the concerned regulatory authorities. They shall also make available the draft EIA report for inspection electronically or otherwise to the public during normal office hour still the Public Hearing is over. The SPCB shall also make similar arrangements for giving publicity about the project within the State/Union Territory and make available the summary of the draft Environmental Impact Assessment Report for inspection in selected offices or public libraries or any other suitable location etc. They shall also additionally make available a copy of the draft Environmental Impact Assessment report to the above five authorities/offices.

CONCLUSION

- The Member-Secretary of the concerned SPCB or UTPCC shall finalize the date, time and exact venue for the conduct of public hearing within 7 days of the date of receipt of the draft Environmental Impact Assessment Report from the project proponent and advertise the same in one major National Daily and one Regional or vernacular Daily/Official state language. A minimum notice period of 30 days shall be provided to the public for furnishing their responses; the advertisement shall also inform the public about the places or offices where the public could access the draft Environmental Impact Assessment Report and the summary of EIA report before the Public hearing. In places where the newspapers not reach, the Competent Authority should arrange to inform the local public about the public hearing by other means such as by way of beating of drums as well as advertisement/announcement on radio/ television. No postponement of the date or time or change of venue of the public hearing shall be undertaken unless some untoward emergency situation occurs and then only on the recommendation of the concerned District Magistrate/ District Collector/ Deputy Commissioner, the postponement shall be notified to the public through the same National and Regional or vernacular dailies and also prominently displayed at all the identified offices by the concerned SPCB. In the above exceptional circumstances, fresh date, time and venue for the public consultation shall be decided by the Member-Secretary of the concerned SPCB or UTPCC only in consultation with the District Magistrate/ District



Collector/ Deputy Commissioner and notified afresh as per procedure described above. The District Magistrate/ District Collector/ Deputy Commissioner or his or her representative not below the rank of an Additional District Magistrate assisted by a representative of SPCB or UTPCC shall supervise and preside over the entire public hearing process.

- The SPCB shall arrange to video film the entire proceedings. A copy of the videotape or a CD shall be enclosed with the public hearing proceedings while forwarding it to the Regulatory Authority concerned.
- The attendance of all those who are present at the venue shall be noted and annexed with the final proceedings. Persons present at the venue shall be granted the opportunity to seek information or clarification on the project from the applicant. The summary of the public hearing proceedings accurately reflecting all the views and concerns expressed shall be recorded by the representative of the SPCB and read out over to the audience at the end of the proceedings explaining the contents in the local/ vernacular language and the agreed minutes shall be signed by The District Magistrate/ District Collector/ Deputy Commissioner or his or her representative not below the rank of an Additional District Magistrate assisted by a representative of SPCB or UTPCC shall supervise and preside over the entire public hearing process.
- The SPCB shall arrange to video film the entire proceedings. A copy of the videotape or a CD shall be enclosed with the public hearing proceedings while forwarding it to the Regulatory Authority concerned.
- The attendance of all those who are present at the venue shall be noted and annexed with the final proceedings. Persons present at the venue shall be granted the opportunity to seek information or clarification on the project from the applicant. The summary of the public hearing proceedings accurately reflecting all the views and concerns expressed shall be recorded by the representative of the SPCB and read out over to the audience at the end of the proceedings explaining the contents in the local/ vernacular language and the agreed minutes shall be signed by the District Magistrate/ District Collector/ Deputy Commissioner or his or her representative on the same day and forwarded to the PCB/ UTPC.
- A statement of the issues raised by the public and the comments of the applicants shall also be prepared in the local language or the official state language as the case may be and in English and annexed to the proceedings. The proceedings of the public hearing shall be conspicuously displayed at the office of the Panchayats within whose jurisdiction the project is located, offices of the concerned Zilla Parishad, District Magistrate/ District collector etc. The SPCB shall also display the proceedings on its website for general information. Comments if any, on the proceedings may be sent directly to the concerned regulatory authorities and the applicant concerned.
- Time period for completion of public hearing shall be forty five days from date of receipt of the request letter from the applicant. Final EIA report prepared after the public hearing and public consultations incorporating the concerns expressed in the public hearing along with action plan and item wise financial allocation to address the concerns has to be submitted to the concerned competent authority for prior environmental clearance.
- What is stated above is the procedure but is really happening is something different. Why and how?



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 2. The Indian Wildlife Protecting Act (1972).
 3. The Air (Prevention and Control of Pollution) Act (1981).
 4. The Environment (Protection) Act (1986).
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PHARMACEUTICALS AND PERSONAL CARE PRODUCTS - A REVIEW ON THEIR OCCURRENCE, RISKS, ANALYSIS AND REMOVAL METHODS

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ABSTRACT

The amounts of pharmaceuticals and personal care products (PPCPs) have been increasing in ground water and soil leading to various risks. Their occurrence, risks, analysis and removal methods of PPCPs are discussed in the present article.

Key words: PPCPs, Removal, Analysis, Sources, Risks

INTRODUCTION

Pharmaceuticals and personal care products (PPCPs) are widely used for various purposes. Pharmaceuticals include antimicrobials, antipyretics, antibiotics, analgesics, steroids, stimulants, disinfectants, antidepressants etc. Personal care products improve the quality of daily life where cosmetics, fragrances (nitro- and polycyclic-musks), moisturizers, toothpastes, lipsticks, shampoos, hair colors are some of their examples (Daughton and Ternes, 1999). Most of them are synthetic with an exception to few like caffeine. PPCPs enter either surface water or groundwater from septic systems.

OCCURENCE OF PPCPs

PPCPs are consumed in large quantities and entering the aqueous system (surface water and groundwater) due to different anthropogenic activities like landfill leachate, sewage discharge, fertilizing and livestock breeding (Fig.1) (Sui, Q et al, 2015). Literature survey shows that occurrence of PPCPs in the groundwater was observed in different countries like UK (Stuart et al, 2012), Spain (Jurado et al, 2012), Italy (Meffe and de Bustamante, 2014), China (Tong et al, 2014). Drug resistance microorganisms are proliferated in surface water as urine and feces accumulates metabolized as well as unmetabolized antibiotics (McArthur and Tuckfield, 2000). High concentration levels of antiinflammatories and analgesics in groundwater might be due to due to wastewater exfiltration to groundwater (Ellis et al, 2003). Lipid regulators and their metabolites quantities in ground water were found to be lower than other PPCPs like antibiotics, anti-inflammatories etc. Detection frequency of caffeine in surface water is higher compared to those of other PPCPs but not in ground water as it undergoes rapid degradation in presence of bacteria (Knee et al, 2010). DEET (N,N-diethyl-meta-toluamide) is an active ingredient in many insect repellent products all over the world and found to enter in aquatic environment. Beta-blockers (propranolol and metoprolol), musks and sunscreen agents (octocrylene and ethylhexyl methoxycinnamate) are also found in ground water. PPCPs enter the sewer system via sinks or toilets due to either excretion from human body or washing-off.

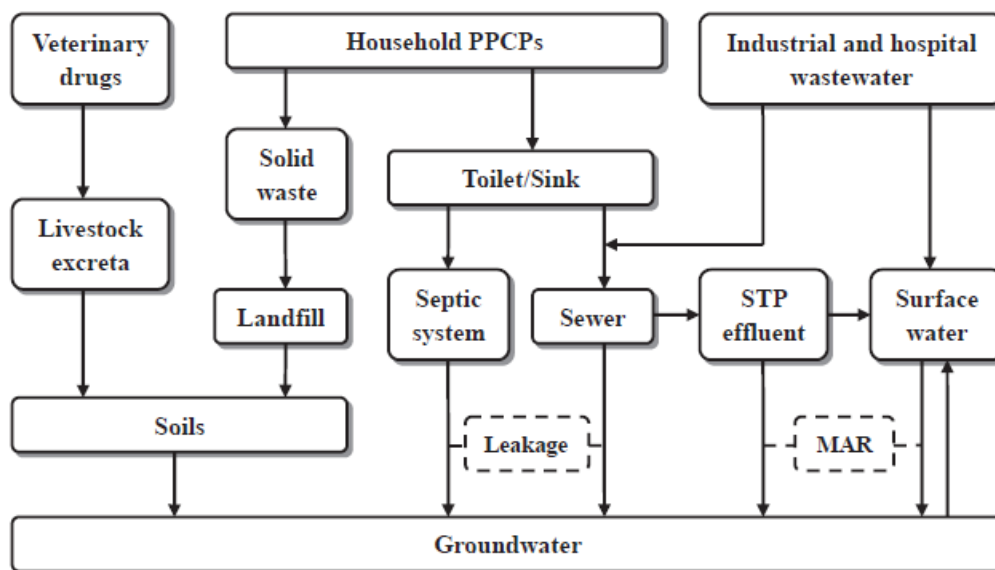


Fig.1. Sources and pathways for PPCPs entering ground water (MAR: Managed aquifer recharge; STP: Sewage treatment plant) (Sui, Q et al, 2015)

RISKS OF PPCPs

Undesirable effects are induced in ecosystem and humans when they are continuously exposed to some of PPCPs (Heberer, 2002). Though some of them are regularly monitored, many others are not regulated due to lack of complete data on their toxicity (Lapworth et al, 2012). Most of PPCPs are detected in different hydrological, climatic, and land-use settings. Moreover, some of them continue in the environment for months to years (e.g., Monteiro and Boxall 2009).

ANALYSIS OF PPCPs

The concentrations of PPCPs in aqueous system are in the range of nanogram to milligram per liter (Sui, Q et al, 2015). Both for identification and quantification PPCPs in environmental matrices, different analytical protocols were proposed (Petrovic *et al.*, 2003; Zwiener and Frimmel 2004). PPCPs present in water were analysed by employing solid-phase extraction (SPE) and liquid chromatography/tandem mass spectrometry (Ternes *et al.*, 2001; Vanderford et al, 2003).

REMOVAL METHODS OF PPCPs

As their adsorption on sludge is less, limited removal was observed in sewage treatment plants (Salgado et al, 2012). When PPCPs are discarded into landfills, they are metabolized by microorganisms and many of them are dissolved in landfill leachate (Musson and Townsend, 2009). Most of them are degrade quickly in aerobic conditions compared to anaerobic conditions (Johnson et al, 1998). Chlorine oxidises compounds with electron activating functional groups (e.g., thiols, amines, hydroxyl) which are located near unsaturation like benzene rings (Westerhoff et al, 2005). Biodegradation of PPCPs was studied in WWTPs, sequencing batch reactors (SBRs), membrane bioreactors (MBRs), sand columns and constructed wetlands. Due to unique properties and potential applications, carbon nanotubes were found to be promising in the removal of PPCPs (Jung et al, 2015). Hydrophobic adsorption and size exclusion help to retain PPCPs by nanofiltration membrane, whereas, hydrophobic adsorption plays a major role in retaining hydrophobic PPCPs by UF membrane (Yoon et al, 2006).



CONCLUSION

Attention has to paid to develop (1) analytical techniques to detect and determine all sorts of PPCPs (2) technology to convert PPCPs to those compounds occurring in nature (3) anticipate standards and regulations to reduce PPCPs in aquatic systems

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IMPACT OF IMPRUDENT USE OF ANTIBIOTICS ON HUMAN HEALTH, ENVIRONMENT, AND ITS MANAGEMENT

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ABSTRACT

Antibiotics are one of the most important groups of pharmaceuticals used to improve human health. Molecules with antibiotic properties, produced by various microbes, have been around long before mankind recognized their usefulness in preventing and treating microbial infections. In the twentieth century, we began mass-producing antibiotics, mainly synthetic derivatives of naturally produced antibiotic molecules, but also a few entirely synthetic compounds. present antibiotic era provides a whole per suite of them for the purpose of treating infections in both humans and animals. All these applications made antibiotics to be released in large amounts in natural ecosystems. While the development of antibiotic-resistant bacteria is becoming of increased concern, there is, however another worry: the fate of antibiotic residues entering the environment. Although antibiotics have been used in large quantities for some decades, the existence of these substances in the environment has received little notice, until recently. During the past decade, lot of research has been done on the adverse effects of the overuse and disposal of antibiotics on human and ecological health. The occurrence of antibiotics and other pharmaceuticals in the environment has become an increasing public concern as recent environmental monitoring activities reveal the presence of a broad range of persistent pharmaceuticals in soil and water. Though Antibiotics have changed the face of medicine, but their impact on human health the environment is now becoming a real concern. This paper attempts to review 1) provide some thoughts about our current knowledge of the associated risks for humans as well as ecosystems, and 2) indicate management options to reduce risks.

Keywords: Antibiotics, Antibiotic Resistance, Recombination, Sustainable Development

INTRODUCTION

Scientists have come a long way since Alexander Fleming's discovery of penicillin in 1928. Antibiotics are some of the most frequently prescribed drugs used in modern medicine and today's doctors are armed with a whole suite of them for the purposes of treating bacterial infections in both humans and animals. The development and refinement of mass-spectrometric techniques during the past 20 years have allowed us to study the flow of antibiotic residues in various complex matrices in great detail. It has now become clear that man-made antibiotics can enter the environment in many ways, from the production of active pharmaceutical ingredients, through the excretion of residues after usage or through discarding, unused medicines. Some antibiotics are easily degraded, such as penicillin, whereas others are considerably more persistent, such as fluoroquinolones and tetracycline, thus allowing them to prevail for longer times in the environment, to spread further, and to accumulate to higher concentrations.

A variety of prescription and over-the-counter drugs have been detected in the water supplies of at least 41 million Americans throughout the United States (Associated Press, 2008).



Veterinary antibiotics used in livestock are another major source of contamination: agricultural waste such as manure and water runoff can carry antibiotics into the soil and groundwater. In the USA, ~16 200 tons were produced in 2008 of which 70% was used in livestock farming. This is eight times the amount used in human medicine. While it is estimated total antibiotic market consumption world-wide to lie between 100 000 and 200 000 tons. If the drugs are not degraded or eliminated during sewage treatment, in soil or in other environmental compartments, they will reach surface water and ground water, and, potentially, drinking water. Unmetabolized antibiotic substances are often passed into the aquatic environment in wastewater

One major concern is the development of antibiotic-resistant strains of bacteria that can critically disturb natural bacterial ecosystems and lead to a serious threat to human health. In addition, there are concerns that exposure to antibiotic residues in the environment might lead to carcinogenic or allergic reactions in people and present hazards to aquatic and soil organisms (Göbel et al., 2004; Yang et al., 2004).

Direct discharges from manufacturing, either during the actual production of the active ingredient, or during formulation, can be exceedingly high. In several cases concentrations exceeding 1 mg/L have been detected in treated industrial effluents or recipient waters. This is orders of magnitude higher than the ng/L levels regularly found as a result of contamination via excretion. This is true not only in India and China that serve much of the world with bulk drugs, but also in Europe and the US. Antibiotic residues have also been found in marine environments

Exposure routes often differ if the antibiotic is intended for animal use. Depending on the animal species, whether companion animals or animals for meat production are treated, and depending on farming practices, urine and feces are collected, treated, and distributed to land and/or water in quite different ways. With the obvious exception of aquaculture, in general, direct exposure to land/soil is more common for antibiotics used to treat animals than for human use. The often-high microbial activity in soil contributes to a relatively rapid removal of many antibiotics over time, although some are able to persist for years. The concentrations found in manure or manure-amended soils are often considerably higher than those found in aquatic environments.

A portion of prescribed medicines that we buy are not used and are eventually discarded. Many countries do not have well-established take-back programs and still dump their household waste in landfills. In such situations, environmental exposure from unused medicines should not be neglected. On the other hand, some countries have had a solid take-back program in place for decades. Sweden is one example of this, and furthermore only approximately 1% of the Swedish household waste is deposited in landfills. In countries with such practices, discarded medicines are very unlikely to contribute to an appreciable extent to the environmental contamination with antibiotics.

RISKS: Although the ideal antibiotic is toxic to bacteria without affecting humans/animals, reality is more complicated, and directly toxic side effects are common for several classes of antibiotics at doses used for therapy. A few, relatively persistent antibiotics have been found in drinking-water at very low ng/L levels. Near manufacturing discharges, ground-water contamination has led to levels up to low µg/L in drinking-water well posing a direct risk for toxicity to humans ingesting the water.

Another important fact is the potential effect of antibiotics on the function and services of ecosystems. Micro-organisms in farmland soil are crucial for e.g. nitrogen fixation and other nutrient fluxes, and there is a potential for antibiotics to disrupt such processes. To date, however, there is



no clear evidence for disturbed ecosystem services in soil communities due to antibiotic exposure given the prevailing exposure levels documented in the field. Similarly, waste-water treatment of both household and industrial discharges depends on the functionality of complex microbial ecosystems within the treatment plants, ecosystems that could be disturbed by antibiotic exposure. Many microbial ecosystems tend to show a large degree of resilience, possibly governed by their ability for horizontal gene transfer and ability to rapidly accumulate mutations. Thus, given sufficiently long exposure times, even environments exposed to very high antibiotic exposures appear to harbor a rather diverse bacterial flora.

The greatest concern about antibiotics in the environment is their potential role in promoting resistance development in human and animal pathogens. Many of the mobile resistance genes we face in pathogens in the clinic today have their origin in harmless bacteria in and around us. The environmental microbiome represents a much greater diversity than those micro-organisms that thrive in or on our bodies. As such, the external environment provides a reservoir or source for resistance genes not yet encountered in pathogens. The external environment also provides unique opportunities for genetic recombination and thus the creation of novel vectors for genes already circulating in pathogens. Arenas and conditions that favor such recombination and transfer events are not clear, but an added selection pressure from antibiotics, increasing the available pool of resistance genes and selecting for bacteria acquiring resistance genes through horizontal gene transfer, is an obvious risk factor. Such crucial gene transfer events may take place in the external environment, in animals or inside our bodies, in one or several steps. Hence, assessing risks is a complicated endeavor.

The clearest consequence of antibiotic release in natural environments is the selection of resistant bacteria. The same resistance genes found at clinical settings are currently disseminated among pristine ecosystems without any record of antibiotic contamination. Nevertheless, the effect of antibiotics on the biosphere is wider than this and can impact the structure and activity of environmental micro biota.

Management : The emission of antibiotics into the environment should be reduced as an important part of the risk management. For this reason, unused therapeutic drugs should not be flushed down the drain and physicians must be made aware that antibiotics are not completely metabolized by patients. On the contrary, antibiotics and other pharmaceuticals are often excreted largely unchanged, i.e. as active compounds. The environmental significance of antibiotics and disinfectants should be included in the undergraduate curriculum of medical students and pharmacists. Patients should be made aware that antibiotics help against bacterial diseases but not against the common viral infections like common cold. These issues should be addressed as part of a sustainable development in medicine and for the environment. This holds also for the agricultural use of antibiotics as well as their use in aquaculture and elsewhere, e.g. as pesticides or for pets.

Given what is at stake, the precautionary principle can be invoked in order to reduce risks with environmental antibiotic contamination also in the absence of final evidence that it ultimately results in more infections with resistant bacterial pathogens. As stressed above, the transfer of resistance from an environmental bacterium to a human pathogen can be a one-time event. Thus, preventing or delaying this from happening is key, regardless of where it might occur. This puts challenges to co-ordinate international actions, as well as focusing mitigations toward environments where risks are considered to be particularly high. Regulations are important but difficult to



implement in all countries and furthermore, regulations are not always followed. Overall, it is important to create awareness in all relevant sectors, and to provide incentives, primarily economic incentives, in order to motivate actions to reduce risks.

The technical solutions depend heavily on the exposure route. Importantly, not only discharges of antibiotics need to be controlled, but also antibiotic-resistant bacteria that might develop and become enriched within e.g. industrial processes. Even releases of pathogenic bacteria containing integrons, capable of capturing and expressing arrays of genes, may conceivably accelerate the development of resistance by providing increased possibilities to probe the environmental resistome for novel resistance genes not yet encountered in the clinic.

Conclusion

The emission of antibiotics into the environment should be reduced as an important part of mitigating the deleterious effects of antibiotics on human health and environment. For this creating awareness among medical professionals and public is very essential. It also requires imposing strict rules and regulations on disposal of antibiotic containing materials and effluents for sustainable development

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PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN THE ENVIRONMENT

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ABSTRACT

The UN has declared 2005 to 2014 the Decade of Education for Sustainable Development. However, education is often viewed as an unalloyed good and consequently, there have been few empirical studies on the costs and benefits of different forms of education within the fields of environmental conservation and sustainable development. Likewise, studies quantifying success of conservation and sustainable development projects are also limited. Without quantitative data on either of these aspects it is difficult to translate research into action, which is vital if conservation and sustainable development strategies are to succeed. This study explores educational policies at global and local scales based on conservation interventions funded by the DEFRA Darwin Initiative. At the global scale, I carry out an analysis of the role of educational activities in projects funded by the Darwin Initiative since its inception. At the local scale, I carry out an in-depth case study of the success of a Darwin-funded project for the conservation of the saiga antelope (*Saiga tatarica*) conservation in Kalmykia, Russia. The geographically small area studied meant that cultural and demographic influences could be controlled, allowing for an in-depth exploration of a media-based public awareness campaign in comparison with other conservation interventions. Over the past 10–15 years, a substantial amount of work has been done by the scientific, regulatory, and business communities to elucidate the effects and risks of pharmaceuticals and personal care products (PPCPs) in the environment. This review was undertaken to identify key outstanding issues regarding the effects of PPCPs on human and ecological health in order to ensure that future resources will be focused on the most important areas.

Keywords: Pharmaceuticals, Personal Care Products, Effects, Environment.

INTRODUCTION

Pharmaceuticals and personal care products (PPCPs) include numerous chemical classes. Pharmaceuticals are used primarily to prevent or treat human and animal disease, whereas personal care products are used to improve the quality of daily life and include products such as moisturizers, lipsticks, shampoos, hair colors, deodorants, and toothpastes. Human-use PPCPs are generally excreted and emitted into the sewerage system following use. The compounds may then be released into surface waters or enter terrestrial systems when sewage effluent is used for irrigation or where sewage sludge is applied as a fertilizer to agricultural land (Kinney et al. 2006; Ternes et al. 2004). Veterinary pharmaceuticals are released to the environment either directly, from use in aquaculture and the treatment of pasture animals, or indirectly during the land application of manure and slurry from livestock facilities (Boxall et al. 2003a). PPCPs may also be released to the environment from manufacturing sites (Fick et al. 2009).

PPCPs have been detected in the natural environment across the world (Kolpin et al. 2002; Ramirez et al. 2009). Although reported concentrations are generally low, many PPCPs have been detected in a variety of hydrological, climatic, and land-use settings and some can persist in the



environment for months to years (e.g., Monteiro and Boxall 2009). Pharmaceuticals, as well as several chemicals used in personal care products, are biologically active compounds that are designed to interact with specific pathways and processes in target humans and animals. Concerns have therefore been raised about the potential effects of active PPCPs in the environment on human and environmental health; over the past 15 years, a substantial amount of work has been done to determine the occurrence, fate, effects, and risks of PPCPs in the environment. Regulations have also been developed regarding the assessment of risks of environmental exposure to PPCPs World Health Organization (WHO) 2011].

Attempts have been made to synthesize the wealth of knowledge gained to date and to identify the remaining major research gaps and gaps in regulation [e.g., Knowledge and Need Assessment of Pharmaceutical Products in Environmental Waters (KNAPPE) 2008]. However, these exercises have tended to focus on select regions of the world, as well as established markets, and have not always engaged fully with major stakeholder groups.

Effects of Characterization

A lot of information is available from mammalian studies and clinical trials on the behavior and effects of active pharmaceutical ingredients. The pharmaceutical industry devotes significant resources to collating new and emerging data as part of their post authorization pharmacovigilance programs, and several epidemiological studies have been performed to explore the potential long-term health effects of pharmaceuticals on workers in the pharmaceutical industry (Heron and Pickering 2003). In contrast, comprehensive information on fate and effects in the environment is publicly available for only a small percentage of pharmaceuticals and, with a few exceptions (e.g., the U.K. Veterinary Medicines Directorate Suspected Adverse Reactions Reporting Scheme), pharmacovigilance programs do not examine environmental effects.

Because many human-use PPCPs will be emitted continuously into the environment, organisms in the environment will be exposed throughout their lifetime. However, no regulatory program for prospective environmental risk assessment of PPCPs (or other product classes) takes into account the long-term combined toxicity of mixtures of chemicals, so there is a need to develop new approaches for assessing the risks arising from long-term exposure to mixtures. The concept of mixture risk assessment is gathering momentum, particularly in the public health arena, and recent reports by the European Commission, the UK Committee on Toxicology, and the U.S.

Risk and Relative Risks

Risks of PPCPs in the environment in different geographic regions vary because of differences in the presence/absence and type of manufacturing sites, level of PPCP use, population demographics, cultural practices, environmental and climatic characteristics, dilution potential of receiving environments, and infrastructure related to wastewater and drinking water treatment. Risks may change in the long term due to factors such as increased urbanization and effluent-dominated instream flows (Brooks et al. 2006), increased disease pressures, demographic change, population increases, technological developments (e.g., move from small molecules to biologics, development of nano medicines, improvements in drug delivery), and climate change. By better understanding the drivers for PPCP exposure in different regions, it may be possible to identify those areas that are at greatest risk, meaning that control options can be focused to areas/regions where they will be most effective. By understanding how risks will change in the longer term, it may be possible to anticipate and preemptively mitigate against unacceptable changes in risks.



Wider Global Relevance of the Exercise

Although participants from different regions of the world were engaged in the exercise, most question submissions (92%) were from North America (46.6%), Europe (29.8%), and Australia/New Zealand (15.5%). The workshop was also dominated by North American (51%) and European attendees (14.6%) and representatives of multinational corporations (34%). Two subsequent regional workshops were held in South Korea and Australia to determine the relevance of the 20 questions to the East Asian and Australia/New Zealand regions, respectively, and to identify additional questions that may be important to these regions. Participants at these workshops agreed that the 20 questions were of high importance to the East Asian and Australasian regions, and they highlighted the fact that these regions had unique characteristics (e.g., in terms of biodiversity) that should be considered when addressing the questions. Participants felt that important issues, such as better risk communication, consideration of cultural differences, and the impacts of natural medicines had also been overlooked. The conclusions of these later workshops will be presented in detail elsewhere.

Conclusions

The present study is the first to use the key question approach to identify key issues regarding exposure, effects, and risks of PPCPs in the environment. We see this exercise as the start of a broader program, and in the short term we are planning a broader global survey to identify which questions are most relevant to different stakeholders and why (additional questions proposed by the "local" workshops will be included in this exercise). In addition to this survey, additional workshops are planned on select topics (e.g., antibiotic resistance), and the conclusions of the survey and the workshops will be disseminated to policy makers around the world. We are optimistic that the results of this exercise will be invaluable in informing the design, coordination, and implementation of future research programs on PPCPs in the environment.

We hope that these programs will help us to better understand the potential and relative risks of these substances in the natural environment and to effectively control and manage these risks. "Green Peace Organization" is the well-known organization around the world, which is very sensitive to the environmental problems in the world. In Turkey, as a candidate to EU, the members of this organization have also done sensitive works to environment. TEMA is also another crucial organization doing good works for the environment in Turkey. As the efforts in Turkey, many studies are carried out all over the world about the environmental education and conscious. Instead of performing such studies separately in all countries, they should take common precautions altogether.

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BIOACCUMULATION AND BIOMAGNIFICATION POTENTIAL OF PHARMACEUTICALS WITH A FOCUS TO THE AQUATIC ENVIRONMENT

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Abstract

Pharmaceuticals, among the emerging contaminants, are one of the most relevant groups of substances in aquatic ecosystems due to universal use, their chemico-physical properties and known mode of action in aquatic organisms at low concentrations. After administration, many drugs and their transformation products are only retained to some extent in wastewater treatment plants therefore entering the aquatic environment in considerable high amounts. The yearly consumption to treat human and animal diseases, also in livestock and aquaculture was estimated to be hundred thousand tons per year leading to high concentrations in surface water of developed countries. Mostly, pharmaceutical residues in effluents of wastewater treatment plants or in the water column of surface waters have been reported, but data about concentrations in the aquatic biota, partitioning of pharmaceuticals to biosolids, soils, and sediments and the bioaccumulation properties are often lacking. Chronic and subtle effects can be expected when aquatic organisms are long term exposed by pseudo-persistent, persistent, and accumulative compounds. This review aims to summarize the current state of research about the fate of pharmaceuticals regarding bioconcentration, bioaccumulation and potential biomagnification in aquatic ecosystems. More comprehensive approaches for the evaluation of environmental (ERA) and human health risk assessment (HRA) are included and analytical methods required to detect bioaccumulation of pharmaceuticals are discussed in this review paper.

Keywords: Aquatic ecosystems, Bioaccumulation, Biomagnification, Human health, Pharmaceuticals.

Introduction

Bioaccumulation, the accumulation of a chemical in an organism relative to its level in the ambient medium, is of major environmental concern. Thus, monitoring chemical concentrations in biota are widely and increasingly used for assessing the chemical status of aquatic ecosystems. In this paper, various scientific and regulatory aspects of bioaccumulation in aquatic systems and the relevant critical issues are discussed. Monitoring chemical concentrations in biota can be used for compliance checking with regulatory directives, for identification of chemical sources or event-related environmental risk assessment. Assessing bioaccumulation in the field is challenging since many factors must be considered that can affect the accumulation of a chemical in an organism. Passive sampling can complement biota monitoring since samplers with standardised partition properties can be used over a wide temporal and geographical range. Bioaccumulation is also assessed for regulation of chemicals of environmental concern whereby mainly data from laboratory studies on fish bioaccumulation are used. Field data can, however, provide additional important information for regulators. Strategies for bioaccumulation assessment still need to be harmonised for different regulations and groups of chemicals. To create awareness for critical issues and to mutually benefit from technical expertise and scientific findings, communication between risk assessment and monitoring communities needs to be improved. Scientists can support the



establishment of new monitoring programs for bioaccumulation, e.g. in the frame of the amended European Environmental Quality Standard Directive.

Bioaccumulation as environmental quality criteria

Within the European Water Framework Directive (WFD), Environmental Quality Standards (EQS) for some chemicals in biota (EQS_{biota}) have been set, and measures have to be taken by the member states if an EQS is exceeded [2]. The European Commission has strengthened the significance for monitoring bioaccumulation in aquatic organisms by amending the EQS directive in August 2013 [3]: The directive states that 'very hydrophobic substances accumulate in biota and are hardly detectable in water even using the most advanced analytical techniques. For such substances, EQS should be set for biota. Therefore, in addition to hexachlorobenzene, hexachlorobutadiene and mercury, EQS_{biota} have been set for eight new priority substances or substance groups. These include polybrominated diphenyl ethers, fluoranthene, benzo[a]pyrene, dicofol, perfluorooctanesulfonic acid (PFOS) and its derivatives, dioxins, and dioxin-like compounds, hexabromocyclododecane (HBCDD), as well as heptachlor and heptachlorepoxy. EQS for new priority substances must be considered for monitoring programs that must be submitted by the end of 2018 and must be complied with by the end of 2027.

Assessing bioaccumulation potential of chemicals

For the registration of chemicals, bioaccumulation potential must be assessed in aquatic animals. For HOCs, log K_{OW} is used as a screening tool. Indeed, threshold levels differ between regulations. In Europe, the threshold value for industrial chemicals having a production volume of ≥ 100 t/a and for agricultural pesticides is log K_{OW} > 3 whereas for veterinary medicines, it is log K_{OW} ≥ 4 , and for human pharmaceuticals, it is log K_{OW} ≥ 4.5 . In addition to log K_{OW}, the BCF value is used for the identification of bioaccumulative substances. According to EU regulation 253/2011, in the context of assessing persistent, bioaccumulative and toxic substances as well as very persistent and very bioaccumulative substances^b, substances are bioaccumulative with a BCF > 2,000 and very bioaccumulative with BCF > 5,000. Similarly, the Stockholm Convention regards persistent organic chemicals (POP) with BCF > 5,000 as bioaccumulative. [4]

Use of monitoring data for bioaccumulation assessment

In addition to laboratory-derived BCF and BMF data, bioaccumulation can be assessed retrospectively by monitoring data if a chemical has already been in use and discharged into the environment. The implementation of the Stockholm Convention particularly has promoted the use of monitoring data for bioaccumulation assessment. In this context, a range of substances were defined as bioaccumulative and are now listed as POP by the Stockholm Convention despite relatively low BCF values. PFOS, for example, has only a moderate BCF of 240 to 1,300 but was assessed as bioaccumulative due to data on biomagnification in terrestrial and marine mammals. Monitoring data can be used for existing substances such as PFOS or HBCDD for which a ban is elaborated. For chemicals which have already been authorised (e.g. as biocides), knowledge on their concentrations in the environment can be used for potential reauthorisation or new authorisations (e.g. as veterinary medicine) in other legal frameworks (Bänsch-Baltruschat B, Claus E, Coors A, Duis K, Hommen U, Rüdél H, Keller K: Nutzung des Umweltmonitorings für das Risikomanagement bedenklicher Stoffe unter besonderer Berücksichtigung von PBT-Stoffen, submitted).



General approaches for analysing chemicals in biota

Today, the most common standard methodology to quantify the total content of trace metals and metalloids (metal(loid)s) in organisms is microwave-assisted acid digestion followed by inductively coupled plasma mass spectrometry (ICP-MS). However, for some analytes like mercury, direct methods for solids are available (e.g. cold vapour atomic absorption spectrometry method (CV-AAS). Indeed, the sample preparation, acid digestion and dilution are critical factors in single organism or target organ analyses for most metal(loid)s if the organisms are very small. Coupling ICP-MS to an electrothermal vaporisation unit (ETV) may have the potential to be an alternative (direct) approach in total content multi-element analyses. In the ETV, the sample is vaporised within seconds by heating in a graphite furnace up to approximately 2,000°C (this is comparable to CV-AAS or graphite furnace AAS). Advantages of the direct method are direct transfer of a dry aerosol to the plasma (no oxygen-based interferences from water), combined with multi-element capacity and high sensitivity of the ICP-MS. A lower effort for sample preparation is paid for with certain analytical drawbacks. Since it is still an analytical niche application, there is a lack of appropriate reference materials certified for homogeneity and concentration of various metal(loid)s.

Comparable to the sample preparation for metal(loid)s, the sample preparation for quantifying HOCs in biota is also very labour-intensive. After freeze-drying and extraction with organic solvents, clean-up of the extracts is performed to remove unwanted cell debris and tissue components that can interfere with the analytical measurements. Depending on the target analytes, the cleaned extracts are then analysed by, e.g. liquid chromatography

Monitoring for compliance checking with regulatory directives

Environmental contaminants are monitored in aquatic organisms, particularly in fish, for compliance checking with regulatory directives. In Europe, next to EQS_{biota}, there are threshold levels for fish, fishery products and seafood per European food laws such as the European Contaminant Regulation and the recommendation 2006/88/EC of the European Commission. Furthermore, national directives such as the German regulation on tolerable levels of contaminants in food also define maximum allowable concentrations in food.

Investigative monitoring

In contrast to compliance monitoring with fish, an investigative monitoring with zebra mussels (*Dreissena polymorpha*) in Bavaria (Germany) has shown that mercury concentrations in this species is generally below EQS_{biota}. In the frame of this monitoring program, zebra mussels were transposed from relatively unpolluted waters to a number of Bavarian rivers and lakes for 6 months. Mussels can hint at more local pollution events, e.g. upstream or downstream of a discharge, while fishes integrate the pollutant load over their whole migration area. Only at one site, the EQS_{biota} for mercury was exceeded in zebra mussels in 2007 to 2011 indicating a very local input of mercury.

Event-related monitoring

Monitoring bioaccumulation can also support risk assessment of various natural or anthropogenic events such as floods or dredging activities. For the maintenance of waterways, dredging of sediments may be necessary. As an example, the amount of sediments had increased to an unacceptable level in the Hamburg Port in 2004. In consequence, 6.5 Mio. m³ of sediments were dredged from the lower Elbe river in the Hamburg Port area and disposed 25 km north-west of the island Scharhörn in the inner German Bight between 2005 and 2010. To assess the potential ecological impacts on the marine environment, a comprehensive monitoring program has been



established [43]. Among many other parameters, bioaccumulation of metals and organic chemicals has been measured in two benthic invertebrates (mussels (white furrow shell, *Abra alba*) and snails (common whelk, *Buccinum undatum*)) and fish (dab, *Limanda limanda*) sampled in and around the disposal site as well as in reference sites. These species were selected since they are abundant in the monitoring area and they represent different trophic levels. Since 2008, significantly increased levels of the organotin compounds monobutyltin (MBT) and dibutyltin (DBT) were detected in snails from the disposal site hinting at an increased bioavailability of contaminants due to the sediment disposals. Indeed, bioaccumulation decreased again after cessation of the disposals in 2010: concentrations of the DDT metabolites p,p'-DDD and p,p'-DDE that had increased in snails sampled at the disposal site attained the same level as in reference sites in 2011. Sediment disposals had, in contrast to snails, no clear effect on concentrations of chemicals in fish and mussels. This shows that the selection of monitoring species can influence the outcome of monitoring studies.

Passive sampling

Species-specific differences in bioaccumulation potential also must be considered when the same species is not available in the whole monitoring area, such as the different river basins within Europe. In addition to species, bioaccumulation depends on further biotic (e.g. size, age, sex and physiological conditions of organisms) as well as abiotic parameters that have to be taken into account when evaluating chemical concentrations in biota. Passive sampling suffers less from the variability connected to biota and may in some cases complement biota monitoring. Passive sampling devices have a sampling phase, usually a polymer that accumulates chemicals when exposed in the environment or to an environmental sample. By quantifying concentrations of target analytes in the polymer of the sampler, freely dissolved concentrations (c_{free}) are determined that are a measure of contaminant bioavailability. Due to the enrichment of target analytes within the passive sampling polymer, quantification limits of passive sampling techniques are often lower than those for conventional techniques (e.g. quantification of HOCs in water).

Conclusions

The significance of bioaccumulation for assessing the chemical status of bodies of water is increasingly acknowledged as exemplified by setting new EQS_{biota} in the amended WFD EQS directive. Implementing the monitoring for compliance checking with these new EQS_{biota} is one of the challenges for the EU member states soon. As previously stated by Fuerhacker, the EQS directive is valuable for approaching a good chemical status of bodies of water even though new chemicals are not adequately considered. We further suggest that for bioaccumulative and non-metabolisable substances, EQS_{biota} are more relevant to chemical water quality than EQS_{water} since internal chemical concentrations are more related to a chemical's uptake and toxicity. Additionally, biota monitoring results can be related to ecological water quality as demonstrated by Van Ael et al.. The authors showed that for most investigated chemicals, ecological water quality being assessed by fish community structure was lower when chemical concentrations in fish were elevated. However, due to limited resources, the European member states have implemented biota monitoring for compliance checking with the WFD on a smaller scale than monitoring of the water phase and sediment.



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IMPACT OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN DRINKING WATER

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ABSTRACT

The presence of Pharmaceuticals and personal care products in raw and finished drinking water is a complex issue that remains the forces of sustained, continued study and issue of concern recently the original reports of pharmaceutical chemicals presence in water go back three decades. Worldwide detection of aquatic environment and drinking water has been cause for concern recent years. The advantages and availability of pharmaceuticals improve the health of the human beings result of recent researchers indicated that severe health problems of human beings are very unlikely from exposure to the Trans concentration of pharmaceuticals and personal care products that could potentially be found in drinking water. The PPCPs enter our water supply directly or indirectly through this manufacture and use by humans for health personal and veterinary purposes. According to US environmental protection agency (EPA) two classes of PPCPs are considered therapeutics, antibiotics and steroidal hormones. This paper discusses the possible sources of PPCPs, effect of PPCPs on human being's relevant legislations, basic terminology, research on PPCPs in water.

Key words: Pharmaceuticals, Personal care products, effects of PPCPs on human beings, endocrines, prevention methods, water recycling, treatment methods of PPCPs and awareness for consumers.

Methodology: Secondary data used from different books and journals.

Sources of Pharmaceuticals and Personal care products in drinking water: The term PPCPs refers to any product used for personal health and any product used in the agriculture to maintain the health or enhance the growth of livestock. In the last decade traces of Pharmaceuticals and personal care products, typically at the levels of Nano grams to low microns per liter, range have been reported in the water cycle including surface water, waste water, ground water and a lesser extent in drinking water. Their presence in water even at low concentration has raised concerns among stake holders such as drinking water regulators government, municipal water suppliers, and public water suppliers regarding the potential risks to human health from exposure to the trace of pharmaceuticals via drinking water.

Pharmaceuticals and personal care products enter our water supply directly and indirectly through this manufacture and used by human beings for health, personal and veterinary purposes. Flushing and disposing of unused medications, bathing, swimming, washing and excretions are not the only routes PPCPs may travel to unlimitedly emerge in detectable concentrations in our environment. PPCPs may also traced in medications for pain, depression, colds, birth control pills, caffeine, hair dyes, cleaning suppliers, deodorants, and pesticides. Some of these products contain endocrine destructing compounds and other contaminants may harm aquatic life. Discharge of waste water from drug producers, hospitals, leakage from aging or in adequate sewages and septic systems and agricultural uses of Pharmaceuticals as pesticides or other path ways of PPCPs may enter our water supply. Long term care facilities Pharmacies veterinary operations, land fill, leaches,



septic tank hatters, meat processors and run off from animal feeding operators where large quantities of antibiotics and other drugs are used.

PPCPs also enter waste water treatment plant through human excrements from typical house holders. Flushing unused medications, washing chemicals flow in to the drain, in chemical substances including prescriptions and over the counter therapeutic drugs for humans and animals, biopharmaceuticals diagnostic agents, vitamins and other nutritional supplements, cosmetics and fragrances and growth enhancing chemicals used for life stock. Water born PPCPs can also results from the disposal of illegal drugs. We also found PPCPs in the water which are thrown by the human intentionally and unintentionally. Without our knowledge PPCPs contamination of water by consumers also occur through the simple elimination of waste material from the body, since drugs are not always fully metabolized by the body and also through the bathing are showering when soaps and cosmetic creams are washed from the body in to wastewater system.

Effect of PPCPs in drinking water: There are number of confirmed adverse effects on human and aquatic life associated with Pharmaceutical and personal care products in drinking water. PPCPs contamination remains a significant concern for ex: Pharmaceuticals are designed to interact with cellular level receptors at low concentrations to induce specific biological effects and the side effects caused by interaction with non-receptor targets are unpredictable and poorly understood. The sex steroids from oral contraceptives and other similar chemicals can feminize male fish and change behavior of either sex. A three-year study by a research team at Brunel University in the UK found that many final sewage effluents contains estrogenic hormones believed to originate from women urine. The research began after the discovery that male fish in the lagoons of the United Kingdom wastewater treatment plant and become partly feminized. The Europe scholars have tied a declined human sperm count to low levels of birth control hormones in the environment. Some PPCPs such as steroid hormones like estrone, Progesterone and testosterone and fragrance additives like galaxolide have been identified as endocrine disrupting compounds. These are synthetic chemicals that block natural hormones in the body disrupting normal organ function. The wider spread use of Antibiotics both humans and in life stock has led to antibiotic resistant bacteria found in water sheds may only magnify this problem. From hospital and veterinary clinic waste may contain varying amounts of antibiotics like sulphonamides and trimethoprim are down gradient to ground water. One Wisconsin study found antibiotics in waste water effluent as well as adjacent ground water monitoring wells as result the samples contained only minute amounts of antibiotics.

Effect of PPCPs on Endocrine: Natural and manmade chemicals can interfere with the hormonal systems of humans, animals, and aquatic life. In the human body, endocrine disrupting chemicals can act in a few ways. They may reduce the production of hormones in endocrine glands, after the release of hormones from endocrine glands speed up the metabolism of hormones and reduce their action.

According to the national institute of environmental health science, endocrine disruptors may be responsible for breast and other cancers, endometriosis and infertility. EDC also came from chlorinated organic chemicals like DDT, Toxafit and Kepone. They also came from the herbicides 2, 4-D; mercury, dioxine, poly chlorinated bi phenols.

Preventing the PPCPs in Drinking Water: Conventional drinking water quality monitoring that places emphasis on end product testing is very resource intensive in terms of capital investments and human resources. The large list of chemical contaminant detected in drinking water and water



resources, that may be of insignificant health concern an over emphasis on end product monitoring and the upgrading of treatment infrastructure is clearly not sustainable. According to WHO guidelines for drinking water quality states that in the water safety plan is “the most effective means of constantly ensuring the safety of a drinking water supply through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in the water supply from catchment to consumer” (WHO2011). The importance of water safety plans that looking at risk assessment and risk management entire the water cycle starting of source. With this water cycle approach to pharmaceuticals in drinking water means that preventing pharmaceuticals from entering the environment during their production, consumption, and disposal a pragmatic and effective means of risk management. In appropriate disposal practices, such as flushing unwanted drugs down toilets and sinks and discarded them in house hold waste are common and often a significant contributor of pharmaceuticals present in waste water, surface water and landfill leachete. A survey from UK house holders in 2003 found that 63% of unwanted pharmaceuticals were discarded in house hold waste, 11.5% were flushed down sinks or toilets. Similarly, proper, and well managed disposal practices at health care and veterinary facilities will help mitigate the entry of pharmaceutical with our environment. Disposal of non-controlled substances tends to be more variable and often developed and a local, regional basis. A scan of current literature which is not exhaustive revealed broadly categorized preventive measures in Australia, Canada, the USA, and European countries that could potentially reduce the entry of Pharmaceuticals and personal care products in to our environment.

Preventive measures such as policies promoting or regulations governing disposal practices at concentrated point sources like health care and veterinary facilities can reduce the amount of pharmaceutical and personal care products entering water bodies in addition that the take back programs, guidance, and enhanced consumer education will support efforts for proper disposal of medicines and reduced the impact of PPCPs entering drinking water sources.

PPCPs and water recycling: According to Environmental protection Agency researches noted that one of the major reasons people have fears about PPCPs is they can come from excrement. The agency noted that also may be a reason that some water recycling projects fail i.e. such as various toilets – tap programs which propose to reclaim waste water for drink.

The PPCPs detection that the soil absorption characteristics of selected pharmaceutical compounds and the fate and the transport of PPCPs in recycled water during percolation through soil in field – test plots.” What we are trying to do figure out what the fate of these compounds in which they are discharged in to environment,” Babcock said.

“Recycled water is generally only approved for use in areas where it’s not over a drinking water supply but there is a proposal for fairly large scale reuse over a potable aquifer”. (Babcock said)

Treatment methods for PPCPs in drinking water: Most conventional water treatment systems are not equipped to remove PPCPs from drinking water. However, depending on specific chemical class of the contaminant, there is a range of treatment methodologies that have proven effective for emerging PPCPs in reducing their concentration. Such as activated carbon, biological activated carbon, nano filtration, reverse osmosis.

More than 90% of steroids, antibiotics, anti-depressants and anti-microbial, anti-inflammatory can be removed from drinking water using activated sludge, activated carbon,



biologically activated carbon, reverse osmosis, UV treatments, Nano filtrations and ozone/advanced oxidation. Less than 40% listed PPCPs can be removed through the use of Coagulation, flocculation and softening/metal oxide.

Awareness for consumers: Consumers are accustomed to disposing of unwanted and expired medicines through house hold waste, toilets, sewage canals. Such improper disposal practices release Pharmaceuticals and personal care products in to environment, waste water and other water resources. There is a need to create awareness in public and encourage adopting proper disposal processes for unwanted pharmaceuticals. In New York State Department of environmental conservation publishes posters for all pharmacies and retail stores that sell PPCPs to advice consumers on the proper storage disposal unwanted medicine. Consumers can then serve as environmental stewards to reduce water pollution. Advice to consumers to throw drugs into the trash is not preferable but it is less harm full to the environment than disposal in to the waste water stream. Better advice to do following guidelines to reduce potential for abuse.

1. Key pharmaceuticals in the container with safety lids.
2. Scratch out patient information on labels.
3. Put the liquids in glass bottles in plastic resalable bags to contain leakage.
4. Add some water to dry tablets and capsules to dissolve them slightly.

Conclusion

The presence of pharmaceuticals and personal care products and other emerging contaminants in drinking water is a significant research is still required to both the problems and its implications for the safety of the public drinking water supply. The occurrence of PPCPs in the environment including the water cycle rising from nano grams to low microns per liter has been widely discussed. This paper focus primarily reviewing the risks to human health associated with exposure to concentrations of PPCPs in drinking water. It also discusses the potential impact on aquatic system and environment. Discharge of waste water from drug producers' hospitals, septic systems, and agricultural uses of pharmaceuticals as antibiotics are other ways PPCPs may enter the water supply. Few laboratories in US can analyze a wide variety of emerging contaminants in drinking water including PPCPs, hormones, Phenolic endocrine disruptors, herbicides depredate and per fluoro chemicals. There are few comprehensive systematic studies on PPCPs in drinking water. The discharge of untreated waste water to water bodies used as drinking water sources should be strongly discouraged. The study also determines soil absorption characteristics of PPCPs and in the fate and transport of its in recycled water during percolation through the soil in field test plots.

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NEW METHODS FOR QUANTITATIVE ESTIMATION OF FROVATRIPTAN IN BULK AND PHARMACEUTICAL FORMULATION (M1-M5)

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Abstract

Frovatriptan is a second generation triptan drug intended for treatment of headache migraine. Five novel, safe, simple, accurate, sensitive and economical uv-spectrophotometric methods have been developed and subsequently validated for the determination of frovatriptan in bulk and pharmaceutical formulation. The method was based on the formulation of coloured complex of frovatriptan with different reagents. Absorbance of the formed colour complex is measured against the reagent blank at the wavelength of maximum absorbance. In this work, five spectrophotometric methods were proposed (M1-M5). Method 1 is based on the formation of oxidative coupling reaction and with the use of iron (III)-MBTH (3-methyl-2-benzo thiazolinone hydrazone hydrochloride). The resulting green coloured chromogen complex absorbs at $\lambda_{\max}=570$ nm. Reaction of frovatriptan with ferric chloride and $K_3[Fe(CN)_6]$ to form green coloured species having absorption maxima at $\lambda_{\max}=780$ nm is used in Method 2. Method 3 is based on the reaction of frovatriptan with $FeCl_3$ and 1,10 phenanthroline to form a blood red coloured chromogen which exhibits absorption at $\lambda_{\max}=520$ nm. Formation of oxidative coupling of drug with brucine in the presence of sodium metaperiodate is used to form a purple red coloured species in Method 4 which exhibits absorption maxima at $\lambda_{\max}=600$ nm. Method 5 is based on the formation of drug with acidic dye WFBBL having absorption maxima at $\lambda_{\max}=490$ nm. All these methods have different linearity reagent and statistical analysis proves that the proposed methods are reproducible and selective for the estimation of frovatriptan in bulk drug and in its tablet dosage form.

Keywords: Frovatriptan, Spectrophotometric methods, MBTH, $K_3[Fe(CN)_6]$, 1, 10 Phenanthroline, Brucine, WFBBL, Beer's Law

Introduction

Flovatriptan is a second-generation triptan drug intended for treatment of migraine. It is used as an abortive medication, blocking a migraine attack that is already in progress. Flovatriptan is marketed and manufactured by Pfizer Inc. Flovatriptan was approved by the U.S. Food and Drug Administration (FDA) on December 26, 2002 for the acute treatment of migraine with or without aura in adults. IUPAC name of Flovatriptan is (3R)-3-(methylamino)-2,3,4,9-tetrahydro-1H-carbazole-6-carboxamide and its molecular mass is 243.3 g/mol. Formula of Flovatriptan is $C_{14}H_{17}N_3O$.

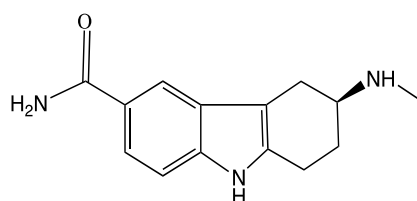


Fig.1 Structure of Flovatriptan



In the existing literature, several analytical methods such as HPLC, HPLTC, UV Spectrophotometric fluorometric and chromatographic methods have been reported for the determination of Flovatriptan in formulations. For routine analysis; simple, rapid and cost effective visible spectrophotometric methods are required. Nevertheless, there still exists a need for development of sensitive accurate and flexible visible spectrophotometric methods for the determination of Flovatriptan in pharmaceutical preparations. In this work, an attempt is made in this direction and succeeded in developing five methods based on the reaction between the drug, reagents and chemicals.

The proposed methods for Flovatriptan determination have many advantages over other analytical methods due to its rapidity, normal cost and environmental safety. Unlike HPLC and HPLTC procedures, these methods are simple and cost effective. Economically, all the analytical reagents are inexpensive and available in any analytical laboratory. The results of analysis of these five methods were validated statistically following ICH Q2A (R1) guidelines

Remainder of the paper is organized in different sections as follows.

1. Instrumentation: A systronics UV Spectrophotometer, Genesys 10 UV split beam Spectrophotometer with 1 cm matched quartz cells procured from Thermo Scientific Company marketed by Merck were used for all spectral and absorbance measurements. A systronics digital p^H meter 361 was used for p^H measurements.

2. Reagents and Chemicals: All reagents and chemicals used were of analytical or pharmacopeia grade purity. Doubly distilled water was used throughout this work. The details for five methods are as follows.

2.1 MBTH Method 1: 0.2% MBTH solution (Fluka, 8.55×10^{-3} M) is prepared by dissolving 200 mg of MBTH in 100 mL of distill water. 0.25% Fe (III) solution (Wilson Labs, 3.32×10^{-3} M) is prepared by dissolving 250 mg of Fe (III) in 100 mL of distill water.

0.4% NaOH solution (Loba, 1M) is prepared by dissolving 400 mg of NaOH in 100 mL of distills water and standardized.

HCl (E.Merck, 1M) solution is prepared by diluting 86 ml of conc. HCl to 100 mL with distill water and standardized.

2.2 Potassium ferricyanide Method 2: Potassium ferricyanide (BDH, 0.1%, 3.02×10^{-3} M) solution is prepared by dissolve 100 mg of Pot. ferricyanide in 100 mL of double distill water.

Fe (III) solution (Wilson Labs, 0.054 %, 3.32×10^{-3} M) Prepared by dissolving 54 mg of anhydrous ferric chloride in 100 mL of distill water.

HCl (E.Merck, 1M) solution is prepared by diluting 86 ml of conc. HCl to 100 mL with distill water and standardized.

2.3 1, 10 Phenanthroline Method 3: 1, 10 Phenanthroline solution (BDH, 0.2%, 3.02×10^{-3} M) is prepared by dissolve 200 mg of 1, 10 Phenanthroline in 100 mL of double distill water with warming

Fe (III) solution (Wilson Labs, 0.054 %, 3.32×10^{-3} M) Prepared by dissolving 54 mg of anhydrous ferric chloride in 100 mL of distill water.

HCl (E.Merck, 1M) solution is prepared by diluting 86 ml of conc. HCl to 100 mL with distill water and standardized.

2.4 Brucine Method 4: Brucine solution (Loba, 0.2%, 5.067×10^{-3} M) is prepared by diluting 200mg of brucine in 100 mL with distill water and standardized.



NaIO₄ solution (BDH, 0.2%, 9.35×10^{-3} M) is prepared by diluting 200mg of NaIO₄ in 100 mL with distill water and standardized iodometrically.

H₂SO₄ solution (Qualigens, 2.3M) is prepared by diluting 6.38 ml of 18 M H₂SO₄ in 100 ml with distill water.

2.5 WF BBL Method 5: WF BBL Solution (Fluka, 0.2%, 5.84×10^{-3} M) is prepared by dissolving 200 mg of Wool Fast Blue and is dissolving in 100 mL of distilled water.

Buffer solution (pH 1.5) is prepared by mixing 289 mL of glycine solution (37.52 g glycine and 29.24 g of NaCl were dissolved in 500 mL distilled water) with 711 mL of 0.1 M HCl and the pH of solution was adjusted to 1.5.

Chloroform: AR grade chloroform was used

3. Drug sample

The pharmaceutical grade Frovatriptan sample was gifted from Sun Pharm, Ahmadabad. The formulations of Frovatriptan [(Frova ,2.5&5 mg, dosage form) samples were procured from the local pharmacy agencies.

4. Preparation of working standard drug solution: The standard 10 mg of Frovatriptan [(Frova ,2.5&5 mg, dosage form)], 10 mg of API was weighed accurately and transferred to 100ml volumetric flask. It was dissolved properly and diluted up to the mark with methanol to obtain final concentration of 100 µg / ml.

5. Methods

5.1 MBTH Method (1): One ml of MBTH was transferred into a series of 10ml volumetric flasks. An aliquot volume of Frovatriptan standard solution was added so that the final concentration was in the range of 5-40 µg/ml, then 1ml of ferric chloride solution was added. This solution was mixed and allowed to stand for 20 min, measured against a reagent blanks (which contains all reagents except Frovatriptan) at 570 nm. The absorbance versus the final concentration was plotted to get the calibration curve or to derive the regression equation.

5.2 Potassium ferricyanide method (2): 0.5 ml of Potassium ferricyanide was transferred into a series of 10 ml volumetric flasks. An aliquot volume of Frovatriptan standard solution was added so that the final concentration was in the range of 4-24 µg/ml, then 1ml of ferric chloride solution was added. The tubes were stopper immediately and shaken well for 5 min. After 5 min, 1 mL of 1N HCl was added and the final volume was made up to 10 mL with distill water. The absorbance of the solution in each tube was measured immediately at 780 nm against a similar reagent blank. The absorbance versus the final concentration was plotted to get the calibration curve, or to derive the regression equation.

5.3 1, 10 Phenanthroline method (3): Aliquots of standard stock solution ranging 1-32 µg/ml were transferred to a series of 10 ml volumetric flasks. To each flask were 1ml of 0.1M ferric chlorides and 1.5 ml of 0.03 M 1,10- Phenanthroline were added. The flasks were allowed to stand in water bath 15 min at 100 °C. The flasks were then cooled to room temperature and the solution was made up to the volume with water. The absorbance of the orange red colored chromogen was measured at 520 nm against reagent blank. The colored species were stable for more than 3 hours. The absorbance of the sample solution was also measured by repeating the same procedure.



5.4 Brucine Method (4): Aliquots of standard stock solution ranging 5-40 µg/ml were transferred to a series of 10 ml volumetric flasks. To each flask 3.0 ml brucine, 1.5 ml of NaIO₄ solution and 2.0 ml of sulphuric acid were added successively and the volume was brought up to 10ml with distilled water and kept in boiling water bath for 15min. The absorbance of the purple red colored chromogen was measured at 600 nm against reagent blank. The colored species were stable for more than 3 hours. The absorbance of the sample solution was also measured by repeating the same procedure.

5.5 WFB BL Method (5): Into a series of 125 mL separating funnels containing aliquots of standard drug solution ranging from 10-70 µg/mL, 6 mL of buffer solution [pH 1.5 or 0.1 M HCl] and 2.0 mL of dye solution WFB BL is added. The total volume of aqueous phase in each separating funnel was adjusted to 15 mL with distilled water and 10 mL of CHCl₃ was added. The contents were shaken for 2 min. The two phases were allowed to separate and the absorbance of the separated organic layer was measured at 490 nm against a similar reagent blank after 10 min. The amount of drug was deduced from the calibration curve.

6. Assay procedure for formulations: An amount of finely ground tablet equivalent to 100 mg of Frovatriptan (Frova, 2.5 & 5 mg) was accurately weighed into a 100 mL-calibrated flask, 60 mL of water added and shaken for 20 min. Then, the volume was made up to the mark with water and after mixing it well, it is filtered using Whatmann filter paper No 42. First 10 mL portion of the filtrate was discarded and a suitable aliquot of the subsequent portion (1000 µg/mL) was diluted approximately to get suitable concentrations for analysis by proposed methods.

7. Method validation

7.1 Linearity: Linearity was evaluated by measuring the absorbance values of standard solution. The standard stock solution of Frovatriptan, appropriate aliquots were pipetted out in to a six or seven series of volumetric flasks and add the solutions required for each individual method. After color formation absorbance of each concentration was measured at wavelength found for the proposed method. Results were shown in Table 1 and standard graphs of Linearity for proposed methods were shown in Fig 2 and Fig 3.

Table 1 Linearity results of proposed methods (1 - 5)

MBTH Method (1)		
S. No	Concentration µg/mL	Absorbance
1	5	0.102
2	10	0.214
3	15	0.326
4	20	0.431
5	25	0.547
6	30	0.653
7	35	0.749
8	40	0.902

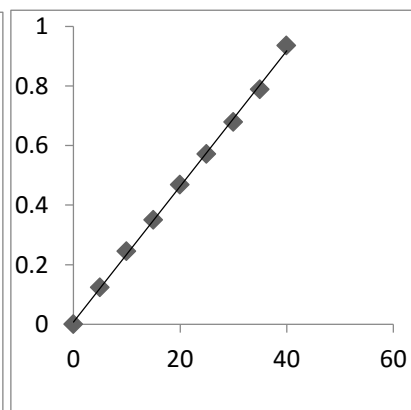
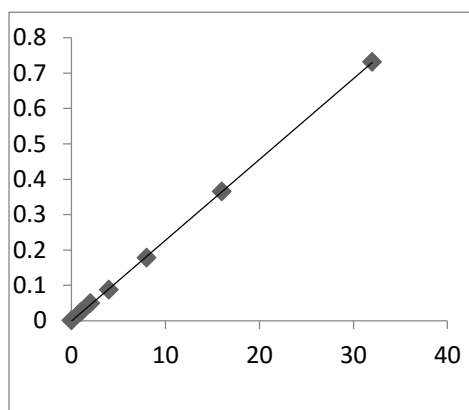
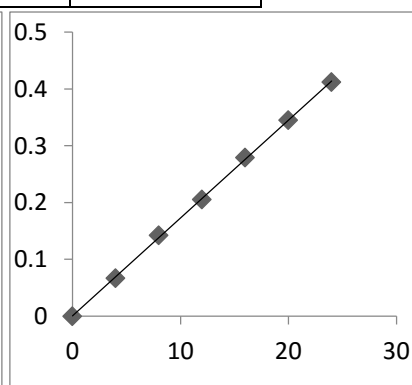
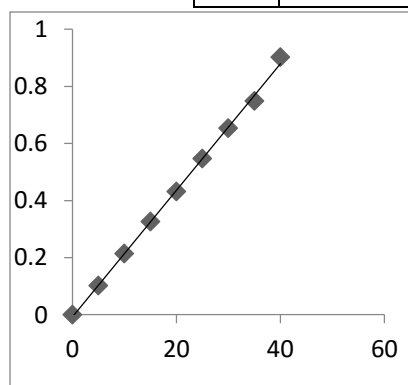
Potassium ferricyanide Method (2)		
S. No	Concentration µg/mL	Absorbance
1	4	0.067
2	8	0.142
3	12	0.205
4	16	0.279
5	20	0.345
6	24	0.412



1,10 –Phenanthroline Method (3)		
S. No	Concentration µg/mL	Absorbance
1	2	0.049
2	4	0.087
3	8	0.178
4	16	0.365
5	32	0.731

Brucine Method (4)		
S. No	Concentration µg/mL	Absorbance
1	5	0.124
2	10	0.245
3	15	0.351
4	20	0.469
5	25	0.572
6	30	0.679
7	35	0.789
8	40	0.936

WFB BL Method (5)		
S.No	Concentration µg/ml	Absorbance
1	10	0.083
2	20	0.169
3	30	0.251
4	40	0.342
5	50	0.421
6	60	0.492
7	70	0.582



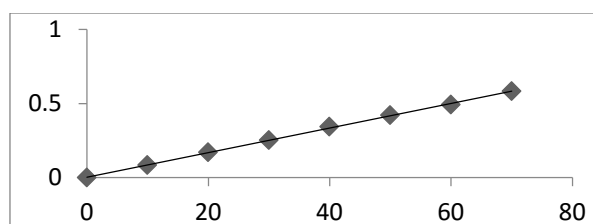
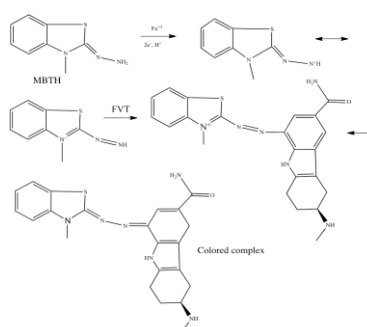
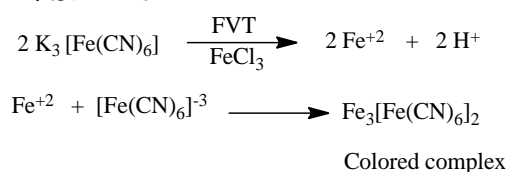


Fig2 : Calibration curves of proposed methods 1 – 5

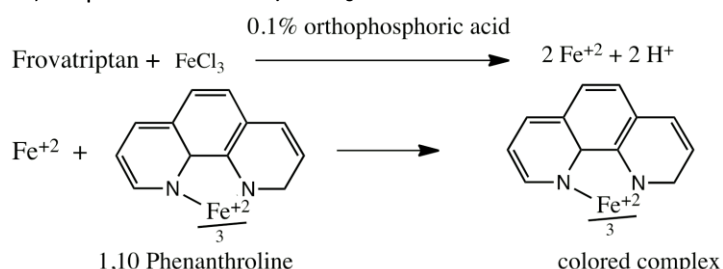
Reaction of FVT with MBTH/FeCl₃



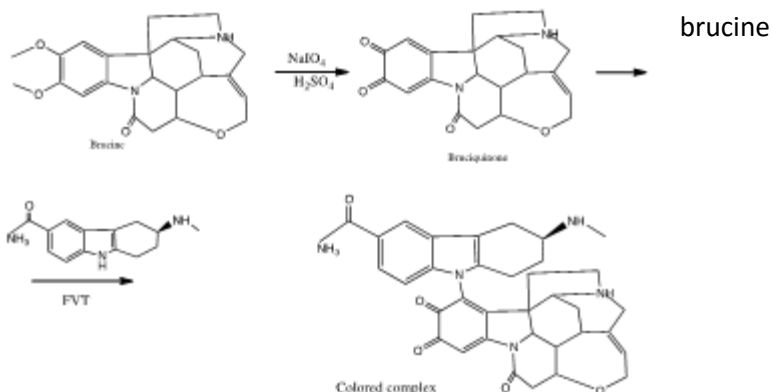
Reaction of FVT with K₃[Fe(CN)₆] / FeCl₃



Reaction of FVT with 1, 10 phenanthroline / FeCl₃



Reaction of FVT with





Reaction of FVT with WF BBL

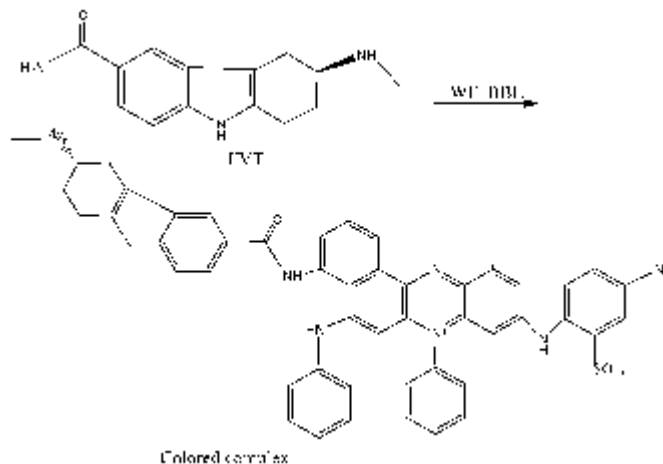


Fig 3 : Reaction of drug with reagent

7.2 Analysis of commercial sample

In order to examine the validity of the proposed methods, **Frovatriptan** was determined in commercial formulation. From the results of the determination it is clear that there is close agreement between the results obtained by the proposed methods and the label claim. These one results indicating that there was no significant difference between the proposed methods and the reference methods in respect to accuracy and precision Table 2.

7.3 Precision

To estimate the accuracy and precision of the methods, pure drug solution was analyzed and being repeated six times. The relative error (%) and relative standard deviation (%) were less than 2.0 and indicate the high accuracy and precision for the proposed methods Table 3

8. Discussion

The present study was carried out to develop a simple, accurate and sensitive UV spectrophotometric method for the determination of Frovatriptan tablets. In the method 1, the Frovatriptan reacts with MBTH in the presence of ferric chloride in acidic medium to give a blue color product. Actually, this is an iron catalyzed oxidative coupling reaction of MBTH with the drug. Under the reaction conditions, on oxidation, MBTH loses two electrons and proton forming an electrophilic intermediate, which is the active coupling species. This intermediate undergoes electrophilic substitution with the drug to form the green colored product, which shows λ_{max} at 570 nm against the corresponding reagent blank. In the method 2, Frovatriptan reduces the ferric chloride to ferrous in presence of Potassium ferricyanide. It leads to development of highly intense green colored complex, which shows λ_{max} at 780 nm against the corresponding reagent blank.



Table 2. Results comparison of the proposed spectrophotometric methods with the HPLC Method

Method	Pharmaceutical formulation	Labelled amount (mg)	Proposed Method			Amount found by reference method \pm SD	% Recovery by proposed methods \pm SD
			Amount found* (mg) \pm SD	t (value)	F (value)		
M1	Tablet -I	2.5	2.49 \pm 0.017	0.804	1.245	2.43 \pm 0.025	99.45 \pm 0.89
	Tablet -II	2.5	2.51 \pm 0.019	0.407	2.215	2.44 \pm 0.028	101.1 \pm 0.99
	Tablet -III	2.5	2.44 \pm 0.085	0.357	1.678	2.51 \pm 0.088	99.49 \pm 1.01
M2	Tablet -I	2.5	2.51 \pm 0.018	0.091	1.421	2.48 \pm 0.019	100.5 \pm 0.87
	Tablet -II	2.5	2.48 \pm 0.089	0.614	1.623	2.49 \pm 0.048	99.85 \pm 0.95
	Tablet -III	2.5	2.41 \pm 0.099	0.782	1.117	2.47 \pm 0.020	99.64 \pm 1.03
M3	Tablet -I	2.5	2.46 \pm 0.019	0.714	2.365	2.46 \pm 0.022	100.9 \pm 0.85
	Tablet -II	2.5	2.52 \pm 0.019	0.326	1.485	2.51 \pm 0.019	99.82 \pm 1.01
	Tablet -III	2.5	2.49 \pm 0.025	0.484	1.784	2.52 \pm 0.022	99.97 \pm 0.96
M4	Tablet -I	2.5	2.44 \pm 0.088	0.087	2.132	2.46 \pm 0.018	100.8 \pm 1.06
	Tablet -II	2.5	2.49 \pm 0.018	0.0916	1.764	2.51 \pm 0.004	100.2 \pm 0.77
	Tablet -III	2.5	2.37 \pm 0.093	1.012	1.683	2.487 \pm 0.088	99.51 \pm 0.83
M5	Tablet -I	2.5	2.42 \pm 0.019	1.121	1.917	2.501 \pm 0.033	100.9 \pm 0.67
	Tablet -II	2.5	2.39 \pm 0.027	0.921	1.312	2.465 \pm 0.018	99.25 \pm 0.96
	Tablet -III	2.5	2.45 \pm 0.036	0.843	1.784	2.49 \pm 0.059	99.88 \pm 1.02
HPLC	Frova	2.5 \pm 0.043	2.503	0.84	2.58	2.38 \pm 0.031	95.2 \pm 0.84
		5 \pm 0.032	5.978	1.45	1.49	5.267 \pm 0.097	101.2 \pm 0.47

Note:

- Tablet -I, II, III are three different Frova pharmaceutical batches
- * Average of amount found for five determinants
- Theoretical values at 95% confidence limits are T = 2.365 and F = 4.88
- ** Average of five determinations

Method 3 is based on the reduction of ferric chloride to ferrous form by the Frovatriptan, which forms complex with 1, 10 Phenanthroline to yield blood red colored chromogen. The colored chromogen was stable and exhibited maximum absorption at 520 nm. In method 4, the dimethoxy



benzene nucleus of brucine is attacked by IO_4^- with the formation of o – Quinone (bruciquinone) that in turn undergo nucleophilic attack on the most electron rich position of the coupler (aliphatic secondary amino group of Frovatriptan) to give 1-monosubstituted bruciquinone derivative (purplered colored species) and exhibit absorption maxima at λ_{max} 600nm. In method 5, Frovatriptan being basic in nature forms an ion-association complex with the acidic dye WFB BL, which is extractable into chloroform from the aqueous phase. The protonated nitrogen positive charge of the drug molecule in acid medium is expected to attack the positive charge of the dye. Hence form a colored complex, which is extracted with chloroform. The obtained color chromogens show absorption maxima at λ_{max} 490nm.

The assay results are shown in Table 2. The regression characteristics like slope (b), intercept, (a), correlation coefficient (r) obtained from different concentrations were calculated and the results are summarized in Table 3. HPLC results are also included in the last column of Table 3 for comparison purpose. The conditions required for the formation of colored complexes were optimized. Statistical analysis was carried out and the results were found to be satisfactory. The results indicate that there is no interference of other ingredients present in the formulations. Thus, the proposed methods are simple, sensitive, precise, accurate, reproducible and useful for the routine quality control.

Five useful micro methods (M1-M5) for the determination of Flovatriptan have been developed and validated. The methods are simple and rapid taking more than 25 to 30 minutes for the assay. These spectrophotometric methods are more sensitive than the existing UV and HPLC methods. The chemicals used are very chief and easily available in the market. Thus, they can be used as alternatives for rapid and routine determination of bulk sample and tablets.

Table 3 Results comparison of the proposed spectrophotometric methods with the HPLC Method

S. No	Parameter	M _{2a} (MBTH)	M _{2b} (K ₃ [Fe(CN) ₆])	M _{2c} (1,10 Phenanthroline)	M _{2d} (Brucine)	M _{2e} (WF BBL)	HPLC Method
1	λ_{max} (nm)	570	780	520	600	490	245
2	Beer's law limits($\mu\text{g/ml}$)	5.0– 40	4.0 – 24	1.0 – 32	5.0 - 40	10 - 70	20 - 100
3	Regression equation (y = mx+c) Slope (m)	0.0222	0.01722	0.02284	0.02276	0.00829	1992x
	Intercept (c)	0.0072	0.00046	0.00084	0.00760	0.00250	1219.8
4	Standard deviation on slope (Sm)	4.684×10^{-4}	1.750×10^{-4}	1.535×10^{-4}	2.520×10^{-3}	7.168×10^{-5}	30.05
5	Standard deviation on intercept (Sb)	1.018×10^{-2}	2.720×10^{-3}	1.317×10^{-3}	6.380×10^{-3}	3.205×10^{-3}	1995.04
6	Standard error estimate (Se)	2.246×10^{-2}	2.930×10^{-3}	4.073×10^{-3}	1.212×10^{-2}	3.793×10^{-3}	1902.2
7	Correlation coefficient(r)	0.9986	0.9997	0.9998	0.9988	0.9994	0.9996
8	% of RSD	0.7905	1.2100	0.9881	0.6919	0.4805	0.9993



9	% Range of error (Confidence limit) 0.05 level 0.01 level	± 0.1965 ± 1.6260	± 1.5040 ± 2.4890	± 1.2280 ± 2.0328	± 2.871 ± 4.749	± 1.318 ± 2.180	± 0.2992 ± 0.9976
10	Limit of Detection (LOD) ($\mu\text{g/ml}$)	1.5975	0.4749	0.1730	0.84106	1.1600	0.9993
11	Limit of Quantization (LOQ)($\mu\text{g/ml}$)	5.3240	1.5830	0.5766	2.8031	3.8668	0.0299

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NATURAL REMEDY FOR TOXICITY OF PHARMACEUTICALS & PERSONAL CARE PRODUCTS

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ABSTRACT

Releasing of Pharmaceuticals, Personal care products by human activities in to water sources and pollutes the environment Multi directionally. So, Environment becoming a threat to human & aquatic life. The reports of Analysis of Edupugallu lake water reveals that "Edupugallu lake water contained different types of Pharmaceuticals, Personal care products". After bioremediation "The reports of Edupugallu lake water reveals decrease the concentration of Toxicity of Pharmaceuticals, Personal care products".

Keywords: Pharmaceuticals, Personal Care Products, Toxicity, Natural Remedies.

INTRODUCTION

Pollutants are those materials that are present in soil, water, or air in more than the normal concentrations present under natural virgin conditions. While there is a natural assimilation capacity of these vital resources of life, there is a limit for the quantity that can be assimilated. Polluted resource is of no use as it is and certain remedial measures are needed before these can be of use for people. In view of the continued failures of monsoon rains there is drastic depletion of fresh water resources. Almost all surface water and ground water resources are polluted to greater or lesser extent. It is therefore essential to protect the water bodies in order maintain the ecological balance and provide proper management plans for conservation and management of water.

Table: Surface water quality classification

Parameter	Condition of water				
	Excellent	Acceptable	Slightly Polluted	Polluted	Grossly Polluted
pH	6.5-8.0	6.0-8.5	5.0-9.0	3.9-10.1	<3.9->10.1
BODmg/l	1.5	3.0	6.0	12.0	>12.0
COD mg/l	10	20	40	80	>80
Suspended solids mg/l	20	40	100	278	>278
Ammonia mg/l	0.1	0.3	0.9	2.7	>2.7
Nitrate mg/l	4	12	36	108	>108
Chloride mg/l	50	150	300	620	>620
Iron mg/l	0.1	0.3	0.9	2.7	>2.7
Manganese mg/l	0.05	0.17	0.5	1.0	>1.0



OBJECTIVES

1. To assess the physical and chemical quality Edupugallu lake water.
2. To identify the biological species and define the biological quality of the lake waters.
3. Identify the pollutants and perform laboratory scale experiments for the removal of these pollutants.
4. To suggest suitable bioremedial methods for the resurrection of the Edupugallu lake waters.

PHYSICO CHEMICAL AND BIOLOGICAL METHODS OF ANALYSIS OF SURFACE WATER OF EDUPUGALLU LAKE

Materials and Methods

Water samples have been collected throughout the lake, of three season of the year. For each sampling we have collected 14 samples around the lake. Samples were collected according to procedures prescribed in UNESCO document. The collected samples were labeled properly indicating the exact position where the samples are collected at the lake. Some field measurements are also done at the lake itself (D.O, pH, etc.) and then the remaining samples are brought to the laboratory in ice containers and analyzed for parameters. Major cations such as Na, K, Ca, Mg and anions such as chlorides, sulphates, phosphates, and levels of BOD, COD and total solids were by determined by standard methods (APHA 1998). All trace metals, which include Mn, Cu, Zn.

CHEMICAL PARAMETERS: pH, Electrical Conductivity (EC), Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrates, Phosphates, Sulphates, Chlorides, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Potassium and Sodium.

Table: Methods used for water analysis

Test conducted	Unit	Principle of the method
Temperature	$^{\circ}\text{C}$	Precision thermometer, measured in situ
Electrical conductivity	Mhos	Digital conductivity meter
Turbidity	NTU	Turbidimeter
Total solids	mg l^{-1}	Evaporation
Total dissolved and suspended solids	mg l^{-1}	Filtration and evaporation
PH		Digital pH meter
Chemical oxygen demand	mg l^{-1}	Org.sub are oxidized by $\text{K}_2\text{Cr}_2\text{O}_7$ in H_2SO_4 and refluxed and titrated
Total alkalinity as CaCO_3	mg l^{-1}	Titration with std. H_2SO_4 P-alkalinity + MO – Alkalinity ----- x 100 ml of sample taken
Chloride	mg l^{-1}	Titration with stand. AgNO_3 using $\text{K}_2\text{Cr}_2\text{O}_7$ as indicator
Total hardness	mg l^{-1}	EDTA titrimetric method
Sulphate	mg l^{-1}	Turbidimetric method using BaCl_2
Nitrate – N (NO_3)	mg l^{-1}	Phenol disulphonic acid spectrophotometric method
Sodium and potassium	Mg l^{-1}	Flame photometer
Metals	mg l^{-1}	ICP
Biochemical oxygen demand BOD	mg l^{-1}	Sample measured for 5 days at 20°C
Coliforms	MPN/100 ml	Multiple tube fermentation technique



PHYSICO CHEMICAL ANALYSIS OF POLLUTED EDUPUGALLU WATER

Before Bioremediation

S.No.	Parameter	S1	S2	S3
1	pH	9	8.7	9
3	Alkalinity	450	420	410
4	Total Hardness	550	555	560
7	Biological Oxygen Demand	6	6.5	6
8	Chemical Oxygen Demand	42	45	43
16	Dissolved Oxygen	4	4.2	4

After Bioremediation

S.No.	Parameter	Acceptable Limits
1	pH	
3	Alkalinity	
4	Total Hardness	
7	Biological Oxygen Demand	
8	Chemical Oxygen Demand	
16	Dissolved Oxygen	

All the units are in mg/l, except pH and EC (milli mhos)

CONCLUSION

The study included physico-chemical and biological parameters for water and suitable remediation methods. The samples were collected at various sampling points, which were identified, based on reachability and proximity of inlet and all around the lake have high values for Sulphates, Chlorides and Nitrates were observed.

A low value of Dissolved Oxygen and high value of BOD was observed during all three seasons. It indicates lake is polluted with organic, Pharmaceutical & Heavy metals. Phytoplankton analysis has shown that certain species of Cyanophyceae and Chlorophyceae was found.

Bioremediation studies are carried out using cultures developed from the soil samples collected from the lake. Further samples are oxidized with Hydrogen peroxide prior to the degradation studies showed better remediation.

The mixed cultures showed enhanced degradation when compared to monocultures, which indicates that the organisms present in mixed culture system must be in association with each other and dissociation was because of interaction with various organisms present therein.

One of the pollutants identified are 2,4D organic compounds and hence the degradation of these organic pollutants was carried out in the lab with organisms isolated and grown in the lab. The λ max for 2,4D were found and are presented in the figs. The standard graphs for 2,4D organic compound were plotted for concentrations in the r This project This research aims to study the microorganisms isolated from the soil that can helps in thee bioremediation of contaminated waters.

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QUALITY ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

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ABSTRACT

Sustainable development is maintaining a delicate balance between the human need to improve lifestyles and feeling of well-being on one hand, and preserving natural resources and ecosystems, on which we and future generations depend. The development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development implies economic growth together with the protection of environmental quality, each reinforcing the other. The essence of this form of development is a stable relationship between human activities and the natural world, which does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own. Many observers believe that participatory democracy, undominated by vested interests, is a prerequisite for achieving sustainable development. The concept of sustainable development has shifted to focus more on economic development, social development and environmental protection for future generations. The objective of this paper is to consider the role of quality environment in sustainable development from all dimensions and examine the process of social, economic and ecological development in order to get good standard of living in the world.

Key words: Quality environment, Sustainable development, **Environmental Education**, Responsibility of manufacturers, Technological progress, challenges.

INTRODUCTION



The population of industrialized countries exploits ten times more natural resources per capita than those living in developing countries. The economic and demographic growth of developing countries, entailing new consumptions, can only resort to natural resources. On the other hand, nowadays and in the years to come, our wealth standard requires unpolluted air, water and food, unspoilt landscapes, enticing sea waters and shores, towns wisely striking a balance between their huge historical heritage preservation needs and their ever changing operational and organizational requirements.

At the end of the second millennium, our civilization conceived sustainable development, designed to meet present needs while preserving the expectations and requirements of future generations, pursuing at the same time different aims such as quality of life, peace, an equitable wealth and a clean and healthy environment. This is not a brand new concept. In fact, many cultures have thoroughly accepted the need to strike a balance among different economic, social and environmental requirements. Today, this standpoint has been restated in industrialized and



developing countries eventually aware of the exhaustibility of global natural resources. However, sustainable development urges a changeover of growth patterns and socio-economic relations.

OBJECTIVES

The aim of sustainable development is to define viable schemes combining the economic, social, and environmental aspects of human activity. These three areas must therefore be taken into consideration by communities, companies, and individuals. The ultimate goal of sustainable development is to find a coherent and long-lasting balance between these three aspects. In addition to these three main factors, there is a transverse consideration, which is essential to the implementation of policies and actions with regard to sustainable development: good governance. Governance consists in the procedures of the decision-making process. In matters of sustainable development, the consensus of all the participants in society is required in order to define objectives and implement them: private and public sector companies, associations, NGOs, unions, and citizens.

1. Securing economic development, social equity and justice, and environmental protection is the goal of sustainable development.
2. The aim of sustainable development is to balance our economic, environmental and social needs, allowing prosperity for now and future generations.
3. Sustainable development encourages us to conserve and enhance our resource base, by gradually changing the ways in which we develop and use technologies.
4. The challenge of sustainable development is to put this understanding into practice, changing our unsustainable ways into more sustainable ones.
5. The UK Govt. has recognized four objectives for Sustainable Development. These include social progress and equality, environmental protection, conservation of natural resources and stable economic growth. Everybody has the right to a healthy, clean and safe environment.

MATERIALS AND METHODS

This is a theoretical research paper, where secondary information produced by different authors and researchers has been used. For obtaining necessary information, various books, journals as well as websites have been explored by the researcher which has been mentioned in the reference section.

QUALITY ENVIRONMENT



Environment plays an important role in the society. It is the duty of every citizen to protect the environment. Various kinds of toxic gases, waste production, and water contamination are some of the issues. The environment directly affects health status and plays a major role in quality of life, years of healthy life lived, and health disparities. Poor air quality is linked to premature death, cancer, and long-term damage to respiratory and cardiovascular systems. Secondhand smoke



containing toxic and cancer-causing chemicals contributes to heart disease and lung cancer in nonsmoking adults. Globally, nearly 25% of all deaths and the total disease burden can be attributed to environmental factors. Poor environmental quality has its greatest impact on people whose health status is already at risk. For example, nearly 1 in 10 children and 1 in 12 adults in the United States have asthma, which is caused, triggered, and exacerbated by environmental factors such as air pollution and secondhand smoke. **HEALTH IMPACT OF ENVIRONMENTAL QUALITY; Poor** air quality contributes to cancers, cardiovascular disease, asthma, and other illnesses. Poor water quality can lead to gastrointestinal illness and a range of other conditions, including neurological problems and cancer. Some chemicals in and around homes and workplaces can contribute to acute poisonings and other toxic effects. The built environment (such as schools, parks, greenways, and transportation systems) affects both individual health and environmental quality. For example, supporting bicycling as a primary mode of transportation increases physical activity and reduces pollution and accidents from motor vehicles.

CONCEPT OF SUSTAINABLE DEVELOPMENT

The concept of sustainable development is based on a set of requirements. It must allow the basic needs of present and future generations to be fulfilled with regard to demographic constraints, such as: access to water, education, health, employment, and the fight against hunger or malnutrition. Another aim of this type of development is to improve quality of life, which involves easier access to medical care, social services, culture, and therefore also social well-being. In addition, respect for rights and freedoms and the promotion of new forms of renewable energy such as wind, solar, and geothermal power, are important aspects of sustainable development. Sustainable development must allow the planet's resources and condition to be protected for future generations and natural assets to be shared. The concept of sustainable development also involves narrowing the gaps between rich and poor countries, insofar as these gaps, if maintained or accentuated, could be the cause of violent conflict, which by its very nature leads to regression rather than development.

SUSTAINABLE DEVELOPMENT



Sustainable development implies the fulfillment of several conditions; preserving the overall balance, respect for the environment, and preventing the exhaustion of natural resources. Reduced production of waste and the rationalization of production and energy consumption must also be implemented. Sustainable development is presented as a more or less clean break from other modes of development, which have led and are still leading to worrying social and ecological damage on both a worldwide and a local scale. In order to be sustainable, development must



combine three main elements: fairness, protection of the environment, and economic efficiency. A sustainable development project must be based on a better-developed mode of consultation between the community and the members it comprises. The success of such a policy also depends on consumers accepting certain constraints and citizens observing certain requirements with regard to transparency and participation.

RESULTS & DISCUSSION

ENVIRONMENTAL IMPACT: Like any human activity, the production and consumption of energy can affect the entire biosphere. It is clear that certain systems, sectors, and regions will be harder hit than others by these large-scale phenomena. Certain terrestrial ecosystems (mountain regions, boreal forests, etc.), marine ecosystems (coral reefs, etc.), and coastal ecosystems (mangroves, etc.) are the most endangered. The following areas are also concerned: certain dry regions at middle latitudes because of changes in rainfall, low-lying coastal regions and large deltas in Asia and Africa, small islands, and populations with little ability to adapt, whose sanitary conditions could deteriorate, etc.

It is therefore important to anticipate the exhaustion of reserves in order to prevent or limit the impact of this. In terms of sustainable development, energy efficiency is the first lever to reduce the consumption of natural resources. Technological progress must contribute to improving energy performance. The Legrand Group works towards this goal every day.

CHALLENGES: Sustainable development must mainly be able to respond to the various problems raised by demographic growth, the planet's limited capacity, and social inequality. In 2100, the world's population will be close to 10 billion, but the Earth does not have unlimited resources, especially since individual consumption has been increasing considerably because the less developed countries wish to catch up with the others. Greenhouse gas emissions are one of the main consequences of human activity that accelerate global warming. This warming carries risks of shortages and the disruption of certain natural cycles such as fresh water, impoverishment of agricultural soil, deforestation, and reduced biodiversity. This means that the future development of all species living on earth, ultimately including human beings, is under threat.

STRATEGY: As a general rule, any policy involving a strategy in favor of sustainable development must include the following guidelines, which have international scope and permanent validity;

1. Becoming more responsible with regard to the future and future generations: promoting the precautionary principle, the 'polluter pays' principle, and the general principle of responsibility.
2. Taking into account the three aspects already mentioned, in a balanced manner, which assumes that the 'environmental responsibility', 'economic capacity', and 'social solidarity' areas must be handled equally.
3. Incorporating sustainable development in all areas of politics. All activities and all processes in the city must be concerned.
4. Increasing the co-ordination between political areas and improving consistency. Thus, any wide-ranging political decision must be preceded by an early evaluation of its social, economic and ecological consequences. This approach requires transparent decision procedures and the involvement of all participants concerned, as well as the prior determination of conflicts of interest.
5. Achieving the sustainable development objectives through partnership. All institutional levels must work together constructively and fully assume their role as an interface with civil society and the private sector.



ENVIRONMENTAL EDUCATION: Environmental education is concerned with those aspects of human behaviour which are more directly related to man's interaction with bio-physical environment and his ability to understand this interaction. One of the most glaring problems which the world faces today is the environmental pollution. Man has exploited nature excessively at the cost of the environment. There is an immediate need to make people aware about environmental degradation. Education and public participation may change and improve the quality of environment. According to UNESCO, "Environmental education is a way of implementing the goals of environmental protection. It is not a separate branch of science but lifelong interdisciplinary field of study." It means education towards protection and enhancement of the environment and education as an instrument of development for improving the quality of life of human communities.

The necessary steps for environmental education are; (a) Awareness (b) Knowledge (c) Attitude building for motivating to protect environment (d) Evaluation of environmental measures and (e) Skill and capacity building.

According to D.H. Meadows', environmental educators on every continent develop materials and methods as varied as the different cultures and ecosystems on earth. He lists some key concepts which underlie all environmental education. These are food for thought, levels of being, complex systems, population growth and carrying capacity, ecologically sustainable development, socially sustainable development, knowledge, uncertainty and sacredness.

SUSTAINABLE DEVELOPMENT – THE RESPONSIBILITIES: Sustainable development covers three dimensions: economic, social, and environmental. Social responsibility is the contribution made by organizations to sustainable development. It is reflected in the company's will to take responsibility for the impact of its decisions and activities on society and on the environment, and to answer for this impact. On 1st November 2010, the first international standard concerning social responsibility, ISO 26000, was published. Its aim is to give guidelines to organizations, taking into account the existing references for general operation, management systems, and reporting. Social responsibility concerns the principles of sustainable development applied to the sphere of an organization and its stakeholders.

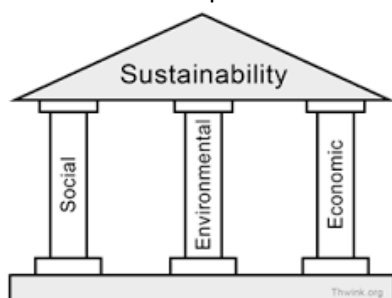
The organization may be a large company, and SME, an administration, an association, or an NGO. Its stakeholders are all individuals or groups with an interest in its decisions or activities: personnel, unions, occupational physicians, shareholders, customers, subcontractors, suppliers, technological or financial partners, as well as representatives of the State, local authorities, neighbors, associations, media, etc. The scope is vast, and it must be delineated with a careful assessment of priorities. Embarking on a social responsibility initiative means first identifying the stakeholders, initiating a dialogue with them to find out about their expectations, and evaluating the impact of the organization on these expectations.

THE RESPONSIBILITY OF MANUFACTURERS:

The environmental responsibility of manufacturers is to continue to develop innovative solutions that favor sustainable development. The Group holds the ongoing quest for more energy-efficient buildings as one of its primary concerns. From this standpoint of respect for the environment and sustainable development, the Legrand Group has defined priority actions to be carried out in its activities. These priorities constitute the charter of its intangible commitment; a). Incorporating the environmental approach on all Group sites by implementing environmental



management on ISO 14001-certified manufacturing sites, continually improving performance, and reducing the environmental impact of sites.



b). Taking the environmental aspect into account right from the design phase of products, systems, and solutions, by incorporating the eco-design concept, for all design and development projects, in order to reduce and quantify the environmental impact of products over their entire life cycle. c). fully informing customers to help them choose the best solutions, through clear and transparent information on the environmental impact of products, systems and solutions. d). Offering customers solutions to improve the energy efficiency of buildings via energy-saving products for residential, commercial, or industrial premises.

CONCLUSION

On the basis of above concepts and issues we can analyse that the field of sustainable development, there are many major challenges to be addressed. They require us to re-think our economy and our growth in favor of a society that is more economical in its use of raw materials and energy. Some of these challenges include: climate change, energy consumption, waste production, threats to public health, poverty, social exclusion, management of natural resources, loss of biodiversity, and land use. In this context, sustainable development approaches are now essential obligation.

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ENVIRONMENT AND ECONOMIC DEVELOPMENT" OF SOCIETY

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ABSTRACT

The word *Environment* is derived from the French word *environner* which means *to surround or to encircle*. Everything which surrounds us may collectively be termed as the environment. We are surrounded by both living and non-living things. The living things are cooed as *biotic* part and the non-living things as *abiotic* part of the environment. The *abiotic* part is also called as *physical environment* and the biotic part as *biological environment*. In fact, there are several environments. The biotic (living) and the abiotic (non-living) structures of the environment live together depending on each other and influencing each other. These two structures have a two-way linkage. The matter and energy flow form one structure to another and within each structure. Since matter and energy neither be created nor destroyed, these two structures have a close, dynamic, inseparable and organic interrelationship. If one component changes, the other responds. Man lives in these biotic and abiotic structures of the nucleus.

The seminar paper concentrates on the components of environment, inter-relationship between environment and economic development of the society. Basic models adopted for maintaining the sustainability for the environmental development in the society and also stress the need for contribution of Government authorities, Local authorities, Voluntary associations, Educational institutions, Corporate Social Responsibility (CSR) of the industries at the present changing scenario.

Keywords: Environment, Economic Development and Society.

Introduction

In fact, there are several environments. The *abiotic structure* of the environment consists of water and other liquids, gases, particles and solids, rocks hills, mountains, deserts, grasslands, land, energy etc. The *biotic structure* of environment consists of flora (plants) and fauna (animals). Biologically all living creatures are classified as animals. The biotic (living) and the abiotic (non-living) structures of the environment live together depending on each other and influencing each other. These two structures have a two-way linkage. The matter and energy flow form one structure to another and within each structure. Since matter and energy neither be created nor destroyed, these two structures have a close, dynamic, inseparable and organic interrelationship. If one component changes, the other responds. Man lives in these biotic and abiotic structures of the nucleus.

Objectives

- (A) To create awareness about the of the "Environment "
- (B) To explain the inter relationship between Environment and Economic development of the society.
- (C) To analyses the sustainable Development of society



Components of Environment: Environment has six important components. They are:

Physical Component: Like land, water, air, mountains, forests, rivers.

Biological Component: Like flora and fauna.

Social Component: Like populations, customs, human relations, urbanization

Cultural Components: Like moral, economic, political, religions and industrial aspects

Energy Components: Like solar energy, wind energy, geothermal energy, electromagnetic energy etc.

Psychological Component: Like knowledge and wisdom, maturity of mind, philosophical and spiritual outlook towards life etc.,

As the environment consists of all these different components, it is considered to be a completely inter disciplinary discipline. We need the knowledge of physics, botany, zoology, geology, geography, agriculture, chemistry, economics, education, demography, ecology, sociology, philosophy, political science, biotechnology, biochemistry, and genetics to understand what an environment is. The global environment consists of the atmosphere, the hydrosphere, the lithosphere and the biosphere.

Functions of Environment: They are

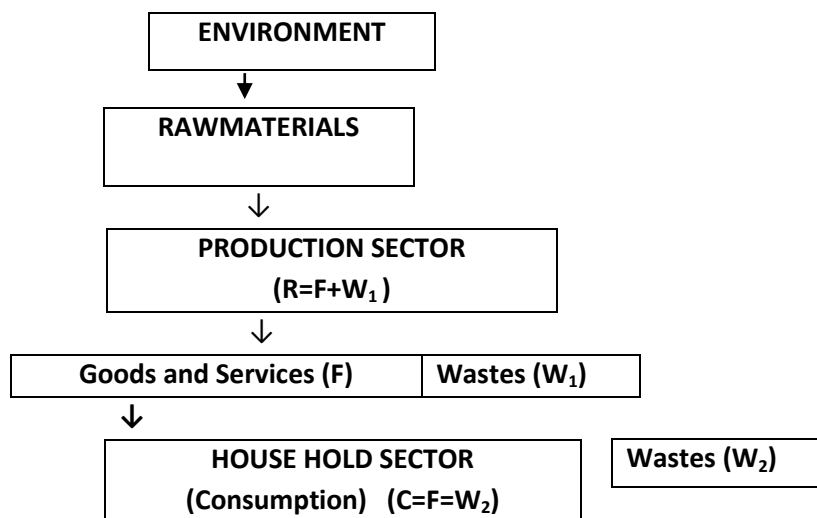
1. The environment supplies both renewable and non-renewable resources.
2. The environment absorbs solid, liquid, gaseous wastes. It acts as a sink.
3. The environment provides life-support services by maintaining ecological balance and genetic diversity. The life-support services help to convert the unused materials and energy into useful materials and energy.
4. The environment provides natural services such as aesthetic enjoyment and recreation.
5. All these function of environment are interdependent and complementary in nature. Each influences the other function. If one function fails to perform, the other function becomes inactive and ineffective. These functions decide the operation of the economy. Social development of human beings depends upon the development of the environment. Economy and society perpetuates with the active and healthy functioning of the environment.

RELATIONSHIP BETWEEN ENVIRONMENT AND ECONOMIC DEVELOPMENT: It acts as the supplier of materials to the economy and absorbs the wastes discharged by the economy. However, in modern days, the reckless and exploitative behaviour of the economics activity is setting a limit to the efficiency of environment to supply the resources. The capacity of the environment to absorb the wastes is also declining. In 1966, Kenneth. E. Boulding, the British Economist warned the world about the consequences of overuse of environmental resources. He said that earth is a spaceship with a limited amount of life support resources. In other words, there should be a balance between inputs and outputs. When we receive the inputs to produce goods and services, it must be equal to the consumption and the discharge of wastes. The quality of wastes and emissions must be less, so that the environment can absorb them. Material Balance Model provides an excellent answer for the relationship that must exist between environment and the economy.

Material Balance Model: Material Balance Model assumes that economy is made up of the production sector and the household (consumption) sector. The production sector uses the factors of production and produces goods and services. The household sector on the other hand consumes the goods and services produced by the production sector. This sector is made up of the consumers



in the economy. Assuming this two sector model, material balance can be explained by the following diagram.



Material Balance Model

The Reveals that production sector uses R (Raw materials) units of raw materials from the environment to produce F units of final products. While producing the final products, it also produces W_1 amount of wastes. So in the production sector

$$R = F + W_1$$

The household sector consumes all the ' F ' units of produced goods and services. While doing so, it also produces W_2 units of wastes.

Hence, in the economy $R = F + W_2$

Therefore $R = (W_1 + W_2)$

Above equation show that the entire mass of inputs (raw materials) equals the entire mass of output (wastes). This entire amount of wastes is returned to the environment. Thus, the materials taken from the environment are again returned to the environment in equal amounts. Hence, $R = (W_1 + W_2)$. This equality shows the accounting identity of the material balance.

It can be concluded that this material balance model depends upon the first two laws of thermodynamics. The first law explains that the energy can be changed from one form to another. But it can neither be created nor destroyed. The second law is the law of entropy. Economic activities of production and consumption are dependent on these two laws. Similarly generation and assimilation of wastes are also dependent on these two laws.

NEED FOR THE PROTECTION OF ENVIRONMENT OF THE SOCIETY:

Environment is a common property. It belongs to the total living organisms of the world. Everyone humans, animals, plants, trees, birds and fish is using, enjoying and experiencing the products of the environment. Particularly the human beings, out of their greed, are overusing this public resource. As a result, it is becoming weak and even unable to discharge its natural functions. A galaxy of economists, starting from J.S.Mill, has cautioned the mankind to use environment and its components in a judicious way. Neglecting all these cautions, man is continuing the exploitation of his environment. Before 1960's, it was believed that economic growth, measured in terms of quantity of goods and services consumed was an index of human welfare. This argument was proved wrong in 1960's. The Silent Spring (Rachel Carson, 1962), The Costs of Economic Growth (Mishan,



1967), Limits to Growth (Meadows,1973) have cautioned about the consequences of environmental degradation.

Now the world has recognized the fact that effluents reduce affluence. It has also identified that the three factors are influencing and deteriorating the quality of environment. They are Population Per capita production (consumption) Pollution per unit of economic goods.

These three factors are the sources of the formation of vicious circle of environment. The gross effect of this vicious circle is global warming, changing climatic conditions and concentration of greenhouse gases. In brief, the house of the man-the earth is converted into the pandemonium of pollutions. Agricultural productivity has declined. Soil fertility is reduced. Per capita availability of clean water and air is declining. Food security is reduced. Human development is affected. Bio-diversity is disturbed. Ozone layer is deteriorating. Polar ice caps are melting down. Rainfall is becoming deficient. Aquatic life is deteriorating. The forests are slowly disappearing. The natural colours of the crops, plants, flowers and birds are changing. In sum, people synonymous of pollution are holding right today. Governments, research institutions, international summits, meetings and conferences, enactment of legislations, fiscal instruments-all are putting their efforts to conserve the quality of our environment. However, in spite of all these efforts, the environment has been suffering from a variety of pollutions. Man is the cause and effect for this state of affairs.

SUSTAINABILITY OF ENVIRONMENT

The countries, today, are progressing towards development, which includes both economic and non-economic influencing factors. Among non-economic factors that determine the human well-being, environment and its quality are given vital importance. It is recognized that the well-being of humans as well as the ecosystems are equally important and they are interdependent. The human beings have realized that a balance between the use of resources and their regeneration sustains the process of development. Being recognized this fact the concept of sustainability came into existence. Sustainable development of the environment, economy and the society is the mantra of today's development strategy.

The idea behind this attempt is that we have to use resources over the long run. The present use of resources should not decrease the ability of the resource base to support the future generations. However, it does not mean that the resources should remain untouched. We have to choose a rate of use that sustains the resource for the future also. Sustainability means non-declining utility. Similarly it also means a non-declining per capita human well-being over time. Sustainability can also be defined "as achievement of constant real consumption through time, keeping the capital intact. A flow of consumption without reducing the capital is also called as Sustainability". In 1992, the Earth Summit defined sustainable development as "meeting the needs of the present without compromising the ability of the future generations to meet their own needs". These definitions explain that the society, ecosystem and economy must be made functioning with key resources.

Components of Sustainability

There are three basic components of sustainable development. They are economic, social and environmental components. These three components are interdependent. A balance is to be achieved among these three components for achieving the sustainable development. This balance is shown in Fig.

Balance Among the Three Components



These three aspects of sustainable development indicate that:

1. The next generation should inherit both man-made and environmental assets.
2. The stock of environmental assets to be inherited by the next generation should not be less than the assets inherited by the present generation.
3. The inherited stock must consist man-made, natural and human assets.

Generally different assets complement each other, in the improvement of human well-being. Thus, social, economic and environmental assets together must be employed in such a way that well-being sustains in future also. This is the philosophy behind the concept of Sustainable Development.

Sustainable development reminds us that:

1. Do not deplete or degrade Earth's physical, chemical and biological capital.
2. We remember that we belong to this earth and the earth is not for us only but for all living organisms. We must respect the Earth and cooperate with it by respecting all forms of life and also all non-living things.
3. use our environment in such a way that does not pass any negative effects to other species.
4. recognize that every species has the equal right to live as we have.
5. No species should become extinct because of our activities.
6. Do little things based on think globally and act locally.
7. Work with others to help, sustain and heal the earth.
8. Enjoy the nature, beauty, friendship and love

Conclusion

To ensure sustainable development, economic activities must consider their environmental impacts. Then only the activities would be more consistent with long term growth and development. Environmental education must be given due importance. The United Nation has declared the decade 2005-2015 as a decade of education for sustainable development. Thus, people especially the students must be taught the art of living associated with environmental sustainability. They must be imparted with practical skills needed to help, solve the local environmental issues. The students must become Environmental Hero and preserve and maintain the quality of environment in which they are living and have to live.

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ENVIRONMENTAL LAWS AND POLICIES GLOBALLY TO PROTECT ENVIRONMENT

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ABSTRACT

Environmental Law term describing the network of treaties, statutes, regulations, and common and customary laws addressing the effects of human activity on the natural environment. Environmental impact assessment (EA) is the term used for the assessment of the environmental consequences (positive and native) of a plan, policy, program, or concrete projects prior to the decision to move forward with the proposed action.

Global and regional environmental issues are increasingly the subject of international law. International environmental agreements are generally multilateral treaties. The bodies that proposed, argued, agreed upon and ultimately adopted existing international agreements including 1972's United National Conference on the Human Environment, 1983's World Commission on Environment and Development, 1992's United Nations Conference on Environment and Development and 2002's World Summit on Sustainable Development have been particularly important. International environmental laws also include the opinions of international courts and tribunals.

In India, Environmental law is governed by the Environment Protection Act, 1986. This act is enforced by the Central Pollution Control Board and the numerous State Pollution Control Boards. There are also individual legislations specifically enacted for the protection of Water, Air, Wildlife, etc. Such legislation included: -

- The Water (Prevention and Control of Pollution) Act, 1974
- The Water (Prevention and Control of Pollution) Cess Act, 1977
- The Forest (Conservation) Act, 1980
- The Air (Prevention and Control of Pollution) Act, 1981
- Air (Prevention and Control of Pollution) (Union Territories) Rules, 1983
- The Biological Diversity Act, 2002 and Wild Life Protection Act, 1972
- Batteries (Management and Handling) Rules, 2001

KEY WORDS: Environment, Pollution, Biological Diversity acts, Environmental Laws

INTRODUCTION

Environmental Law term describing the network of treaties, statutes, regulations, and common and customary laws addressing the effects of human activity on the natural environment. Environmental impact assessment (EA) is the term used for the assessment of the environmental consequences (positive and native) of a plan, policy, program, or concrete projects prior to the decision to move forward with the proposed action.

Air quality laws govern the emission of air pollutants into the atmosphere. Air quality laws are often designed specifically to protect human health by limiting or eliminating airborne pollutant concentrations. Regulatory efforts Chemical safety laws govern the use of chemicals in human activities, particularly man-made chemicals in modern industrial applications. Water resources laws



govern the ownership and use of water resources, including surface water and ground water. Regulatory areas may include water conservation, use restrictions, and ownership regimes.

Forestry laws govern activities in designed forest lands, most commonly with respect to forest management and timber harvesting. Governmental agencies are generally responsible for planning and implementing forestry laws on public forest lands and may be involved in forest inventory, planning and conservation, and oversight of timber sales.

Wildlife laws govern the potential impact of human activity on wild animals, whether directly on individuals or populations, or indirectly via habitat degradation. Fish and game laws regulate the right to pursue and take or kill certain kinds of fish and wild animal.

Environmental law has developed in response to emerging awareness of and concern over issues impacting the entire world. Defined by the United Nations Environment Programme as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" sustainable development may be considered together with the concepts of "integration" and interdependence". Defined by UNEP to include intergenerational equity – "the right of future generations to enjoy a fair level of the common patrimony". Pollution control and resource management laws may be assessed against this principal.

International Laws

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According to the International Networks for Environmental Compliance and Enforcement (INECE), the major environmental issues in Africa are "drought and flooding air pollution, deforestation, loss of biodiversity, freshwater availability, degradation of soil and vegetation, and widespread poverty. The U.S. Environmental Protection Agency (EPA) is focused on the "growing urban and industrial pollution, water quality, electronic waste and indoor air from cookstoves"

The Asian Environmental Compliance and Enforcement Network (AECEN) is an agreement between 16 Asian countries dedicated to improving cooperation with environmental laws in Asia. The countries are Cambodia, China, Indonesia, India, Maldives, Japan, Korea, Malaysia, Nepal, Philippines, Pakistan, Singapore, Sri Lanka, Thailand, Vietnam, and Lao PDR.

According to EU legislation is ruled in Article 249. EU Legislation says Climate change, Air pollution, Water protection and management, Waste management, Soil protection, Protection of nature, species and biodiversity, Noise pollution, Cooperation for the environment with third countries (other than EU member states), Civil protection.

The Brazilian government created the Ministry of Environment in 1992. The Ministry of Environment give polices are environment, water resource, preservation, and environmental programs involving the Amazon. The Environmental Protection Act of Canada focuses on "respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development.



In India, Environmental law is governed by the Environment Protection Act, 1986. This act is enforced by the Central Pollution Control Board and the numerous State Pollution Control Boards. There are also individual legislations specifically enacted for the protection of Water, Air, Wildlife, etc. Such legislation included: -

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ENVIRONMENTAL LAWS AND CONSTITUTIONAL PROVISIONS IN INDIA

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ABSTRACT

It is interesting to note that natural resources had been stored virtually untouched in the earth for millions of years. But since the start of industrial revolution, vast amounts of these resources had been exploited within a period of just a couple of hundreds of years at unimaginable rates, with all the waste from its exploitation going straight into the environment (land, water, air) and seriously damaging its natural resources. Environmental degradation in India has been caused by a variety of socio, economic, institutional, and technical factors. Rapid growth in population, urbanization and industrial activities have all resulted in considerable deterioration in the quality and sustainability of the environment. Environmental ethics have also formed an inherent part of Indian religious perceptions and philosophy.

The importance of judiciary in a democratic set up for protection of life and personal rights can hardly be overestimated. India has a highly developed judicial system with the Supreme Court having plenary power to make any order for doing complete justice in any cause or matter and a mandate in the constitution to all authorities, civil and judicial in the territory of India to act in aid of the Supreme Court. The scope of writ jurisdiction of the High Court is wider than traditionally understood and the judiciary is separate and independent of the executive to ensure impartiality in administration of justice. In considering the role of judiciary in environmental governance, there are two issues that need to be considered. The first is the role of the judiciary in the interpretation of environmental law, and in law making and the second is the capability of jurists to effectively interpret the increasingly cross-linked issues brought to their attention.

Keywords: Proportions, Urbanization, Writ, Jurisdiction, Jurists.

INTRODUCTION

The Environmental Protection Act defines environment as "environment includes water, air, and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, microorganisms and property. Besides the physical and biological aspect, the "environment" embraces the social, economic, cultural, religious and several other aspects as well. The environment, thus, is an amalgamation of various factors surrounding an organism that interact not only with the organism but also among themselves. It means the aggregation of all the external conditions and influences affecting life and development of organs of human beings, animals and plants.

Explanation: Article 246 of the constitution divides the subject areas of legislation between the Union and States. The Union list includes defence, foreign affairs, atomic energy, interstate transportation, shipping, air traffic, oil fields, mines and interstate rivers. The State list includes public health and sanitation, agriculture, water supplies, irrigation and drainage, fisheries. The Concurrent List (under which both state and union can legislate) includes forests, protection of wildlife, mines and minerals and development not covered in the Union list, population control and factories. From an environmental standpoint, the allocation of legislative authority is an important



one –some environmental problems such as sanitation and waste disposal ,are best tackled at the local level;others,like water pollution and wildlife protection ,are better regulated uniform national laws.

Article 14 and Article 19 (1) (g) ART. 14 states: "The states shall not deny to any person equality before the law or the equal protection of the laws within the territory of India." The right to equality may also be infringed by government decisions that have an impact on the environment. An arbitrary action must necessary involve a negation of equality, thus urban environment groups often resort to Art.14 to quash arbitrary municipal permission for construction that are contrary to development regulations.

Article 21 (Right to Wholesome Environment) "No person shall be deprived of his life or personal liberty except according procedure established by law "

In *Maneka Gandhi v Union of India*, the Supreme Court while elucidating on the importance of the 'right to life under -: Art 21 held that the right to life is not confined to mere animal existence, but extends to the right to live with the basic human dignity (Bhagwati J.) Similarly while interpreting ArL21 in *Ganga Pollution Case* as discussed before,Justice Singh justified the closure of polluting tanneries observed: "we are conscious that closure of tanneries may bring unemployment, loss of revenue but life. Health and ecology have greater importance to the people."

Environmental Laws in India

THE WATER (PREVENTION AND CONTROL OF POLLUTION) ACT 1974 The Act prohibits discharge of pollutants into water bodies beyond a given standard and lays down penalties for non compliance with its provisions. It set up the Central Pollution Control Board (CPCB) which lays down standard for the prevention and control of water pollution. At the state level, the State Pollution Control Board (SPCB) functions under the direction of CPCB.

The functions of CPCB have been laid down in section 16 whereas the functions of SPCB has been laid down in section 17

The sampling of effluents for test has been laid down in section 21. In *Delhi Bottling Co Pvt. Ltd V. CPCB*, AIR 1986 Del 152, it was found that the representatives of board got the samples analysed from a non-recognized laboratory by the state. The court held that since section 21 was not complied upon, the test results were inadmissible as evidence. The Air (Prevention And Control Of Pollution Act. 1981)

To implement the decision taken in the Stockholm Conference, the Parliament enacted the Air Act under Article 253 It controls mainly air pollution and its abatement. Also establishes air quality standards. The Central and state Boards set up under section 16 and 17 Independently notify emission standards. Every industrial operator within a declared air pollution area, must obtain a permit from the State Board (Sec-21(1) 7.irit (2)). Within four months from the date of application for the permit, the board must complete the formalities - either grant or refuse co Writs And PILs For Safeguarding The Environment

A writ petition can be filed to the Supreme Court under Art.32 and the High Court under Art.226. in the case of (-1 violation of a fundamental right. Since the right to a wholesome environment has been recognised as an implied fundamental rights, the writ petitions are often restorted to in environment cases. Generally, the writs of Mandamus, Certiorari and Prohibition are used in environmental matters. For instance, a Mandamus (a writ to command actionby, a public authority when an authority vested with power and wrongfully refuses to exercise it would lie



against a municipality that fails to construct sewers and drains, clean street and clear garbage (Rampal v., State of Rajasthan) likewise, a state pollution control board may be compelled to take action against an industry discharging pollutants, beyond the permissible level.

The writs of certiorari and prohibition are issued when an authority acts in excess of jurisdiction, acts in violation of the rules of natural justice, acts under a law which is unconstitutional, commits an error apparent on the face of the record, etc. For instance, a writ of certiorari will lie against a municipal authority that considers a builder's applications and permits construction contrary to development rules e.g. wrongfully sanctions an office building in an area reserved for a garden. Similarly, against water pollution control board that wrongly permits an industry to discharge effluents beyond prescribed levels.

A writ of Certiorari will lie against a municipal authority that permits construction contrary to development rules act in excess of Jurisdiction or in violation of rules of natural justice for instance wrongly sanctioning an office building in an area reserved for garden.

When a fundamental right, which includes right to wholesome environment is violated Art 32 and 226 appropriate remedy.

In E. Sampath Kumar v. Government of Tamil Nadu , 1998, AIR 4498

Taj Mahal Case: In Taj Mahal's case (M C Mehta V. Union of India, AIR 1997. SC 734), the Supreme Court issued directions that coal and coke based industries in Taj Trapezium (TTZ) which were damaging Taj should either change over to natural Gas or to be relocated outside TTZ. Again the Supreme Court directed to protect the plants planted around Taj by the Forest Department as under.

The Divisional Forest Officer. Agra is directed to take immediate steps for seeing that water is supplied to the plants. The Union Government is directed to release the funds immediately without waiting for receipt of the proposal from U.P. Government on the basis of the copy of the report. Funding may be subsequently settled with the U.P. Government. but in any set of circumstances for want of funds the officer is directed to see that plants do not wither away.

The Court held that 292 industries located and operating in Agra must changeover within fixed time schedule to natural gas as industrial fuel or stop functioning with coke /coal and get relocated. The industries not applying for gas or relocated are to stop functioning with coke/coal from 30-04-97. The Shifting industries shall be given incentives in terms of the provisions of Agra Master Plan and also the incentive normally extended to the new industrial units. The integration of the international principles of environmental law into the Indian legal framework is an important consequence of the emergence of Public Interest Litigation in the realm of environmental law. (Razzaques 2004 fact, the application and re-interpretation of international legal principles in the Indian context reflect a greater concern with making hazardous industrial enterprises responsible towards environmental concerns. In M. C Mehta v Union of India the Supreme Court extends the principle of strict liability drawing from the Rylands v Fletcher's case in English, law to formulate a principle of absolute liability whereby an enterprise carrying out a hazardous activity is "absolutely liable" to compensate for any harm arising from such activity. The principle of strict liability In English common law states that "a person will be strict liable when he brings or accumulates on his land something likely to cause harm if escapes, and damage arises as a natural consequence of its escape." (Razzaque, 2004: 210) However, in formulating a principle of absolute liability, the Court



contends that such liability is not subject to any of the exceptions' under the rule in Rylands v Fletcher."

The Bhopal Gas Leak Case

The Bhopal disaster raised complex legal questions about the liability of parent companies for the acts of their subsidiaries, the responsibilities of multinational corporations engaged in hazardous activities, the transfer of hazardous technologies and the applicable principles of liability. Bhopal was inspirational factor for the judicial innovation in the area of evolving principles of corporate liability for use of hazardous technology.

On December 3, 1984, highly toxic methyl isocyanides (MIC), which had been manufactured and stored in Union Carbide's chemical plant in Bhopal, escaped into the atmosphere and killed over 3,500 people and seriously injured about 2 lakh people.

The Bhopal gas leak disaster (Processing of Claims) Act, 1985 was passed by parliament to ensure that the claims arising out of the Bhopal disaster were dealt with speedily, effectively, equitably and to the best advantage of claimants.

High Court Judgment: Justice Seth used English Rules of procedure to create an entitlement to interim compensation (i.e. it is permissible for courts to grant relief of interim payment under the substantive law of torts). Under the English rules, interim granted in personal injury cases if a prima facie case is made out. He said that 'more than prima facie case have been made out' against the Carbide.

He observed that the principle of absolute liability without exceptions laid down in M.G. Mehta case applied more vigorously to the Bhopal suit. He holds that Carbide is financially a viable corporation with 6.5 billion unencumbered assets and \$200 millions encumbered assets plus an insurance which could cover up to \$250 millions worth of damages. Given Carbide's resources, it is eminently just that it meet a part of its liability by interim compensation (Rs.250 cr.)

In Union Carbide Corporation v Union of India (AIR 1990 SC 273), the Supreme Court secured a compromise between the UCC and Government of India. Under the settlement, UCC agreed to pay US 470 million in full and final settlement of all past, present and future claims arising from the Bhopal disaster. In addition to facilitate the settlement the Supreme Court exercised its extraordinary jurisdiction and terminated all the civil, criminal and contempt of court proceedings that had arisen out of the Bhopal disaster. It was declared by the court that if the settlement fund is exhausted, the Union of India should make good the deficiency.

Review petition under Art. 137 and writ petitions under Art. 32 of the Constitution of India were filed questioning the constitutionality and under the Bhopal Act (providing for the registration and processing of claims) and the resultant categorization of the victims was also upheld. It was laid down that there is no need to tie down the tortfeasor to future liability [UCC v UOI AIR 1992 SC 2481]. In UCC v UOI (AIR 1992 SC 248), the Supreme Court reinstated criminal charges for homicide not amounting to murder (Sec 304, Part II, IPC) against top executives at Union Carbide (viz. nine UCIL employees and three foreign were accused including Warren Anderson, the CEO) while uploading the rest of the settlement. The CBI in December 1993 finally prepared the documents necessary to extradite Warren Anderson.

Conclusion

The powers vested to the Pollution Control Boards are not enough to prevent pollution. The Boards do not have power to punish the violators but can launch prosecution against them in the



Courts which ultimately defeat the purpose and object of the Environmental Laws due to long delays in deciding the cases. Thus, it is imperatively necessary to give more powers to the Boards.

What we need is social awareness from below, not laws from the above. No law works out smoothly unless the interaction is voluntary. In order to educate people about the environmental issues, there should be exhibition of slides in the regional languages at cinema houses and televisions at free of cost. Further, as directed by the Supreme Court of India in M C Mehta Case (M C Mehta V Union of India 1992, SC 382) school and college levels in graded system so that there should be general growth of awareness.

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ANALYSIS OF PERSISTENT PESTICIDES IN THE KRISHNA RIVER CANAL NETWORK IN PENAMALURU MANDAL OF VIJAYAWADA

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Abstract

Agricultural development continues to remain the most important objective of Indian planning. In the process of development of agriculture, pesticides have become an important tool as plant protection agents for boosting food production. Contamination of water bodies by these toxic chemicals has become commonly recognized as an environmental concern in the world. With this view an attempt was made to assess the quality of Krishna river canal network in Penamaluru Mandal rural areas of Vijayawada, to check the suitability of water for human consumption. Reports of water samples have indicated the presence of Aldrin, Alpha HCH, Beta HCH, Delta HCH, Atrazine and DDT pesticides. Almost all the pre-monsoon water samples analyzed exceeded the BIS permissible limits.

Keywords: Aldrin, Alpha HCH, Beta HCH, Delta HCH, Atrazine, DDT.

Introduction

Pure drinking water is a luxury in India. Water quality is important in our lives because it is essential to support physiological activities of any biological cell. Most water sources are contaminated. Water borne diseases such as diarrhea, dysentery, typhoid, jaundice, and gastroenteritis are legion in our country. Even the municipal water supply is not free of contaminants like pesticides and heavy metals. According to a report published in 1990 from the Environment Protection Agency (EPA) more than 50% of the water pollution of streams and rivers occur due to leaching and mixing of chemicals from the agricultural practices. Not only the farmers in rural areas but also the people in urban areas use more than half of pesticides in their homes and home gardens in and around the schools, business areas and hospitals.

Pesticides belong to a group of chemicals used to control pests, weeds and diseases in agriculture and also for growth regulations. The positive aspect of application of pesticides render enhanced crop productivity and drastically reduces the vector-borne diseases. However their vigorous uses have raised serious problems in entire environment. Despite ban on applications of some of the environmentally persistent pesticides in many parts of the world, their use is ever on rise. Even at the low concentrations several pesticides are persistent, bio-accumulated, bio-concentrated and mobile in environment. Cook *et al.* had mentioned that pesticides enter to surface waters through drainage, surface run-off, microbial activity etc. since exposure to pesticides through drinking water has potential health effects. All pesticides are subject to degradation or metabolism once released into the environment. A study was undertaken to assess the quality of Krishna river canal network waters in terms of pesticide levels.

Study area

Vijayawada the third largest city in Krishna district of Andhra Pradesh is chosen as the study area. Vijayawada and its rural areas are situated on the bank of the river Krishna along NH5.



Agriculture is the main occupation and 60 percent of population is engaged in agriculture and allied activities. Rice, maize, pulses, minor millets, sugarcane and vegetables are abundantly grown in this zone. Krishna river water is being used for domestic purposes including drinking water supply for several villages, major panchayats and towns, for irrigation in the delta, for fisheries, industry and religious purposes.

Materials and Methods

Water samples were collected from Bandar canal of Krishna river canal network areas of Penamaluru Mandal. The water samples were collected in a clean polythene bottles. Sample bottles were pre-treated with dilute nitric acid, dried and rinsed with sample water and subjected for analysis. Pre-monsoon and Post-monsoon test reports were compared to standards for BIS permissible limits.

Results and Discussion

All the water samples collected showed the presence of Aldrin, Alpha HCH, Beta HCH, Delta HCH, Atrazine and DDT pesticides. These organochlorine pesticides are most widely used in the Penamaluru Mandal. The observations are presented in Table 1 and 2 below.

Aldrin is a highly effective insecticide and widely used as an alternative to DDT. It is a persistent pollutant that bio-magnify as it is passed along the food chain. Aldrin was detected in all the water samples with maximum concentrations 0.042 µg/l during pre-monsoon and 0.024 µg/l during post-monsoon. Health effects majorly cause breast cancer, immune, reproductive and nervous system damage.

The use of HCH in agriculture on large scale has been mainly because of certain peculiar properties like fumigant action and non-phytotoxic nature. HCH has been recommended in agriculture for controlling wide varieties of pests of paddy, maize, cotton, sugarcane, grams and various plantation crops (ICAR 1961, 1981, 1970). Alpha HCH, Beta HCH and Delta HCH was detected with maximum concentrations 0.06 µg/l, 0.046 µg/l, and 0.041 µg/l during pre-monsoon and 0.03 µg/l, 0.023 µg/l, and 0.024 µg/l during post monsoon. Isomers of HCH are possible human carcinogens.

DDT is a widely used insecticide. It is a highly bio-magnifiable carcinogen. DDT was detected with maximum concentrations 1.32 µg/l during pre-monsoon and 0.69 µg/l during post monsoon.

Atrazine is a best weed controller in corn and sugarcane. A high concentration leads to reproductive effects in human beings. The maximum concentrations 2.32 µg/l during pre-monsoons and 0.021 µg/l during post-monsoon were detected.

Conclusion

Krishna river canal network waters are widely used for drinking, irrigation, industries and fisheries etc. Degradation of water quality by pesticides runoff has two principal human health impacts. The first is the consumption of fish and shellfish that are contaminated by pesticides. The second is the direct consumption of pesticide contaminated water. Most of the municipalities won't concentrate on the pesticide treatments during water supply. There is limited information available on pesticide contamination, and a lack of reliable and comparable data. Monitoring of pesticides is a challenging task because of the high number of registered pesticides, cost of analysis, and the need for sampling to be performed during periods of application and use, and under various weather conditions. Extensive data sets of high quality are consequently often missing.

In the present study the concentration of selected pesticides slightly exceeded the BIS permissible limits during pre-monsoon period. The untreated municipal water is the canal water



during pre-monsoon period. The sources for these chemicals have to be identified and regulated. Their concentration may reach alarming levels due to leaching and bioaccumulation. Overall the usage of pesticides is to be regulated.

Table 1: Pesticide concentrations ($\mu\text{g/l}$) in pre monsoon water samples

Pesticide	Chowdavaram	Pedapulipaka	Gosala	Ganguru	Vanukurru	IS limits
Aldrin	0.039	0.041	0.042	0.036	0.04	0.03
Alpha HCH	0.03	0.06	0.05	0.051	0.041	0.01
Beta HCH	0.045	0.046	0.042	0.043	0.041	0.04
Delta HCH	0.041	0.041	0.04	0.041	0.04	0.041
DDT	1.31	1.19	1.23	1.32	1.29	1
Atrazine	2.11	2.32	2.32	2.16	2.3	2

Table 2: Pesticide concentrations ($\mu\text{g/l}$) in post monsoon water samples

Pesticide	Chowdavaram	Pedapulipaka	Gosala	Ganguru	Vanukurru	IS limits
Aldrin	0.021	0.021	0.014	0.024	0.020	0.03
Alpha HCH	0.01	0.016	0.025	0.03	0.018	0.01
Beta HCH	0.018	0.022	0.023	0.023	0.022	0.04
Delta HCH	0.021	0.020	0.024	0.011	0.020	0.04
DDT	0.53	0.47	0.69	0.59	0.67	1
Atrazine	0.012	0.017	0.19	0.021	0.004	2

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SOLID WASTE MANAGEMENT PRACTICES IN INDIA

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ABSTRACT

Solid Waste Management (SWM) is the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Solid waste management is one such service where India has an enormous gap to fill. Proper Municipal Solid Waste (MSW) disposal systems to address the burgeoning amount of wastes are absent. The current SWM services are inefficient, incur heavy expenditure and are so low as to be a potential threat to the public health and environmental quality. Improper solid waste management deteriorates public health, causes environmental pollution, accelerates natural resources degradation, causes climate change and greatly impacts the quality of life of citizens. Every waste generator shall segregate and store the waste generated by them in three separate streams namely: bio-degradable, non bio-degradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorized rag pickers or waste collectors. In line with the above, the event organizers, Resident Welfare and Market Associations, Gated communities, Institutions and Special Economic Zones (SEZ) have been assigned responsibility. This will improve the waste segregation and utilization, less waste or only inert to landfill. This article discusses the Solid Waste Management (SWM) issues, challenges and interventions in urban India.

Keywords: Solid Waste Management (SWM), Municipal Solid Waste (MSW), Biodegradable Waste, Hazardous Waste, Special Economic Zone (SEZ).

Salient features of Solid Waste Management

Solid Waste Management (SWM) is the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease - that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.

Developments in Solid Waste Management

A technological approach to solid-waste management began to develop in the latter part of the 19th century. Watertight garbage cans were first introduced in the United States, and sturdier vehicles were used to collect and transport wastes. A significant development in solid-waste treatment and disposal practices was marked by the construction of the first refuse incinerator in England 1874. By the beginning of the 20th century, 15 percent of major American cities were incinerating solid waste. Even then, however, most of the largest cities were still using primitive disposal methods such as open dumping on land or in water.

Technological advances continued during the first half of the 20th century, including the development of garbage grinders, compaction trucks, and pneumatic collection systems. By mid-century, however, it had become evident that open dumping and improper incineration of solid



waste were causing problems of pollution and jeopardizing public health. As a result, sanitary landfills were developed to replace the practice of open dumping and to reduce the reliance on waste incineration. In many countries waste was divided into two categories, hazardous and nonhazardous, and separate regulations were developed for their disposal. Landfills were designed and operated in a manner that minimized risks to public health and the environment. New refuse incinerators were designed to recover heat energy from the waste and were provided with extensive air pollution control devices to satisfy stringent standards of air quality. Modern solid-waste management plants in most developed countries now emphasize the practice of recycling and waste reduction at the source rather than incineration and land disposal.

Solid Waste Management in India

India is the second largest nation in the world, with a population of 1.21 billion, accounting for nearly 18 percent of world's human population, but it does not have enough resources or adequate systems in place to treat its solid wastes. Its urban population grew at a rate of 31.8 percent during the last decade to 377 million, which is greater than the entire population of United States, the third largest country in the world according to population. India is facing a sharp contrast between its increasing urban population and available services and resources. Solid waste management is one such service where India has an enormous gap to fill. Proper municipal solid waste disposal systems to address the burgeoning amount of wastes are absent. The current SWM services are inefficient, incur heavy expenditure and are so low as to be a potential threat to the public health and environmental quality. Improper solid waste management deteriorates public health, causes environmental pollution, accelerates natural resources degradation, causes climate change and greatly impacts the quality of life of citizens.

Solid Waste Management Rules, 2016

- The Rules are now applicable beyond Municipal areas and extend to urban agglomerations, census towns, notified industrial townships, areas under the control of Indian Railways, airports, airbase, Port and harbour, defence establishments, special economic zones, State and Central government organizations, places of pilgrims, religious and historical importance.
- The source segregation of waste has been mandated to channelize the waste to wealth by recovery, reuse and recycle.
- Responsibilities of Generators have been introduced to segregate waste in to three streams, Wet (Biodegradable), Dry (Plastic, Paper, metal, wood, etc.) and domestic hazardous wastes (diapers, napkins, empty containers of cleaning agents, mosquito repellents, etc.) and handover segregated wastes to authorized rag-pickers/ waste collectors or local bodies.
- Integration of waste pickers/rag pickers and waste dealers/kabadiwalas in the formal system should be done by State Governments, and Self Help Groups, or any other group to be formed.
- No person should throw, burn, or bury the solid waste generated by him, on streets, open public spaces outside his premises, or in the drain, or water bodies.
- Generator will have to pay 'User Fee' to waste collector and for 'Spot Fine' for Littering and Non-segregation.
- Used sanitary waste like diapers, sanitary pads should be wrapped securely in pouches provided by manufacturers or brand owners of these products or in a suitable wrapping material and shall place the same in the bin meant for dry/non bio-degradable waste.



- The concept of partnership in Swatch Bharat has been introduced. Bulk and institutional generators, market associations, event organizers and hotels and restaurants have been made directly responsible for segregation and sorting the waste and manage in partnership with local bodies.
- All hotels and restaurants should segregate biodegradable waste and set up a system of collection or follow the system of collection set up by local body to ensure that such food waste is utilized for composting/bio-methanation.
- All Resident Welfare and Market Associations, Gated Communities and institution with an area >5,000 sq. m should segregate waste at source- in to valuable dry waste like plastic, tin, glass, paper, etc. and handover recyclable material to either the authorized waste pickers or the authorized recyclers, or to the urban local body.
- The bio-degradable waste should be processed, treated and disposed of through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local authority.
- The bio-degradable waste should be processed, treated and disposed of through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local authority.
- New townships and Group Housing Societies have been made responsible to develop in-house waste handling, and processing arrangements for bio-degradable waste.
- Every street vendor should keep suitable containers for storage of waste generated during the course of his activity such as food waste, disposable plates, cups, cans, wrappers, coconut shells, leftover food, vegetables, fruits etc. and deposit such waste at waste storage depot or container or vehicle as notified by the local authority.
- The developers of SEZ, industrial estate, industrial park to earmark at least 5 percent of the total area of the plot or minimum 5 plots/sheds for recovery and recycling facility.
- All manufacturers of disposable products such as tin, glass, plastics packaging etc. or brand owners who introduce such products in the market shall provide necessary financial assistance to local authorities for the establishment of waste management system.
- All such brand owners who sale or market their products in such packaging material which are non-biodegradable should put in place a system to collect back the packaging waste generated due to their production.
- Manufacturers or Brand Owners or marketing companies of sanitary napkins and diapers should explore the possibility of using all recyclable materials in their products or they shall provide a pouch or wrapper for disposal of each napkin or diapers along with the packet of their sanitary products.
- All such manufacturers, brand owners or marketing companies should educate the masses for wrapping and disposal of their products.
- All industrial units using fuel and located within 100 km from a solid waste based RDF plant shall make arrangements within six months from the date of notification of these rules to replace at least 5 % of their fuel requirement by RDF so produced.
- Non-recyclable waste having calorific value of 1500 K/cal/kg or more shall not be disposed of on landfills and shall only be utilized for generating energy either or through refuse derived fuel or by giving away as feed stock for preparing refuse derived fuel.



- High calorific wastes shall be used for co-processing in cement or thermal power plants.
- Construction and demolition waste should be stored, separately disposed off, as per the Construction and Demolition Waste Management Rules, 2016
- Horticulture waste and garden waste generated from his premises should be disposed as per the directions of local authority.
- An event, or gathering organiser of more than 100 persons at any licensed/ unlicensed place, should ensure segregation of waste at source and handing over of segregated waste to waste collector or agency, as specified by local authority.
- Special provision for management of solid waste in hilly areas: Construction of landfill on the hill shall be avoided. A transfer station at a suitable enclosed location shall be setup to collect residual waste from the processing facility and inert waste. Suitable land shall be identified in the plain areas, down the hill, within 25 kilometres for setting up sanitary landfill. The residual waste from the transfer station shall be disposed off at this sanitary landfill.
- In case of non-availability of such land, efforts shall be made to set up regional sanitary landfill for the inert and residual waste.

Urban Local Bodies and Solid Waste Management

Solid waste management is an obligatory function of Urban Local Bodies in India. However, this is poorly performed resulting in problems of health, sanitation and environment degradation. With over 3.6 percent annual growth in urban population and the rapid pace of urbanization, the sanitation is becoming more and more critical with the passage of time. Lack of political will, inadequate financial resources, institutional weakness, improper choice of technology and public apathy towards solid waste management have made this services far from satisfactory.

The responsibility of Urban Local Body is for collection, transportation and disposal of solid waste except untreated Bio-medical waste and hazardous industrial waste. Storage and segregation of waste at source is not very prominent in Indian urban agglomeration. Only a few houses, large hotels segregated and store the waste in their premises.

Unless concerned efforts are made to improve the flow resources to solid waste management and build up system which incorporated the basic requirement of a proper waste management practice, the problem of urban waste will be further aggravated and cause environment health problems.

Public Awareness Initiatives

The Ministry of Environment and Forests has notified the new Solid Waste Management Rules, 2016 with clear responsibilities assigned to various classes of consumers. For these rules to have any significant impact, however, the local bodies' in-charge of implementation should appeal to the rational impulses of communities a small effort at segregating trash at source would be a good thing for their household budgets. Cities and towns would then have to provide the logistical chain to evacuate waste, with a cash compensation system in place for the consumer.

- The cities can be divided into sanitary divisions and should use services of staff from Development of Women and Child in Urban Areas (DWCUA) groups have taken up the task of cleaning the roads every day in Andhra Pradesh.
- Dust bins are supplied free of cost to all schools and residential units for segregation of waste at source.



- 'No Plastic' rallies, public meetings, Audio/Video advertisements etc., are being carried out on a regular basis to bring awareness among general public and school children.
- Services of RWAs are being utilized for public awareness in their respective localities.
- All the roads shall maintain in the city are litter free.
- Projects shall be taken up to clean water bodies/canals by engaging motorized boats.
- Rainwater harvesting made mandatory for getting approval of building plan. Special drives shall promote rain water harvesting for all apartments and individual houses.
- Transfer station equipped to transfer MSW from dumper bins to bulk transfer vehicles is being used to convey MSW (collected from transfer station to land fill site).

Highlights of Solid Waste Management Rules 2016

Title: From "Municipal Solid Waste (Management and Handling) rules" to "Solid Waste Management Rules" The jurisdiction of the rules have been extended beyond Municipal area hence the word 'Municipal' has been removed.

Application: The jurisdiction of the rules has been extended beyond Municipal area to ensure effective implementation of the Rules and achieve objectives of the Swatch Bharat Abhiyaan.

Duties of Waste generator: Every waste generator shall segregate and store the waste generated by them in 3 separate streams namely - bio-degradable, non-bio- degradable and domestic hazardous wastes in suitable bins and hand-over segregated wastes to authorized rag-pickers or waste collectors . The SWM rules, 2016 emphasizes source segregation of waste, a basic need for channelizing the waste to wealth by recovery, reuse and recycle.

In line with the above, the event organizers, Resident Welfare and Market Associations, Gated communities, institution and SEZ have been assigned responsibility. This will improve the waste segregation and utilization, less waste or only inert to landfill.

Collection and disposal of sanitary waste: The issue of collection and disposal of sanitary waste like diapers, sanitary pads and other disposal items have been addressed.

Duties of Ministry of Urban Development: MoUD shall formulate National Policy and Strategy on Solid Waste Management including policy on Waste to Energy in consultation with stakeholders within 6 months from the date of notification of these rules. The technical and financial support will improve the SWM.

Promotion of marketing and utilization of compost: The Department of Fertilizers, Ministry of Chemicals and Fertilizers shall provide market development assistance on city compost & ensure promotion of co-marketing of compost with chemical fertilizers. This will make the compost plants economically viable and improve the gainful utilization of waste.

Promotion of waste to energy plant: Ministry of Power shall fix tariff or charges for the power generated from the Waste to Energy plants based on solid waste and ensure compulsory purchase of power generated from such Waste to Energy plants by Electricity distribution companies of India (DISCOMs). This will make the waste to energy plants economically viable.

The Ministry of New and Renewable Energy Sources shall facilitate infrastructure creation for Waste to Energy (WtE) plants and provide appropriate subsidy or incentives for such WtE plants. The incentives and mandatory provision to utilize 5% of Refuse Derived Fuel (RDF) by the nearby industries will support the waste to energy plants, and reduce the consumption of fossil fuel.

Duties of Secretary, State Urban Development Department (UDD), the Commissioner Municipal Administration, Director of Local Bodies, local authorities and village Panchayats: Detailed duties &



responsibilities have been assigned to the Secretary, State UDD, Commissioner Municipal Administration, Director of Local Bodies, local authorities and village Panchayats of census towns and urban agglomerations Integration of Waste pickers/Self Help Groups in waste management will improve the collection, segregation and recovery of reusable etc. They are responsible for preparation of state policy and solid waste management strategy in consultation with stakeholders including representative of waste pickers, self-help group and similar groups working in the field of waste management.

Conclusion

The SWM Rules 2016 provide for detailed criteria for setting-up solid waste processing and treatment facility, solid waste management in hilly areas, for WtE process, for Sanitary Landfills, for site selection, development of facilities at the sanitary landfills, specifications for land filling operations and closure on completion of land filling, pollution prevention, Closure and Rehabilitation of Old Dumps etc. Notify buffer zone for the solid waste processing and disposal facilities of more than 5 tons per day in consultation with the State Pollution Control Board and Buffer zone to be provided. The criteria and buffer zone for waste treatment and landfill facility and stringent standards will facilitate smooth functioning of the facility without any pollution issues.

As the technology increases, the solid wastes produced by all beings also increases. So, the amount of solid waste that is to be managed also increases. So, if we try to reduce solid waste produced, then we can clearly see **"Green India Soon"**.

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FLUORIDE TOXICITY-A GLOBAL PROBLEM

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ABSTRACT

Groundwater is the sole source for various purposes in most parts of the world. Presence of low or high concentration of certain ions is a major issue as they make the groundwater unsuitable for various purposes. Fluoride is one such ion that causes health problems in people living in more than 25 nations around the world. Fluoride concentration of atleast 0.6 mg/l is required for human consumption as it will help to have stronger teeth and bones. Consumption of water with fluoride concentration above 1.5 mg/l results in acute to chronic dental fluorosis where the tooth become coloured and later on brittle. High concentration of fluoride in groundwater is because of Geological or anthropogenic causes or a combination of both.

Natural sources are associated to the geological conditions of an area. The weathering of rocks like apatite, fluorite, biotite and hornblende and infiltration of rainfall through it increases fluoride concentration in groundwater. Anthropogenic sources of fluoride include agricultural fertilizers and combustion of coal. The aerial emission of fluoride in gaseous form during these activities reaches the surface by fall out of particulate fluorides and during rainfall they percolate with the rainwater thus reaching the groundwater table. Also, the improper disposal of fly ash on ground surface contributes to fluoride in groundwater.

There are several methods available for the removal of fluoride from groundwater which is insitu or exsitu. The conventional treatment methods like adsorption, ion exchange, reverse osmosis, electrodialysis, coagulation and precipitation etc can be practiced at community level or at households to reduce fluoride concentration before ingestion. But the choice of each method depends on the local conditions of the region such as the quality of groundwater and the source of contamination whether it is natural or anthropogenic. Fluoride contamination being a prominent and widespread problem in several parts of the world and as causes for this are mostly natural and unpreventable, educating the people and defluorinating the groundwater before consumption are essential for a healthy world.

Introduction

Fluoride is known to contaminate groundwater reserves globally. Groundwater fluoride concentration (>1.5 mg/L), according to WHO estimate, is affecting more than 260 million people around the world (Banerjee et al 2015, Brindha, K. and Elango, L. 2011). Sporadic incidence of high fluoride content in groundwater has been reported from India, China, Sri Lanka, West Indies, Spain, Holland, Italy, Mexico, and North and South American countries. In India, its occurrence in top aquifer system is endemic in many places of Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, Rajasthan, Punjab, Haryana, Bihar and Kerala. (Latha et al, Brindha, K. and Elango, L. 2011).

Sources of Fluoride Contaminants of Natural water

Drinking water is obtained either through surface water or groundwater. SOME parts of the world groundwater is polluted with geological-fluoride with concentrations up to 3.5 mg/L. It is



estimated that worldwide, more than 200 million people are routinely drinking water with fluoride concentrations greater than 1.5 mg/L; majority of these occur in the developing countries. Mainly two factors are responsible for contamination of groundwater with fluoride – geological and anthropogenic

Geological sources

Rock geochemistry has a major control on geological fluoride contamination. Many rocks have fluoride bearing minerals like apatite, fluorite, biotite and hornblende. The weathering of these rocks and percolation of rainfall through it F^- fluoride concentration in groundwater.

Dissolution of fluorite (CaF_2) and/or fluorapatite (FAP) [$Ca_5(PO_4)_3F$], pulled by calcite precipitation, is thought to be the dominant mechanism responsible for groundwater fluoride (F^-) contamination (Banerjee et al 2015).

The sources are usually related to the dissolution of various minerals present in rocks and soils, such as fluorite (or fluorspar), cryolite, fluoroapatite, topaz, villaumite, amphiboles such as hornblende, micas namely muscovite and biotite and also rock phosphate. Clay minerals for instance vermiculite, kaolinite, montmorillonite, illite, chlorite and spectite are also the sources of fluoride in groundwater. Among them fluorite and fluorapatite have generally been considered as the foremost geogenic sources of F^- in groundwater. (Latha et al).

Anthropogenic sources of fluoride include agricultural fertilizers (contaminated rock-phosphate fertilizer), industrialization, urbanization and improper utilization of water resources are of prime importance, and combustion of coal. In irrigates farmland soil, similar to cadmium, phosphate fertilizers is the most common source of contribute to fluoride. Coal is also a potential source of fluoride contamination. The aerial emission of fluoride in gaseous form during these activities could reaches the surface by fall out of particulate fluorides and during rainfall they percolate with the rainwater thus contaminating the groundwater table (jha sk et al 2011).

Coal also a potential source of fluoride contamination. The aerial emission of fluoride in gaseous form during coal-burning could reaches the surface by fall out of particulate fluorides (among other substances, that some are toxic and carcinogenic) and during rainfall they percolate with the rainwater thus contaminating the groundwater table.

Fluoride Affects Many functions of our body- Besides our Teeth

There have been over 34 human studies and 100 animal studies linking fluoride to brain damage,3 including lower IQ in children, and studies have shown that fluoride toxicity can lead to a wide variety of health problems, including: Increased lead absorption, Disrupts synthesis of collagen, Hyperactivity and/or lethargy, Muscle disorders, Thyroid disease, Arthritis, Dementia, Bone fractures , Disrupted immune system, Damaged sperm and increased infertility, Genetic damage and cell death and many more (Z Sun et al 2015, zhou bianhua et al 2009)

Defluoridation methods: Everybody needs clean water. When high fluoride in the drinking water source has been identified, it is better to avoid that source and look for other sources. But this is not a long lasting solution. Insitu and exsitu methods are available to treat groundwater with high fluoride and bring it to the usable form. Defluoridation can be introduced at two organizational levels; as household defluoridation for consumption of single household members, and as community defluoridation for the public use in a village.

Various techniques and materials were explored throughout the world for defluoridation of groundwater. The techniques can broadly be classified into four categories:



1. Adsorption: Carbon materials, Activated Alumina, Magnesia, Tricalcium phosphate, Calcite, Hydroxy apatite, Wood, Lignite, Activated char coal, Fish bone char, Processed bone, Nut shells, Avaram bark, Paddy husk, Coffee husk, Tea waste, Jute waste, Coir pitch, Fly ash, Bauxite, Serpentine
2. Ion-exchange : a) Anion exchange resins- NCL poly anion resin, Tulsion A27, Lewatit-MIH-59, Amberlite IRA-400, Deacedodite FF-IP, Waso resin-14, Polystyrene. b) Cation exchange resins: Defluoron-1, Defluoron-2, Carbion.
3. Precipitation: Lime, Alum, Lime & Alum (Nalgonda technique), Alum flock blanket method, Poly Aluminium Chloride (PAC), Poly Aluminium Hydroxy Sulphate (PAHS), Brushite.
4. Others: Electrochemical method (Aluminium electrode), Electro dialysis, Electrolysis, Reverse Osmosis.

The basic characteristics of an ideal defluoridation process are the following:

- Cost-effective
- Independent of input fluoride concentration, alkalinity, pH, temperature
- Easy to handle/operate by rural population - the major sufferer
- Not affect the taste of water
- Not add other undesirable substances (eg. Aluminum) to treated water.

Conclusions

Natural contamination of groundwater by fluoride causes irreparable damage to plant and human health. High oral intake of fluoride results in physiological disorders, skeletal and dental fluorosis, thyroxine changes and kidney damage in humans¹³. High fluoride levels inhibit germination, cause ultrastructural malformations, reduce photosynthetic capacities, alter membrane permeability, reduce productivity and biomass and inflict other physiological and biochemical disorders in plants¹⁴. Several physical and chemical defluoridation methods have been designed to treat high fluoride waters. However ion exchange and chemical treatments are cost intensive, while physical methods suffer limitations like frequent change of defluoridant beds and inability to reduce fluoride to non-toxic levels. Biological defluoridation can serve as a best alternative to the conventional methods of defluoridation.

Such methods would be cost effective and material employed would be biodegradable. Defluoridation is difficult and expensive, so the best option for dealing with excess levels is recognizing when they are present and pursuing alternative water sources if they are available

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A REVIEW ON HORMONAL DISRUPTIONS

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ABSTRACT

Endocrine disruptors are chemicals that, at certain doses, can interfere with endocrine (or hormone) systems. These disruptions can cause cancerous tumors, birth defects, and other developmental disorders. Any system in the body controlled by hormones can be derailed by hormone disruptors. Recently The Endocrine Society released a statement on Endocrine-Disrupting Chemicals (EDCs) specifically listing obesity, diabetes, female reproduction, male reproduction, hormone-sensitive cancers in females, prostate cancer in males, thyroid, and neurodevelopment and neuroendocrine systems as being affected biological aspects of being exposed to EDCs. Found in many household and industrial products, endocrine disruptors are substances that "interfere with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body that are responsible for development, behavior, fertility, and maintenance of homeostasis (normal cell metabolism)." They are sometimes also referred to as hormonally active agents, endocrine disrupting chemicals or endocrine disrupting compounds.

Keywords: Endocrine disruptors, Chemicals, Health Effects.

INTRODUCTION:

Endocrine disrupters, some of which occur naturally (phytoestrogens) and some of which are man-made, are ubiquitous simply because they are produced in large quantities, others may be found in regions of the world where they are not produced because they are easily transported through the atmosphere and do not break down readily in the environment. Rather, they accumulate in soil and sediments, which serve as continued sources of exposure to wildlife; the substances then make their way up the food chain and unlike phytoestrogens, they can be stored for long periods in the body fat of animals and humans. Consequently, species feeding at the highest levels of the food chain are the most vulnerable to adverse effects of environmental pollutants because in addition to being directly exposed to contaminants, they feed on animals with accumulations of harmful compounds in their body tissue.

The best-known man-made endocrine disrupters are synthetic hormonal drugs, such as birth control pills and diethylstilbestrol (DES). DES is now known to be an endocrine-disrupting chemical, one of a number of substances that interfere with the endocrine system to cause cancer, birth defects, and other developmental abnormalities. The effects of endocrine-disrupting chemicals are most severe when exposure occurs during fetal development. The daughters of women who used DES while pregnant commonly called DES daughters have about 40 times the risk of developing clear cell adenocarcinoma of the lower genital tract than unexposed women. However, this type of cancer is still rare; approximately 1 in 1,000 DES daughters develops it.

The first DES daughters who were diagnosed with clear cell adenocarcinoma were very young at the time of their diagnoses. Subsequent research has shown that the risk of developing this disease remains elevated as women age into their 40s.



DES daughters have an increased risk of developing abnormal cells in the cervix and the vagina that are precursors of cancer (dysplasia, cervical intraepithelial neoplasia, and squamous intraepithelial lesions). These abnormal cells resemble cancer cells, but they do not invade nearby healthy tissue and are not cancer. They may develop into cancer, however, if left untreated. Scientists estimated that DES-exposed daughters were 2.2 times more likely to have these abnormal cell changes in the cervix than unexposed women. Approximately 4% of DES daughters developed these conditions because of their exposure. It has been recommended that DES daughters have a yearly Pap test and pelvic exam to check for abnormal cells.

DES daughters may also have a slightly increased risk of breast cancer after age 40. A 2006 study from the United States suggested that, overall, breast cancer risk is not increased in DES daughters, but that, after age 40, DES daughters have approximately twice the risk of breast cancer as unexposed women of the same age and with similar risk factors. However, a 2010 study from Europe found no difference in breast cancer risk between DES daughters and unexposed women and no difference in overall cancer risk.

CONCLUSION

Scientists, government agencies, funders and industry must work together to study endocrine disruption. In addition to conducting and funding studies, government entities can contribute to the research effort by incorporating relevant measures in national-level surveys, encouraging uniform registration of birth outcomes and requiring manufacturers to disclose the names of all chemicals used in their products so that these may be tested in order to safeguard reproductive well-being.

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ASSESSMENT OF BENIGN CHITOSAN DOPED BIO-COMPOSITE FOR PHOSPHATE AND NITRATE REMOVAL FROM AGRICULTURAL RUNOFF

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Abstract

Agriculture hugely used varied synthetic fertilizer/pesticide as nutrients and during periods of rain, these unused nutrients percolate from fertilized soils into the water-streams/ rivers. Oozing excessive nutrients, mostly phosphorus and nitrogen causes water pollution and eutrophication, thus detrimental to ecosystem. This research synthesized benign bio-composite from naturally abundant chitosan by doping with graphite and SiO₂ to remove nitrate/phosphates contamination from agricultural runoff/drainage percolating through water in batch adsorption mode. At lower concentrations (10–25 mg/L), while at higher concentrations (up to 100 mg/L), removal efficiency decreased, highest removal (70 %) at 25-mg/L nitrate, while at higher concentrations (50 and 100 mg/L), nitrate removal 36.7 and 42.9 %. 50 % mix showed best performance in terms of both rates and percentage of removal for most of nitrate investigated indicating that a higher amount of in mixes improves adsorption capacity. Both Langmuir and Freundlich isotherm models applied to experimental data and Langmuir described better nitrate removal process. Accordingly, graphite doped chitosan composite is benign alternative to the commercial adsorbents to reduce the cost of water treatment with enhanced nitrate/phosphate removal capacity. The saturated adsorbents after adsorption of nitrate was eluted with 0.1 N NaOH solutions for desorption and resultant effluents were collected at regular time intervals and analyzed for residual nitrate ion chromatogram.

Keywords: Nitrate, phosphate, nutrient removal, benign, bio-composite, chitosan, water.

Introduction

Nitrate and phosphate are vital nutrients for growth of plants, hence huge quantity added in agricultural fields and unused nutrients percolate via water, thus responsible for serious environmental problem called eutrophication. Eutrophication is slow-aging of water body, due to exceeds seasonal loading of nutrients which promotes excessive growth of algae and as algae dies/decomposes to high levels of organic matter which depletes water-oxygen, causing subsequent death of fish/aquatic species/ecology besides endanger to human [1]. About 50% crop yields by commercial fertilizer which affects global populations as 2.5% land of terrestrial ecosystems suffered leaching load of nitrate/phosphorous @ 30 kg/ ha year [2]. Rather phosphorus level > 0.025 ppm percolating from agricultural soils has also imparting the eutrophication [3]. Thus, nitrate/phosphate contaminations in water becomes serious environmental issue worldwide [4]. Nitrates/phosphate contaminations are due to agricultural runoffs besides untreated municipal disposal, domestic and industrial wastes. Amid, phosphorus found in rocks/mineral deposits gets gradually release the phosphorus as phosphate during weathering. Phosphates are not toxic as such unless present in very high levels that arise digestive problems. Phosphates 0.1 ppm level is acceptable to avoid accelerated eutrophication but level > 0.1 ppm accelerated consequent problems. The criteria for total phosphorus as recommended by US EPA [5] stated that no more than 0.1 ppm for streams not enter into reservoirs and no more than 0.05 ppm for streams discharging into reservoirs besides no



more than 0.025 mg/L for reservoirs. Nitrate limit of 15 ppm in potable water for discharge is permissible while USEPA established a limit of 10 ppm [6]. Excessive water nitrate cause methemoglobinemia illness (ingestion in human digestive system alters oxyhemoglobin to methoglobin, which cannot carry oxygen, so tissues deprived of oxygen and arise blue coloration of mucous membranes) and digestive and respiratory disturbances [1-3]. Excess nitrates are responsible for stomach cancer in adults and symptoms of nitrate poisoning includes breath shortening, rapid heartbeat, frequent urination, body collapse, in series cases coma and death may result within a few hours [7]. Phosphates are not toxic unless present in very high levels but high phosphate levels causes digestive problems although nutrients are found moderately in natural water systems, but high level contamination mainly reliant due to huge fertilizers consumption [6-7]. Nitrate and phosphate owns high stability and solubility besides less precipitation tendency and so, difficult to remove by conventional water treatment technologies [8]. Certain physicochemical/biological methodologies like adsorption, ion exchange, reverse osmosis, and a combination of several processes developed to remove nitrate and phosphate from water. Amid, adsorption is most attractive due to its ease of operation, simplicity of design and economically more feasible especially when low-cost/bio-adsorbent is used as adsorbents [9]. Thus varied adsorbents viz; carbon materials, agricultural wastes, ion exchange resins and synthetic organic/inorganic compounds were used to remove nitrate and phosphate from water. Nevertheless, adsorption capacities of these materials are very less, so it's essential to find more effective/cheaper adsorbents with higher adsorption capacity. Commercial activated carbon owns low capacity to retain phosphate and adsorption capacity becomes higher with increasing phosphate concentration while presence of nitrate has no influence in phosphate adsorption. Thus, their removal gets promising concern by techniques so as to minimize post-treatment operation and maintenance costs enable bio-waste usages like chitosan sea food-industrial residues/waste has been desired. In this research chitosan is preferred due to availability of multiple adsorption sites in yielded bio-composites which gets utilized for nitrate/phosphate sorptions.

2 Experimental

2.1 Materials and Preparation

The potassium nitrate (KNO_3) and dipotassium phosphate (K_2HPO_4) were purchased from Aldrich Chemicals and directly used without any purification as sources for nitrate and phosphate, respectively and the sample solutions were diluted as and when needed.

2.2 Characterizations fo Synthesized adsorbents

2.2.1 Analytical methods

The concentration of nitrate nitrogen (V) in solution was determined using the colorimetric method, on UV-VIS SP 2000 spectrophotometer. The pH was measured using pH-meter. A liquid characterization was performed by the measurement of pH.

2.2.2. Elementary Analysis (viz; C/H/N/S/O, % Ash, %Moisture, Surface parameters)

The elementary analysis shown in **Table-1**, Ash content calculated by Eqⁿ (1), % moisture by gravimetry and water mass/weight difference of wet-dried sample and calculated by Eqⁿ (2):

$$\% \text{ Ash} = [\text{Weight of residue (g)} / \text{Sample weight (g)}] \times 100 \quad \text{Eq}^n (1)$$

$$\% \text{ Moisture Content} = [\text{Wet weight (g)} - \text{Dry Weight (g)}] / \text{Wet weight (g)} \times 100 \quad \text{Eq}^n (2)$$

**Table 1: Characteristics of FCDGNC novel composite, pure chitosan and pure graphite**

Analyzed Parameters	FCDGNC	Pure Chitosan	Pure Graphite
Appearance	Whitish (2% w/v in 5% acetic acid)	Slightly Yellowish (2% w/v in 5% acetic acid)	Iron-black;luster
Ash on Ignition (800°C)	4.0%	2.10%	< 1.0%
C %	59.35%	42.62 %	> 94 %
H %	3.9%	7.73%	4 %
N %	3.29%	7.98%	Nil
S %	0.155%	0.155%	Nil
O %	33.3%	33.3%	0.001%
Moisture	1.0%	2.90%	Nil
Dry matter %	hydrogel– 5.3%	Flakes – 88%	99%
Volatile matter	55%	55%	Nil
Fixed Carbon	33.80%	42.62%	95 %
Particle size	176µm – 246 µm	75-90 mm	50-75µm
Density (g/cm ³)	0.988 (g/cm ³)	0.20 - 0.30 (g/cm ³)	2.25
Viscosity	Crystalline Particles	250-600 mPa (1% solution)	Non viscous
Solubility	Insoluble in solvents	1% acetic acid	Ethanol < 0.2%
Surface area (m ² /g) (BET)	3.890 m ² /g	12.89 m ² /g	8.0-12.0 m ² /g
Total pore volume (cm ³ /g)	0.002	0.024	0.1-0.3 P/P0
Mean Pore Diameter (nm)	28.12	10.40	---

2.2.3. Determination of reaction equilibrium time: Time needed to attain adsorption equilibrium was determined after optimized pH for the sorption. Nitrates/phosphates sorption was conducted in 100 mL beakers placed on shakers. Samples (50 mL) were analysed after 0, 1, 5, 10, 15, 20, 30, 40, 50, 60, 90, 120, 150, 180, 210, and 240 min. The parameters of analyses of pH value effect on the effectiveness of nitrate sorption on chitosan sorbents as shown in **Table-2** and **Table-3**.

Table-2: Varied parameters effect on effectiveness of nitrate sorption on adsorbent

Sorbent	Sorbent conc. ppm	Sorption pH	Solution [mL]	Sorbate conc. [ppm]	Sorption time [hrs]	Stirring speed [r.p.m.]	Temp/ Pressure
Chitosan dope graphite	1	2 to 10	50	5 to 100	24	200	NTP
Chitosan dope Silica	1	2 to 10	50	5 to 100	24	200	NTP

Table-3: Varied parameters effect on effectiveness of phosphate sorption on adsorbent

Sorbent	Sorbent conc. [g/L]	Sorption pH [pH]	Solution [mL]	Sorbate conc. [ppm]	Sorption time [hrs]	Stirring speed rpm	Temp/ Pressure
Chitosan dope graphite	1.5	2 to 10	50	5 to 50	24	200	NTP
Chitosan dope Silica	1.5	2 to 10	50	5 to 50	24	200	NTP



2.2.4 Eluate Tests and Batch experiments

Eluate tests were performed in distilled water over 24 h, using the same liquid (mL) to solid (g) ratio applied for the batch tests (10:1) to determine leaching capacity. Parameters measured after 24 h were pH, conductivity (C), total phosphate and nitrate concentration (NO_3^-). All these analyses were conducted in duplicate for accuracy and in separate vials in order to avoid contamination. The batch experimental studies were conducted in order to determine nitrate/phosphate removal capacity of the synthesized adsorbents. Tests were carried out in duplicate, under uncontrolled pH condition in bottles with a liquid to solid ratio of 10:1. A total liquid volume of 50 mL was used for all batch tests. The nitrate removal efficiency was tested using 5, 10, 25, 50, and 100 ppm synthetic solutions of potassium nitrate (KNO_3) and prepared distilled water. The samples were collected during the adsorption experiments until complete removal was achieved or a plateau obtained.

2.2.5 Adsorption and Kinetic Experiments

Adsorption of nitrate/phosphate onto adsorbents studied in batch experiments, as 1 to 1.5 g adsorbent with 50 mL nitrate/phosphate adsorbate taken in 100 mL vials with different concentrations and kept on mechanical shaker at 200 rpm, given enough contact time so as to reach equilibrium. The initial nitrate concentration was in the range from 5 to 100 ppm while that of phosphate, 5 to 50 ppm. Dynamic adsorption analysis was also carried out and adsorption kinetic rates of nitrate and phosphate were measured in terms of time in an agitated reactor with a water jacket to maintain a constant adsorption temperature. After the adsorption study, the collected samples were filtered through 0.45- μm glass syringe filters of Whatman-Cat No. 6786-2504 and residual nitrate/phosphate in filtrates was determined with average values. All the batch adsorption experiments were carried out in duplicate and average values are reported. The percentage removal was calculated using equation (3)

$$\% \text{ removal} = \frac{C_i - C_f}{C_i} \times 100 \text{----- (3)}$$

Adsorption capacities were calculated using equation (4) and (5) respectively.

$$q_e = \frac{C_i - C_f}{m} \times V \text{----- (4)}$$

$$q_t = \frac{C_i - C_t}{m} \times V \text{----- (5)}$$

where q_e and q_t were the amount of adsorbate which gets adsorbed at equilibrium and at time t respectively in (mg/g); C_i and C_f were the initial and final adsorbate concentration in (mg/L). C_t = residual adsorbate concentration at time t in (mg/L); V = volume of solution (L) i.e., is volume of nitrate and phosphate solutions, and m = mass of adsorbent (g/L).

2.2.6 Adsorption of Nitrate and Phosphate

The correlation of experimental adsorption results with the adsorption isotherms helps us to understand the adsorption process more theoretically. In this study, the following adsorption isotherm models were used to correlate the experimental results Eqⁿ 6 and 7 below [11].

$$\text{Langmuir; } Q_e = \frac{Q_{\text{max}} b C_e}{1 + b C_e} \text{ (6)}$$

$$\text{Freundlich; } Q_e = K C_e^{1/n} \text{ (7)}$$

C_e is the equilibrium concentration of the adsorbate/nitrate/phosphate in aqueous solution ppm (mg/L), Q_{max} is the maximum adsorption capacity (mg/g), b is Langmuir constant relates binding sites affinity (L/mg), K and n are Freundlich constant relates adsorption capacity (L/g) and adsorption intensity/heterogeneity factor. = Langmuir isotherm is applicable for monolayer adsorption in homogeneous manner on adsorbent surfaces. Amid, best fitting for the adsorption were decided by



study of correlation coefficient (R_2), residual root mean square error (RMSE), and chi-squared test (χ^2) values. The largest value of R_2 (the smallest values of RMSE and χ^2) indicated better fitting and similarity of model with adsorption data due to their definitions as follows. The correlation coefficients, R_2 are in range of 0.979–0.994 and 0.969–0.994 for Langmuir and Freundlich isotherm models, respectively. Based on the obtained values of R_2 , 1-RMSE, and $1-\chi^2$, Langmuir equation-3 looks more accurate than Freundlich as mentioned in **Table-4**: so as to describe adsorption equilibriums with represented fitting ability. However, the unreasonably large values of q_m and small values of b , in case of Langmuir isothermal parameters imply that it's not proper in fitting equilibrium (as some data almost linear/unfavourable). In these cases, linear isotherm/Freundlich seems proper to simulate adsorption process. The adsorption of nitrate/phosphate also decreases slightly with enhancing temperature gets linear/slightly unfavourable implied physical adsorption predominates and removal is difficult.

Table 4: Adsorption isotherm parameters for nitrate on chitosan doped adsorbents

Adsorbents	Adsorbate	Langmuir model	Freundlich model								
		Q_{max}	b	R_2	$1-\chi^2$	1-RMSE	K	n	R_2	$1-\chi^2$	1-RMSE
Chitosan-Graphite	NO_3^-	15.61	0.0020	0.994	0.958	0.948	0.029	1.066	0.993	0.956	0.943
	PO_4^{---}	53.20	0.00041	0.991	0.982	0.996	0.018	1.040	0.992	0.981	0.993

2.2.7 Scanning Electron Micrographic (SEM)

Scanning electron micrographic images of adsorbent (**Fig.1**) showed porous morphology with pores of different sizes/shapes with flaky, smooth, shiny appearance and some voids/cavities, where graphite entered chitosan skeleton giving high surface area required for adsorption.

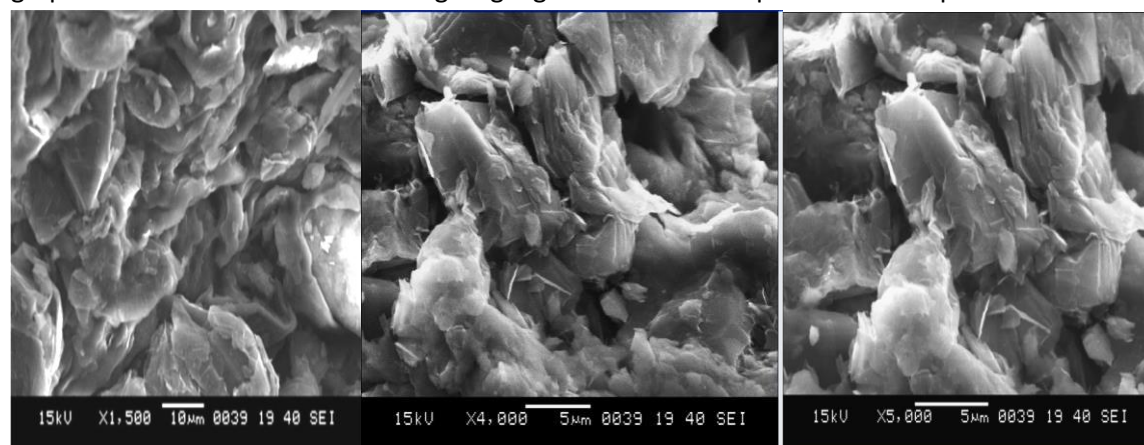


Fig. 1: SEM images of GDCC at (a) 1500 X (b) 4000 X (c) 5000 X



2.2.9 XRD

XRD pattern of pure chitosan, pure graphite and graphite doped chitosan is illustrated in **Fig. 2a, 2b** and **2c** respectively. X ray diffraction pattern of chitosan exhibited broad diffraction peak at $2\theta = 20^\circ$ with d- spacing of 4.2 Å is characteristics of semi crystalline chitosan [31]. A very small peak appeared at $2\theta = 20.74^\circ$ reported in chitosan and peak at $2\theta = 20.2^\circ$ that matches well with the literature [32]. The peaks are broadened due to the amorphous nature of chitosan skeleton. There is no impurity peaks observed in the XRD images of pure chitosan. The diffraction peak appeared at $2\theta = 26.5^\circ$ which indicated d- spacing of about 3.35 Å is a characteristic of graphite peak[33].The XRD pattern of the graphite doped chitosan indicated the formation of single phase composite and the peaks were obtained at 2θ value 26.5. The broad peak at around $2\theta = 20^\circ$ which was due to the chitosan decreased in intensity after doping with graphite which confirms that graphite is doped on the surface of chitosan. A predominant peak of graphite along with small peak of chitosan appeared in doped adsorbent showed graphite incorporation in chitosan matrix successful and effectively to provided a support adsorbent active sites.

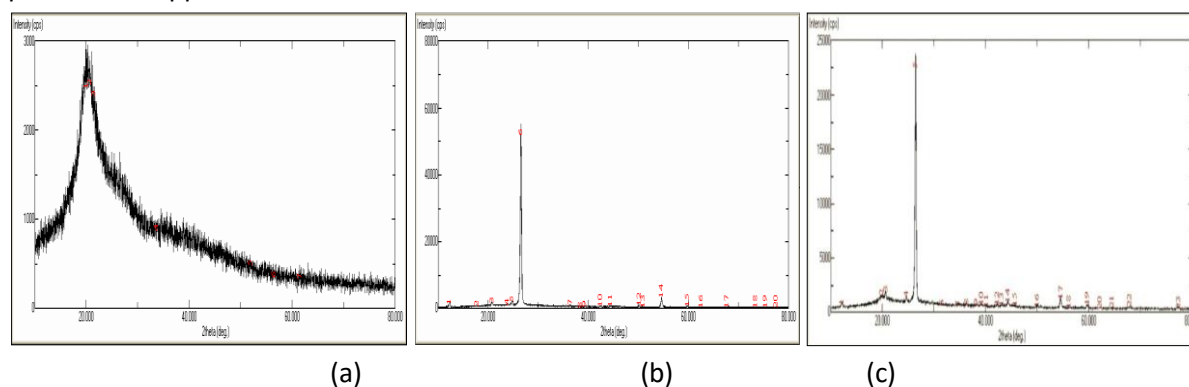


Fig. 2: Powder XRD pattern of (a) Pure chitosan (b) graphite (c) Graphite doped chitosan.

2.2.10 FTIR analysis

FTIR spectra of chitosan powder, graphite powder and chitosan/graphite blend before and after adsorptions of adsorbate are presented in (**Fig. 3**). Pure chitosan showed characteristics absorption band namely 3695 cm^{-1} and 3073 cm^{-1} for stretching vibration of -OH group. Absorption band at 2876 cm^{-1} in range of $2800\text{--}2950\text{ cm}^{-1}$ are assigned to the hydroxyl groups present in chitosan. 1667 cm^{-1} for carbonyl C=O stretch in amide and 1152 cm^{-1} for bridge-O-stretching. Bending vibrations of methylene/methyl groups found peaks at 1375 cm^{-1} and 1434 cm^{-1} respectively. The absorption peak at 1262 cm^{-1} attributed for C-O-H stretching. The broad peak at 1077 cm^{-1} ascribed to C-O stretching vibration of the ring C-O-H, C-O-C and CH_2OH [12, 17]. The absorption peak of chitosan at 1667 cm^{-1} for C=O stretch in amide was disappeared on graphite doping. Similarly absorption band of chitosan at 1375 cm^{-1} for C-H stretch was remarkably shifted to lower wave number of 1367 cm^{-1} . These two polymers i.e., chitosan and graphite are mixed and changes characteristic FTIR peaks due to reflection of physical blends/ interactions. These observations indicate the existence of good miscibility and doping between chitosan and graphite. The spectral analysis of graphite doped chitosan before and after adsorption of adsorbate showed that the peaks either decreases in intensity or disappear might involve in these anionic adsorption.

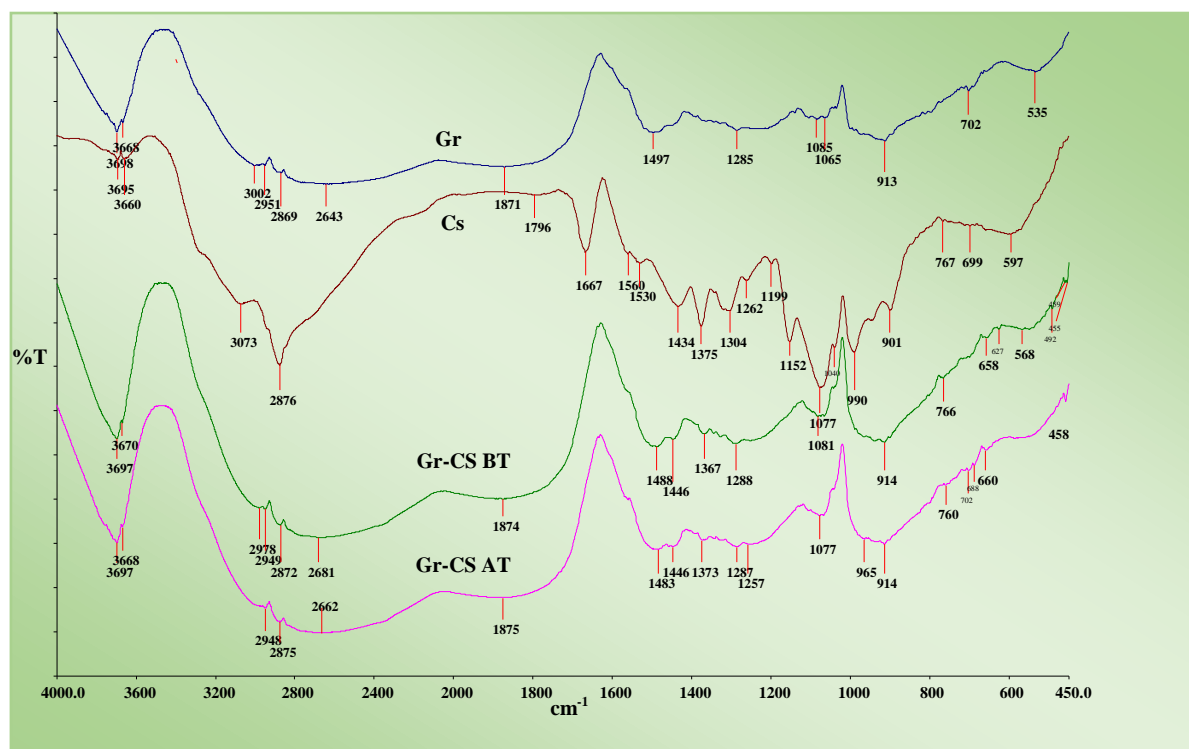


Fig. 3: FTIR spectrum of (a) pure graphite, (b) pure chitosan, (c) Graphite doped chitosan composite before adsorption (d) Graphite doped chitosan after adsorption.

2.2.11 Adsorption isotherm: The relationship between the amount of substance adsorbed per unit mass of adsorbent at constant temperature and its concentration in the equilibrium solution is called as adsorption isotherm. Equilibrium adsorption isotherms are vital to determine sorption capacity of phosphate/nitrate onto graphite doped chitosan. The experimental data were fitted into the Langmuir and Freundlich isotherm models. The kinetic parameters of phosphate and nitrate adsorption onto chitosan doped adsorbents were determined from the pseudo-first order and pseudo-second order models, as provided in Table-5. The reaction rate constants and chitosan sorption capacities for nitrate/phosphate were influenced by their initial concentrations. In the mixture of nitrate/phosphate, regardless of concentration, chitosan sorbent showed highest sorption capacity for phosphates.

Table-5: Kinetic parameters of nitrate/phosphate adsorption from pseudo-1st and 2nd order model

Adsorbate	Concentration (mM)	Pseudo-first order model (non-linear form)			Pseudo-second order model (non- linear form)			Exp. Data
		K_1	$Q_{e,cal}$	R^2	K_2	$Q_{e,cal}$	R^2	
		(1/min)	(mmol/g)	—	(g/mmol min)	(mmol/g)	—	
PO_4^{3-}	0.1	0.0894	0.0491	0.9744	2.0949	0.0563	0.9857	0.0505
	0.5	0.0539	0.1380	0.9952	0.3195	0.1720	0.9957	0.1411
	1.0	0.0491	0.2066	0.9913	0.1894	0.2599	0.9962	0.2111
NO_3^-	0.1	0.4075	0.0194	0.9803	25.72	0.0216	0.9988	0.0205
	0.5	0.2241	0.0888	0.8990	4.1673	0.0970	0.9459	0.0961
	1.0	0.2062	0.1512	0.9712	1.6432	0.1733	0.9868	0.1538

The intraparticle diffusion model found well fitted to experimental data indicated sorptions of nitrate/phosphate proceeds in two phases presumably, first adsorption of nitrate/phosphate anions



by active sorbent's surface, whereas second included slow absorption of nitrate/phosphate as shown in **Figure 4A** and **Figure 4B**. During both phases, nitrate/phosphate anions get penetrated into the composite structure of chitosan and exploits sorption underneath sorbent's surface.

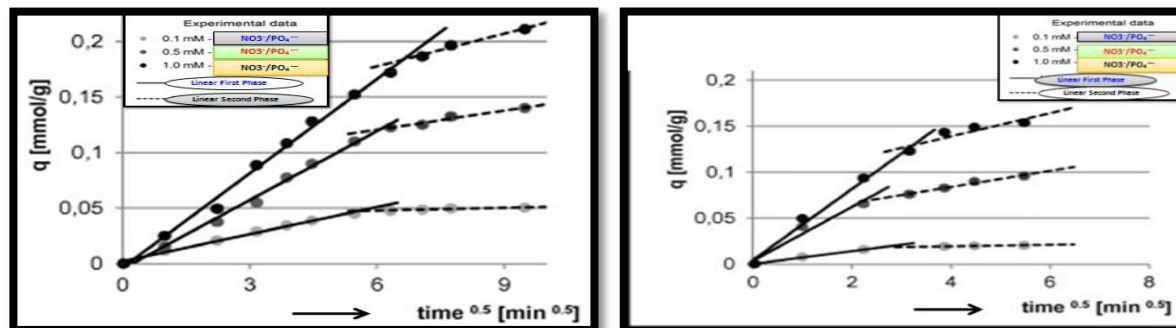


Fig-4 A: Intraparticle diffusion model for phosphate Fig-4 B: Intraparticle diffusion model for nitrate

Nitrate/phosphate sorption effectiveness found higher in the first phase of adsorption, compared to the second phase; however, first phase was much shorter. In the initial 10 minutes of adsorption the most intensive was the sorption of nitrates, which was indicated by high values of k_{d1} constant. A higher rate of nitrate was most probably due to the lower molecular mass than phosphate and their greater capability to penetrate the composite structure adsorbent. Then sorption of nitrates evolved into second phase with significant lower sorption after 30–40 min and then nitrates sorption ended, whereas phosphate sorption already evolved into the second phase and lasts for some more time 50–60 min. Owing to such prolonged sorption, phosphate anions gets more adsorbed onto as compared to nitrates as shown in **Table-6**.

Table-6: Adsorbate diffusion rate constants from intra-particle diffusion model

Sorbent	Sorbate	Molarit y (mM)	First phase of sorption			Second phase of sorption		
			k_{d1} (mmol g ⁻¹ min ^{-0.5})	Phase Time (min)	R^2	k_{d2} (mmol g ⁻¹ min ^{-0.5})	Phase Time (min)	R^2
Chitosan doped graphite	PO ₄ ³⁻	0.1	0.0082	30	0.93	0.0008	60	0.94
		0.5	0.0207	30	0.99	0.0057	60	0.96
		1.0	0.0283	40	0.99	0.0098	50	0.98
	NO ₃ ⁻	0.1	0.0090	5	0.99	0.0007	25	0.93
		0.5	0.0293	5	0.95	0.0088	25	0.98
		1.0	0.0387	10	0.98	0.0126	20	0.83

4.3. Maximum adsorption capacity

The adsorption isotherms of phosphate/nitrate sorption onto a chitosan composite sorbent are plotted in Figure-5. Data obtained were described using the heterogeneous Langmuir's model and Freundlich model. In each case, best fit to experimental data shown for Langmuir model.

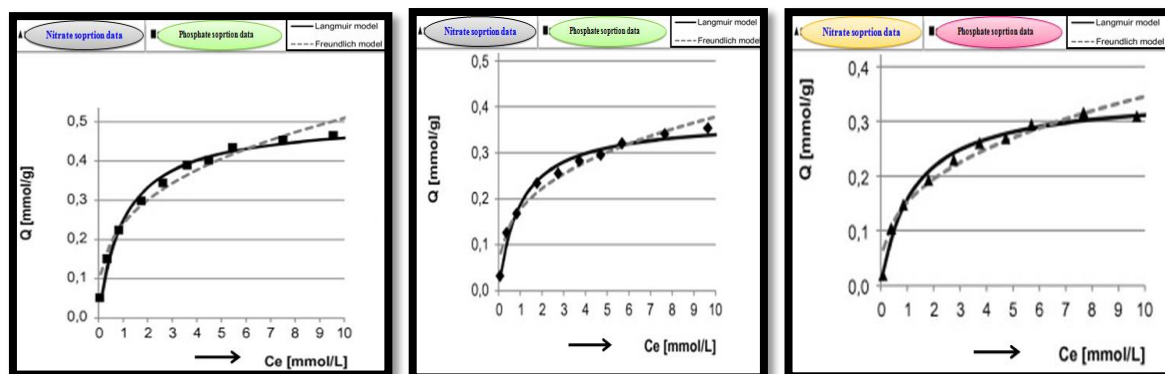


Fig-5: Isotherms of nutrients sorption: A phosphate/nitrates onto chitosan composites (from equimolar mixture) at NTP

In the Langmuir's theory, the binding of sorbate molecules with active adsorbent sites may be chemisorptions/physical in character (e.g. electrostatic interactions, hydrogen bonds). The sorbed adsorbates don't interact with each other and do not form a multilayer. They may, however, change the active centers and be substituted by sorbate from the solution. The mass of the sorbed substance is influenced by the maximum sorption capacity of a sorbent monolayer (Q_{\max}), and by sorbate affinity to sorbent (K_c). The analysis of adsorption isotherm shape and a relatively low value of K_c constant suggested nitrate/phosphate sorption capacity as largely depended on their concentration in solution (Fig. 11). The sorption capacity of 1 g of adsorbent reached 1.2 mmol of all nitrate/phosphate. Amid the used adsorbents for nitrate/phosphate sorption, chitosan showed the highest affinity to phosphates reached 0.51 mmol PO_4^-/g , and 0.36 mmol NO_3^-/g , respectively. Thus the phosphate/nitrate affinity at sorption 'sites in form of hydrogel beads is ordered as follows: $\text{PO}_4^- > \text{NO}_3^-$. The isothermal adsorption constants and sorption capacities were determined from Langmuir's and Freundlich model as summarized in 7, whereas comparison of the effectiveness of nutrients sorption on various sorbents is presented in Table-8.

Table-7: Langmuir's and from Freundlich Constants determined at same conditions.

Sorbent	Pollutant	Langmuir model				Freundlich model		
		$Q_{\max}(\text{mmol/g})$	$Q_{\max}(\text{mg/g})$	$K_c (\text{L/mmol})$	R^2	n	K	R^2
Chitosan graphite	phosphate	0.507	15.72	0.952	0.98	0.33	0.24	0.97
	nitrate	0.350	4.90	0.818	0.98	0.36	0.15	0.96

Table-8: Comparative sorption capacity of varied adsorbents for nitrate/phosphates

Sorbent type	Adsorbate Anions	Q_{\max}		pH
		(mmol/g)	(mg/g)	
Chitosan gels	Equimolar mixture ($\text{PO}_4^{3-}/\text{NO}_3^-$)	1.23 (0.51/0.35)	25.84 (15.72/4.90)	4.0
Chito hydrogels	PO_4^{3-}	1.29	39.90	4.0
Soil (schist)	PO_4^{3-}	0.12	3.62	6.5
Corn bio-char	PO_4^{3-}	0.01	0.17	7.4
Chitosan gels	PO_4^{3-}	0.91	12.71	4.0
Nano- Al_2O_3	PO_4^{3-}	0.39	5.48	4.4



Among the literature reported and synthesized chitosan sorbents, comparative highest affinity to nitrate/phosphate is found for graphite doped chitosan sorbents [11-17] as shown in Table-9. The relatively sorption capacity of 1 g of adsorbent for 1.29 mmol phosphate and 0.9 mmol nitrate was similar, and pointed similar adsorption via binding and to competition between anions for adsorbent active sites. The graphite doped chitosan composites were successfully applied for nitrate/phosphate sorption from aqueous solutions. The effectiveness of NO_3^- sorption onto chitosan sorbents increases along with a decreasing pH and lowest pH=4/acidic conditions enhances sorption capability. Nitrates sorption at lower pH, i.e. pH 2-3, requires the use of cross-linked chitosan which is resistant to dissolution at low pH may significantly increase sorption capability of adsorbent higher compared to unmodified/pure chitosan. An advantage of doping onto chitosan skeleton enhanced its high sorption effectiveness in a wide pH range (pH 2 - 6). Kinetics of nitrates sorption onto doped chitosan is best described with the pseudo-second order model and intraparticle diffusion model points to three stages of nitrate sorption [11]. The equilibrium time of the sorption process for doped chitosan composites reaches 180 min, but most nitrates sorbed within first 30 min of process.

Table-9: Comparative adsorption capacity for nitrate removal from water

S.N.	Type of sorbent	Maximum sorption capacity (mg/g)	Initial pH
1	Chitosan cross linked epichlorohydrin	38.47	3.0
2	Chitosan cross-linked glutaraldehyde	34.99	3.0
3	Chitosan hydrogels/beads	12.71	4.0
4	Chitosan-coated Zeolite	10.39	5.0
5	Activated Carbon (Commercial)	1.22	6.0
6	Graphite doped chitosan	30.1	4.0

2.2.12 Effect of pH on effectiveness of nitrate/phosphate sorption: The adsorption of analyzed nutrients (nitrate/phosphate) found to be influenced by solution pH. In a pH value range from 4 to 11, the effectiveness of (nitrate/phosphate) sorption onto chitosan in the form of hydrogel composites decreased with an increasing initial pH of solution Figure-6, similar trend observed for nitrate/phosphate sorption onto polymer-chitosan composites[12-14].

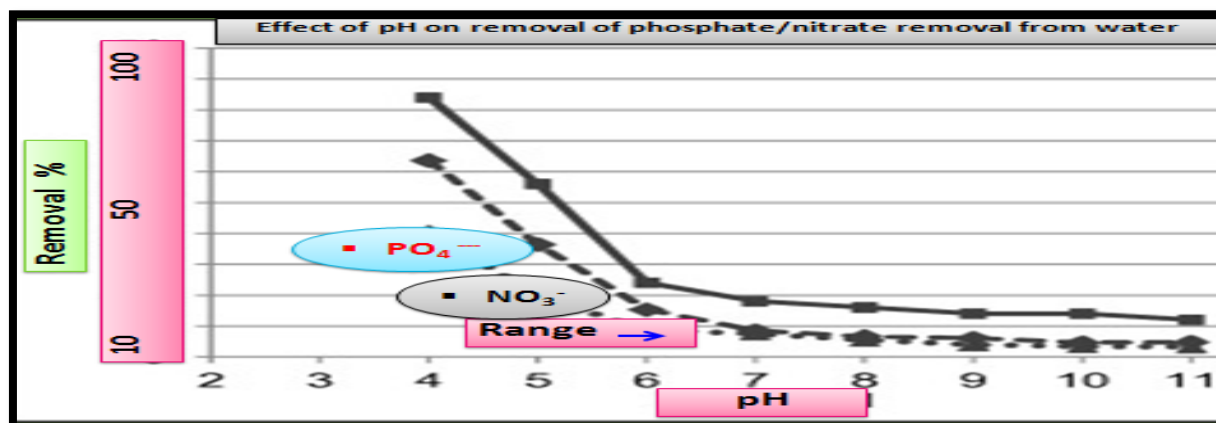


Fig-6: Effect of pH on effectiveness of nitrate/phosphate sorption onto doped chitosan

The nitrate/phosphate adsorption capacity by chitosan composite was resulted due to the electrostatic attraction between protonated amine of chitosan with anionic adsorbent sites. As number of protonated amino groups increases (at low pH) then the sorption of nitrate/phosphate



increases as solution pH decreases. For this reason, the effectiveness of anionic nitrate/phosphate sorption was the highest in acidic solutions at pH 4 as shown in Fig. And above initial pH > 4, the sorption of nitrate/phosphate onto adsorbent surfaces was ineffective and the lowest sorption was determined in a pH 8 to 11 range. But in alkaline pH, the chitosan surface attains a negative charge, and gets electrostatic repulsion with anionic repulsion to prevent their sorption. The very low repulsive sorptions at high pH are also due to competition between and OH⁻ ions nitrate/phosphate anions at the sorption centers of adsorbents. At the initial pH < 4 the electrostatic repulsion between chitosan skeleton found so strong that the chitosan sorbent gets dissolved and lost its adsorption ability so, adsorption between initial pH 2–3 were excluded in Fig. 4. A lower effectiveness of nitrates sorption onto chitosan are due to weaker electrostatic interactions with sorbent's surface. In the pH range from 4.0 to 5.0, most of nitrates possessed the total neutral charge to suppress the electrostatic interactions with protonated –NH₃⁺ of graphite doped chitosan. Thus negative charge of nitrates found distributed among a few oxygen and poorer electrostatic interactions of nitrates with active sites of adsorbents gets induced by dispersion besides impaired sorptions. And phosphate ion exists as dihydrogen phosphate at acidic conditions and charge gets concentrated which increases interactions with protonated amines as shown in **Figure7**.

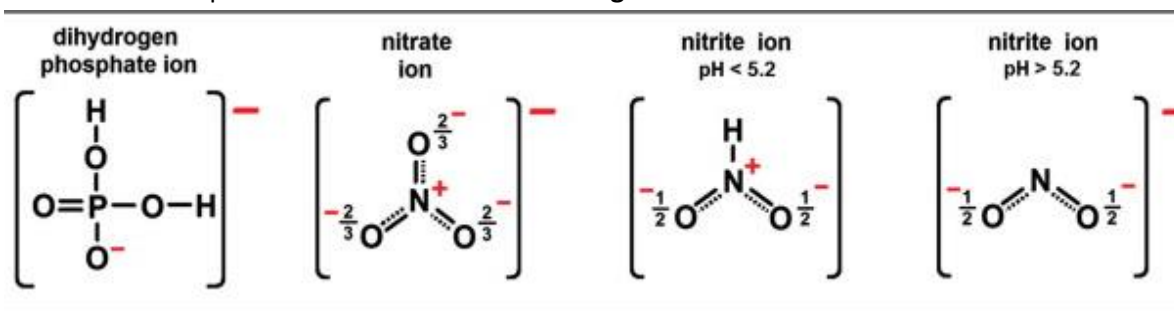


Fig-7: Structures of predominate nitrate/phosphate anions in a pH range from 2 to 6.5.

Chitosan based adsorbent own a great influence on pH changes during sorption and with pH 4 to 9 range, whit decreased sorption and pH 7 to 8 regardless of ionic strength of solution. This is anticipated in the wastewater treatment processes because the solution neutralizes itself throughout the sorption and adjustment of its pH after treatment is unnecessary.

3. Results and Discussion

3.1. Effect of graphite doping: The effect of graphite doping on chitosan for removal of nitrate/phosphate were studied from 5 % to 30 % w/w. It was observed that 20 % of graphite doping is optimum and higher graphite doping induced leaching from composite skeleton besides the permissible limit in water gets achieved with mere 20 % graphite loading.

3.2. Effect of adsorbent/composite dose: Adsorbent dose affected adsorption at fixed initial nitrate/phosphate concentration as shown in Fig. As absorbent dose enhanced, the nitrate/phosphate removal found increased but, loading capacity found gradually decreased. The maximum nitrate/phosphate removal capacity was 3.5 mg/g for 2.5 g/l of dose as shown in Fig. 11. Initially, higher nitrate/phosphate adsorbed per unit mass of adsorbent (due to more adsorbate/adsorbent ratio) which continued to increase up to dose of 10 g/L adsorbent. Further increase in adsorbent doses not showed appreciable progress in nitrate/phosphate removal relatively negligible sorption.

3.4. Effects of pH: Effect of pH value on the effectiveness of NO₃ sorption onto chitosan adsorbents was found to increase along with a decreasing initial pH and highest at an optimal pH 4, the removal



rate reached 70%, 81% and 95% for initial nitrate concentrations of 10, 50 and 100 mg nitrate. At optimal pH, the effectiveness of phosphate sorption reached 48%, 40% and 34%. The increased effectiveness of nitrates sorption at low pH may be caused by chitosan-amine group's protonation and electrostatic forces between positively-charged sorbent and negatively-charged nitrate/phosphate anions significantly enhanced the adsorption process. Such type of impact at low pH conditions for nitrates adsorption also investigated with activated carbon [10], sepiolite [11] and aluminium oxide [12]. But at $\text{pH} > 7$ (alkaline medium) OH^- ions competes with nitrate/phosphate and significantly impaired adsorption. Amid analysed adsorbents, pure chitosan displayed the lowest adsorption capability against nitrate/phosphate. The sorption of nitrate/phosphate was significantly more effective upon the use of doped chitosan composites; however, this processes required pH value adjustment to pH 3. The best sorbent of nitrate/phosphate turned out to be graphite doped chitosan shows high sorption capability in a wide range of pH values (pH 2 - 6).

3.6. Effect of agitation speed: In adsorptions agitation speed is vitally affecting the external boundary film and the distribution of nitrate/phosphate in the bulk solution. Hence, agitation speed was varied in range of 50–300 rpm for adsorption experiments. Initially, adsorbate adsorption was lower at 50, 100 and 150, but enhanced at 180 and remains steady > 200 rpm (so kept optimal speed) attributed to little boundary layer resistance besides high mobility.

3.7. Regeneration of composite/adsorbent: Regeneration/desorption for adsorbed chitosan composites were performed at $\text{pH} = 8$ after every cycle of adsorption. Initial electrostatic binding of nitrate/phosphate onto amino/hydroxyl gets weakened drastically in extreme basic $\text{pH} > 8$ due to competition with OH^- . Literature, supports decreased nitrate/phosphate removal at $\text{pH} > 7$ due to inability of proactive sites of composite. It's known that at basic conditions ($\text{pH} > 7$) chemisorptions decreases, due to deprotonation of chitosan surface. Adsorbents were reused in 4 cycles of adsorption with small reduction in removal capacity.

3.9. Adsorption Mechanism: The proponents of nitrate/phosphate adsorption argued its economical efficiency occurred in following phases and depicted in **Figure-8**:

- (1) Adsorbate diffuses to surface from bulk across boundary layer via external mass transfer;
- (2) Adsorption of dsorbate on to particle surfaces of adsorbent;
- (3) Sorbed adsorbate exchange with structural elements inside adsorbent and transferred to internal surfaces for porous via intra particle diffusion [15].

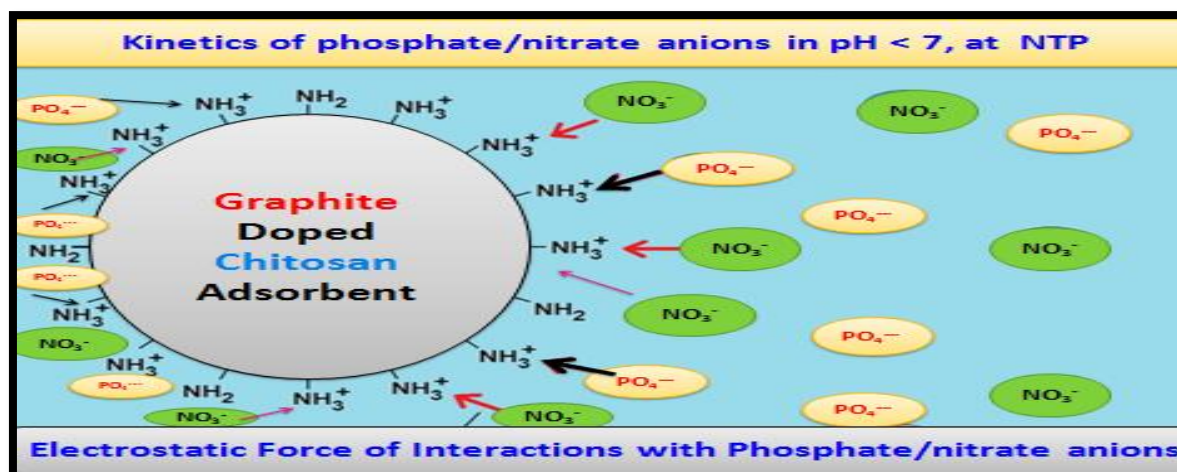


Fig-8: Adsorption Kinetics of phosphate/nitrate anions onto graphite doepd chitosan



3.10. Preparation scheme for graphite doped chitosan composites: At first, chitosan obtained as cross-linked flakes that were converted into hydrogels by dissolving in 5% aqueous acetic acid and this pH inversion collision affected hydrophilic and phobic interaction to induce spontaneous entanglement of chitosan network to self-standing microsphere gel with chitosan content 2 to 3 % as dispersed in 95 % water (Swain, Airoidi, 2009). This followed by coagulation in an alkaline solution which subsequently formed viscous droplets/bids which were treated with graphite residue to yield desired composite powder after drying and proper meshed/crushing as represented in **Figure-9**. While chitosan's gel drying via evaporation causes dramatic shrinkage with continuity in pore size ranging from large mesopores to macropores and lose its porosity owing moderate specific surface area. This macroporosity of developed bids is attributed to space zones of contacts between chitosan fibrils though impregnation on amino groups by dopents [13,14-17].

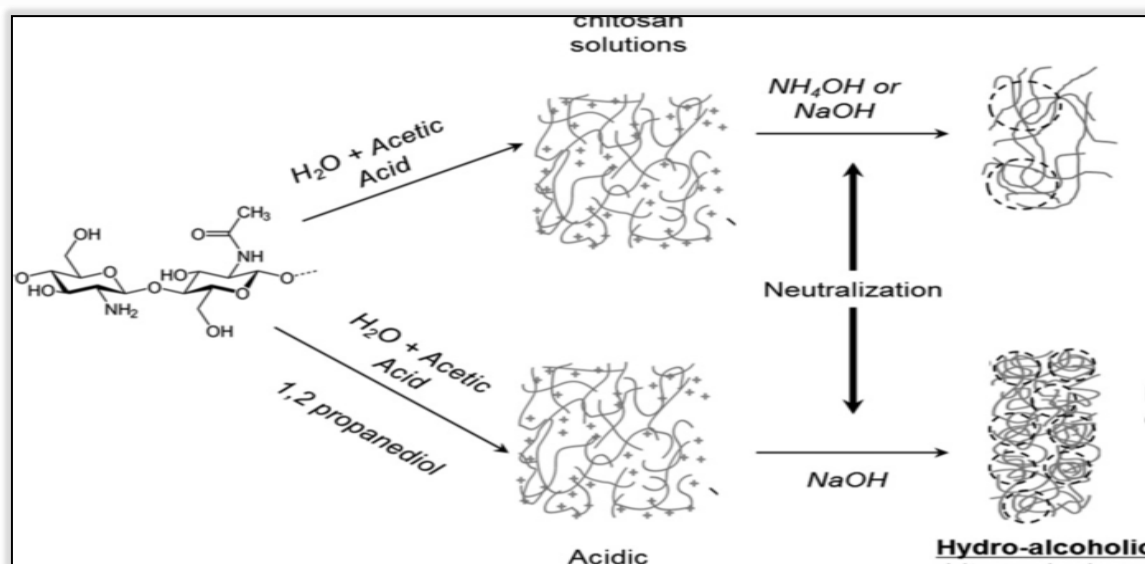


Fig-9: Preparation scheme of graphite doped chitsan composite (scale = 5 mm).

4 Conclusions

Graphite doped chitosan composites acts as an effective sorbent for nitrate/phosphates under acidic pH. The agreeable sorption achieved at appropriate pH of the solution and strictly specified process duration. The optimal pH for sorption onto was pH 4. Further assorption of nitrate/phosphates at pH > 5 is found to be ineffective as system always tends to reach the pH value close to the zero point of charge of chitosan, i.e. $pH_{ZPC} = 7.6$. Thus solves the issue of water neutralization after the sorption treatments. The maximal quantity of nitrate/phosphates capable to be bound by chitosan composite is over 1 mmol/g. The experimental data analysis indicates to tangible competition between nitrate/phosphate for sorption centers of adsorbent surfaces. Thus suggested to apply for treatment of solutions wherein the predominating contaminant is nitrate/phosphate as the final stages of treatment i.e., after bio-treatments.

The nitrate and phosphate adsorption capacities of silica and graphite doped chitosan bio-composites were successfully assessed for good adsorption capacities towards both nutrients. Chitosan doped graphite own relatively higher adsorption capacity for nitrate and phosphate, respectively. Adsorptive removal of nitrate and phosphate generally depends on specific adsorption



sites rather than BET surface area. The adsorption isotherms of phosphate on all the adsorbents are favourable, while nitrate adsorption isotherms are slightly favourable and almost linear. Hence, the adsorptive removal of nitrate seems to be more difficult than phosphate. From kinetic analysis, it is found that the adsorption uptake of nitrate and phosphate was initially rapid but becomes slower by approaching equilibrium. In describing kinetic data, the pseudo-second-order model gives marginally better predictions than the first-order model. Thus, non-expensive and benignly prepared chitosan composites are promising adsorbents for the separation of specific nutrient like nitrates/phosphates from water.

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A REVIEW OF FLUOROSIS – WORLD SCENARIO

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ABSTRACT

Fluoride pollution in the environment occurs through two channels, namely natural and anthropogenic sources. Fluoride is frequently encountered in minerals and in geochemical deposits and is generally released into subsoil water sources by slow natural degradation of fluorine contained in rocks.

Introduction:

Fluoride pollution: Fluorine, the 13th most abundant element of the earth's crust, represents about 0.3g/kg of earth's crust. Fluorine in the environment is therefore found as fluorides which together represent about 0.06–0.09 per cent of the earth's crust. The average crustal abundance is 300 mg/kg . Fluorides are found at significant levels in a wide variety of minerals, including fluorspar, rock phosphate, cryolite, apatite, mica, hornblende and others . Fluorite (CaF_2) is a common fluoride mineral of low solubility occurring in both igneous and sedimentary rocks. Fluoride is commonly associated with volcanic activity and fumarolic gases. Thermal waters, especially those of high pH, are also rich in fluoride. Minerals of commercial importance include cryolite and rock phosphates. The fluoride salt, cryolite is used for the production of aluminium and as a pesticide. Rock phosphates are converted into phosphate fertilizers by the removal of up to 4.2 % fluoride ; the removed and purified fluoride (as fluorosilicates) is a source of fluoride that in some countries is added to drinking-water in order to protect against dental caries. Fluorine is an important element for human beings, as it helps in growth and prevents the enamel of the teeth from dissolving under acidic conditions. Various dietary components influence the absorption of fluorides from gastrointestinal tract and the absorbed fluorides are distributed throughout the body. Drinking water and sea food are good sources of fluoride. Fluoride is beneficial to health if the concentration of the fluoride ion (F^-) in drinking water is less than 1.5 mg/L .

Fluoride is "more toxic than lead and less toxic than arsenic" and is an accumulative toxin. Fluoride has dual significance; if its content is less then it may result in problems like dental caries. World Health Organization (WHO) recommends it in the range of 0.1– 0.5 mg/L. The standard of the United States is between 0.6 and 0.9 mg/L, and of India 1.0 and 1.5 mg/L. Thus the requirement of fluoride content varies among countries and depends on the geography and the age of people involved.

Drinking-water is typically the largest single contributor to daily fluoride intake . However, as noted above, this is not necessarily true in every case . For a given individual, fluoride exposure (mg kg⁻¹ of body weight per day) via drinking-water is determined by the fluoride level in the water and the daily water consumption (litres per day).

The fluoride content of air, water and food determine intake of fluoride depend mainly on the geographical areas. Food seems to be the source of 80%– 85% of fluoride intake, intake from drinking water is 0.03 – 0.68 mg/day and from tooth paste 0.2 mg – 0.3 mg .

FLUOROSIS – WORLD SCENARIO

The latest information shows that fluorosis is endemic in at least 25 countries across the globe . The total number of people affected is not known, but a conservative estimate would number in the tens of millions. In 1993, 15 of India's 32 states were identified as endemic for fluorosis . In Mexico, 5 million people (about 6% of the population) are affected by fluoride in groundwater. Fluorosis is prevalent in some parts of central and western China and caused not only by drinking fluoride in groundwater but also by breathing airborne fluoride released from the burning of fluoride laden coal. Worldwide, such instances of industrial fluorosis are on the rise.

Figure indicates the probability of occurrence of excessive concentrations of fluoride in groundwater in Asia, on a scale of high-medium-low. In India, the chances of occurrence of fluoride has been rated as



medium, and the regions are concentrated in Andhra Pradesh, Karnataka, Tamil Nadu, Gujarat and South Rajasthan

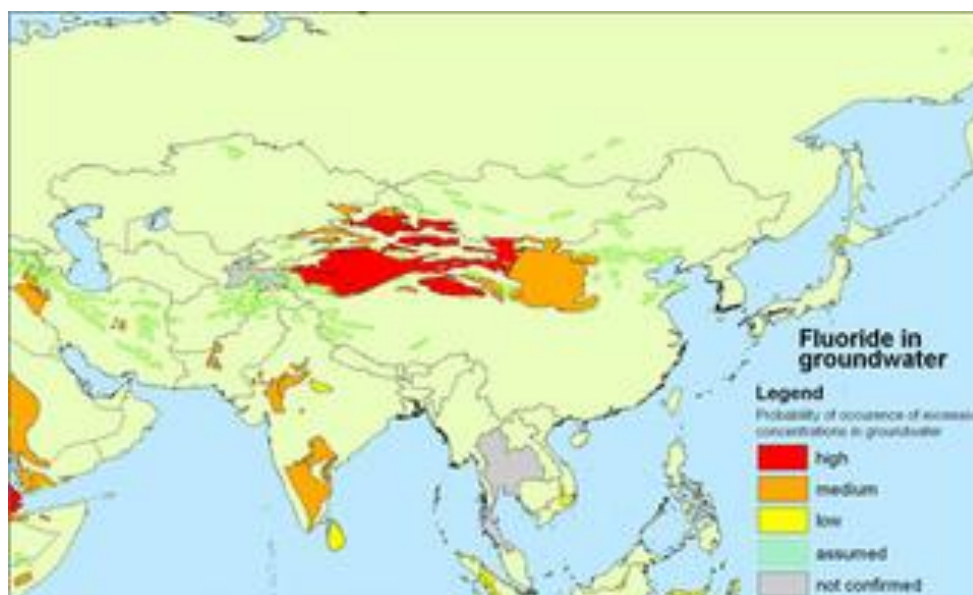


Figure1 : Excessive concentrations of fluoride in groundwater in Asia

The fluoride concentration in water bodies in endemic areas in India has been reported to vary from 0.12 – 24.17 mg/L. Argentina, USA, Morocco , Algeria, Tanzania, Brazil, Turkey, Uganda, Ethiopia, Pakistan , Kenya, New Zealand , Japan, Eritrea, Tanzania , Germany, South Africa, China, Australia, Brazil, Canada, Thailand, Ethiopia and Mexico have endemic fluorosis.

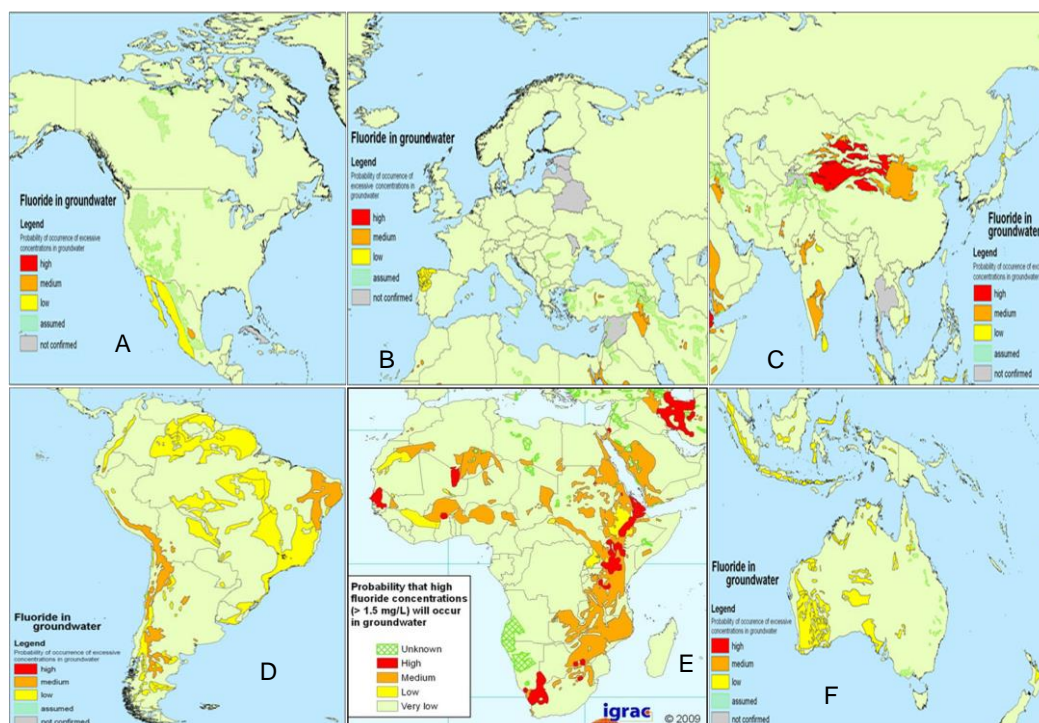


Figure 2: Fluorosis around the globe (from clock wise A-North americ;B- Europe;C-Asia;D- South america;E- Africa; F-Australia)

TOXICITY OF FLUORIDE –INDIAN SCENARIO

The presence of various hazardous contaminants like fluoride, arsenic, nitrate, sulfate, pesticides, other heavy metals, etc. in underground water has been reported from different parts of India . Endemic fluorosis is a



public health problem in India. Sixty two million people including 6.0 million children in the country in nearly 25 states, 150 districts are affected by dental, skeletal or non skeletal fluorosis (Table). Medical advice recommends that drinking water should not contain more than 1.5 mg/L of fluoride. Concentration of fluoride below 1.5 mg/L is helpful in prevention of tooth decay, and such a level of fluoride also assists in the development of perfect bone structure in human and animals. However, doses of fluoride above 1.5 mg/L increase the severity of tooth mottling and induce the prevalence of osteoporosis and collapsed vertebrae. Fluorosis has no treatment and is considered to be a deadly disease. High fluoride content in water even causes change in the shape and colour of the fruits and vegetation.

Fluorosis was first detected in India when the disease was prevalent in four states, namely Andhra Pradesh, Tamil Nadu, Punjab and Uttar Pradesh. During the period 1960-1986, nine more States have been identified as endemic for fluorosis and during 1990-1992, and two additional States, Kerala and Jammu & Kashmir, have also been identified as endemic for the disease. Thus the total number of States declared endemic for fluorosis at present is 25. We affected states and the range of fluoride concentrations have been comprehensively presented in the Table.

Fluoride-Andhra Pradesh scenario: In Andhra Pradesh, the occurrence of fluoride was reported in 1937 in some areas of Podili, Darsi and Kanigiri Talukas of the erstwhile Nellore district . Studies on the incidence of fluoride in the drinking water resources of Andhra Pradesh revealed that fluoride content in Yellareddiguda village of Nalgonda district as 20 mg/L. Epidemiological investigations conducted in selected places in the endemic tracts of Ananthapur, Nalgonda and Prakasam district of Andhra Pradesh revealed prevalence of dental fluorosis associated with 0.8 – 3.5 mg/L of fluoride in drinking waters, and the prevalence of bone fluorosis was recorded with fluoride concentration of 5.0mg/L and above. Varying amounts of fluoride ranging from 0.1 to 2.0 mg/L in water resources of Andhra Pradesh were reported and investigations on the chemical composition of fluoride bearing water revealed that water with excess fluorides usually has high alkaline and low calcium content. Results of ground water quality in Visakhapatnam town indicate that the fluoride concentration is in the range from 0.5 to 7.5 mg/L. The places having the value of more than 1.5 mg/L are affected by industrial effluent, chemical fertilizers, and seawater and fluorine minerals. High fluoride concentration was reported in Kondapalem (1.28 to 3.58 mg/L) and Koduru (1.22 to 3.52 mg/L) and the water is alkaline in nature and cannot be used for domestic purpose due to excess concentration of phosphorous and fluoride. The chemical analysis of ground water of southwest Sadasivpet near Hyderabad indicated fluoride content in the range from 0.3 to 1.9 mg/L . Fluoride concentration in the range from 1.5 to 10.0 mg/L has been reported in Sivannagudem area of Nalgonda district . The high fluoride concentration in ground water is attributed to the presence of fluorite and apatite minerals in the porphyritic granites of the region. The use of phosphatic fertilizers, which are being leached down to the mainground water body by return irrigation flows might also be one of the contributing factors for high fluoride concentration, Studies on the quality of ground water of Kakinada town indicated that fluoride concentration is within permissible limits, but it was found that fluoride content increased with decrease in salinity. The fluoride concentration in the district varied from 0 to 44 mg/L. The fluoride concentration in water bodies in endemic areas in India has been reported to vary from 0.12 – 43mg/L (Figure).

Table : Districts known to be endemic to fluoride in the various States of India

States	Districts	Range of fluoride concentration(mg/L)
Assam	Karbianglong, Nagaon	0.2 – 18.1
Andhra Pradesh	All districts except Adilabad, Nizamabad, West Godhavari, Visakhapatnam, Vijzianagaram, Srikakulam	0.11 – 20.0
Bihar	Palamu, Daltonganj, Gridh, Gaya, Rohtas, Gopalganj, Paschim, Champaran	0.6 – 8.0



Delhi	Kanjhwala, Najafgarh, Alipur	0.4 – 10.0
Gujarat	All districts except Dang	1.58 – 31.0
Haryana	Rcwari, Faridabad, Karnal, Sonipat, Jind, Gurgaon, Mohindcrgarh, Rohtak, Kurukshetra, Kaithal, Bhiwani, Sirsa, Hisar	0.17 – 24.7
Jammu and Kashmir	Doda	0.05 – 1.21
Karnataka	Dharwad, Gadag, Bcllary, Bclgam, Raichur, Bijapur, Gulbarga, Chitradurga, Tumkur, Chikmagalur, Many, Bangalore, Mysore	0.2 – 18.0
Kerala	Palghat, Allepy, Vamanapuram, Alappuzha	0.2 – 2.5
Maharashtra	Chandrapur, Bhandara, Nagpur, Jalgaon, Bulduna, Amravati, Akola, Yavatmal, Nandcd, Sholapur	0.11 – 10.2
Madhya Pradesh Orrissa	Shivpuri, Jabua, Mandla, Dindori, Chhindwara, Dhar, Vidhisha, Seoni, Sehore, Raisen and Bhopal, Phulbani, Koraput, Dhenkanal	0.08-4.2 0.6 – 5.7
Punjab	Mansa, Faridcot, Bhatinda, Mukstar, Moga, Sangrur, Fcrozpur, Ludhiana, Amritsar, Patila, Ropar, Jallandhar, Fatehgarh sahib	0.44 – 6.0
Rajasthan	All the 32 districts	0.2 – 37.0
Tamilnadu	Salem, Periyar, Dharampuri, Coimbatore, Tiruchirapalli, Vellore, Madurai, Virudunagar	1.5 - 5.0
Uttar Pradesh	Unnao, Agra, Meerut, Mathura, Aligarh, Raibareli, Allahabad	0.12 – 8.9
West Bengal	Birbhum, Bardhaman, Bankura	1.5 – 13.0

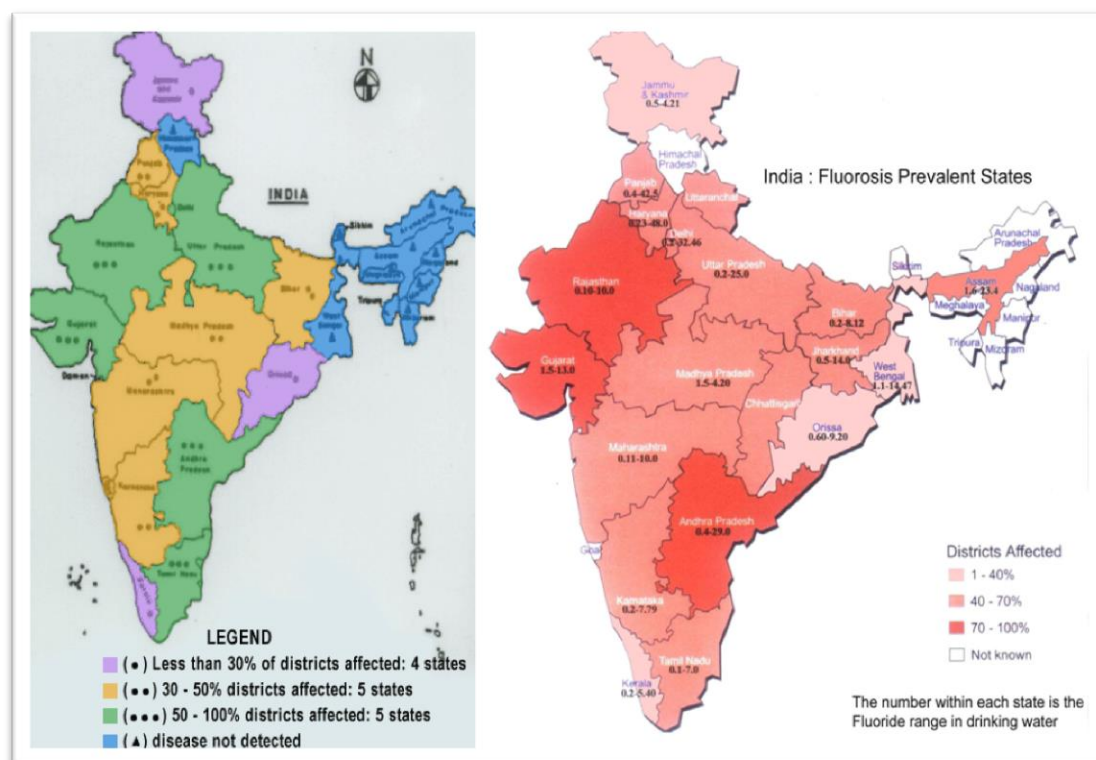


Figure 3 : Fluorosis status in India

SOLUTIONS TO THE PROBLEM

A community with excessive fluoride in its water supply may meet the local Maximum Concentration Limit in one or more of several ways. Fluoride poisoning can be prevented or minimized by:

1. Using alternate water sources:
2. By improving the nutritional status of population at risk and
3. By removing excess fluoride (defluoridation).

Defluoridation: Defluoridation refers to methods of water treatment that reduce the concentration of fluoride in the water, normally, in order to make it safe for human consumption. Some water treatments that have the capacity of reducing the fluoride concentration along with most other anions, and/or cations, in the water, are not considered as defluoridation methods. Thus, general methods like distillation, reverse osmosis, electro dialysis and resin de-ionization, which are able to remove fluoride fully or partly from the water, are not considered as defluoridation methods. On the other hand, methods that only remove fluoride without any addition or reduction of other parameters have not yet been discovered. That is why the expression "fluoride removal" lacks precision. Defluoridation is used to characterize methods that reduce the fluoride ion specifically, without *major* other changes to the quality of the treated water. Defluoridation of large quantities of water, out of which only a small part is used for human consumption, is environmentally unsound. This is because of accumulation of correspondingly large quantities of toxic sludge that would create a new problem, more severe to deal with.

Defluoridation, is only required on a small scale, mostly in rural areas in developing countries. As such, many defluoridation approaches have been launched, proclaiming success, without unbiased field proof and thorough optimization (Figure 1.6). Further confusion comes with the fact that the process or the technical set-up that may work in one context of socio-economic and environmental conditions may fail in another. Local availability and acceptability of the required materials, fluoride contamination level and water quality are major factors to be considered when selecting the process and the design that minimizes the capital and running costs.



Methods	domestic + low costs	community + low costs	domestic + high F removal	community + high F removal	domestic + brackish water	community + brackish water
Activated Alumina						
Ion exchange						
Reverse osmosis						
Electrodialysis						
Nalgonda process						
Contact precipitation						
Bone Charcoal						
Calcined Clay						
Water Pyramid/Solar Dew						

Figure : Fluoride removal methods and its suitability.

The colours in the matrix correspond with the appropriateness of the method for the given situation:

- Green colour means that the method is very suitable
- Orange colour means average suitability
- Red colour means that the method is unattractive or not applicable for the given situation.

Defluoridation technology has to be simple, affordable, reliable and operational at least at three different levels: vide Figure1.6 (98)

- Domestic level, e.g. in the kitchen where piped water may or may not be available.
- Institutional level, e.g. in schools or a working place where piped water may be available, and the defluoridator is protected from theft or misuse.
- Community level, e.g. in a village or a market where the defluoridator is supplied with water often intermittently through a pipe or a hand or power pump.

Numerous methods have been described employing various materials for fluoride removal since the 1930's. Several methods have been suggested for removing excessive fluoride in water. The process may be classified broadly into adsorption (99-100), precipitation (101-102), ion exchange (103), donnadialysis, electro dialysis(104-105), reverse osmosis (106), and nanofiltration(107). Of these, Ion-exchange, reverse osmosis and adsorption are the conventional methods for the removal of fluoride. But the ion-exchange and reverse osmosis methods are relatively expensive. Therefore, still adsorption is the viable method for removal of fluoride.

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PERSONAL CARE PRODUCTS HAVOC TO AQUATIC ENVIRONMENT

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ABSTRACT

Personal care products (PCPs) is a generic term that describes a group of organic chemicals included in different products widely used in daily human life such as tooth pastes, cosmetics, shampoo, soap etc., PCPs are new substances that have been released into the environment during the last decades due to changes in the socio-economic structure in the society. After using the PCPs, the remnants of them are released into the aquatic environment. These compounds can be a potential risk to the aquatic environment due to low bio-degradability. Among different PCPs antiseptics and disinfectants are high in use and also hazardous as they contain benzotriazole, triclosan, triclocarbons. Which act upon endocrine system and adversely change the length, sex ratio and sperm count in some fishes. New and improved waste water management technologies must be adapted in order to removal of these harmful chemicals in the pollutants before releasing them into water bodies to safeguard the aquatic environment.

Keywords: Personal care products, biodegradability

TOTAL SYNTHESIS OF PATULOLIDE C

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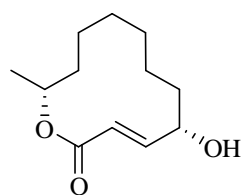
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Abstract

Patulolide C is twelve membered macrolide and it was isolated from *Penicillium urticae* S11R59 by Yamada and co-workers. Patulolide C showed antifungal, antibacterial, and anti-inflammatory activities.¹⁻²

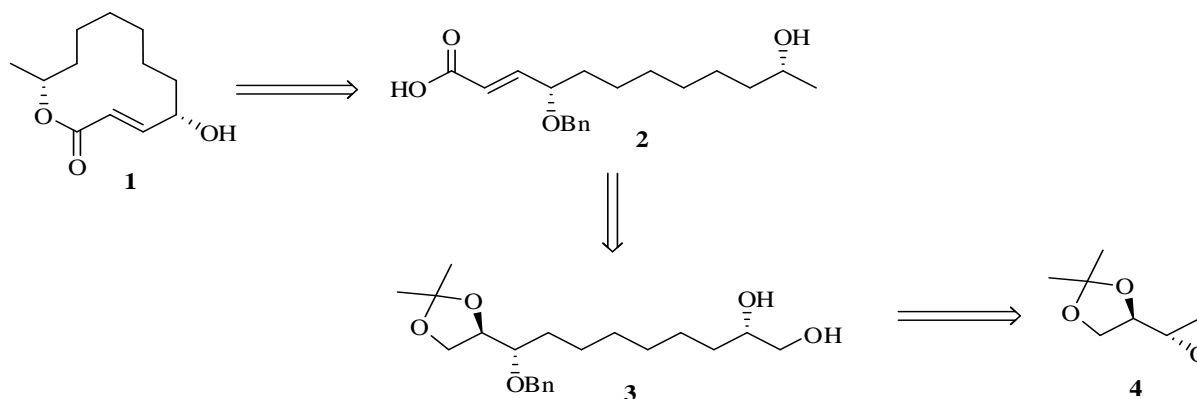


Patulolide-C



Retrosynthesis:

Retrosynthetic analysis of **1** is outlined in Scheme 1. The macrolide **1** could be obtained by Yamaguchi macro lactonization followed by deprotection of benzyl ether of hydroxy acid **2**. Hydroxy acid **2** could be synthesized from diol **3**. The diol **3** could be obtained from known chiral epoxide **4**.



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PHARMACEUTICALS AND ENVIRONMENT

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ABSTRACT

Pharmaceutical residues are environmental concern when they enter into the system. Consumption of human medicines is around 50 to 200 g. per individual per year in the world. Animal medicines are used in smaller quantities. But veterinary drugs towards pets are also another concern in the future. Unused medicines are not recovered that much it may be around 50% or less the rest is more threatening in the environment. We the present generation is totally lacking global view of what happens when these medicinal products are discharged into the environment, and further characterization of possible exposure routes for humans is necessary., which raises the question whether this represents a risk for exposed plants, animals and microbes, or for humans.

This study characterizes the intensity of the environmental effects of medicinal products, personal care products being excluded. The objective was to identify the causes of their presence in the environment, and suggest ways to adapt in order to address it. The major portion of drugs used orally is generally excreted as active substance in the urine of humans, another major portion of drugs disposed in sinks and toilets, finally ends up in the environment. Sometimes excessive consumption of drugs also is at the origin of unnecessary releases into the environment.

Once in the environment, the medicinal products are transferred between different components of the environment (water, soil, air). Food chain receives Highly lipid-soluble medical products which have the ability to accumulate in the fat tissues. These products can degrade either by being digested and metabolized by organisms, or through physico-chemical processes in soils and



water. Some degradation products can be persistent even after wastewater treatment are highly concern.

For a range of pharmaceuticals, environmental risks can be rather negligible as they do not stay for long in the environment and are not very toxic. It is becoming increasingly clear however that some medicinal products, in particular anti-parasitides, anti-mycotics, antibiotics and estrogens, which can all have ecotoxicological effects, pose environmental risks in specific cases. For example, vulture populations on the Indian sub-continent declined due to poisoning with Diclofenac, a painkiller, which was present in the carcasses that the vultures were feeding on. For humans, the possible impacts are less clear than for the environment. The levels of residues in drinking water, or in food are very low and considered not to be a concern for humans, but long-term low-level exposure can occur through those pathways.

Up to date no legal limit exists for human medicinal products potentially present in animal products since this pathway of exposure is assumed to be negligible, although it is currently not well characterized. Now the scientists should be taken this problem in the priority way for solving and arranging the standards or legal limits for bio-accumulated systems.

Key Words: Medicinal products, water pollution, mycotics, Eco toxicity, Drugs, Toxicity.

EFFECT OF FENVALERATE AS ENDOCRINE DISRUPTOR IN FISH

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ABSTRACT

Endocrine disrupting chemicals (EDC) are compounds that alter the normal functioning of the endocrine system of aquatic organisms, wild life and humans. A huge number of chemicals have been identified as endocrine disruptors, among them several pesticides. Pesticides are used to kill unwanted organisms in crops, public areas, homes and gardens, and parasites in medicine. The increasing use of pesticides in agriculture including commercial and household production of vegetables for the control of pests causes chemical pollution of aquatic environment. The chemical pollution causes potential health hazards to live stock, especially to fish, frogs, birds and mammals.

The freshwater fish *Labeo rohita* was exposed fenvalerate a synthetic pyrethroid. The LC₅₀ value determined for fenvalerate at 24hrs was 0.4749 µg l⁻¹. In fish, hormones are critical towards maintaining proper physiological function and amongst the many hormones found in fish, the thyroid hormones (T₄) and (T₃) are known to play an important role in fish growth and early development. In the present study, changes in the T₃ and T₄ were studied in the fish *Labeo rohita*. Suppressed level of thyroid hormones found in *Labeo rohita* depicts physiological stress.

Keywords: Endocrine Disrupting Chemicals, Thyroid Hormones, Pesticides, Fish.



REMOVAL OF FLUORIDE FROM AQUEOUS PHASE BY BIOSORPTION -SORPTION MECHANISM ELUCIDATION

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Abstract

This communication presents results pertaining to the adsorptive studies carried out on fluoride removal onto algal biosorbent (*Phyllanthus neruri*). Batch sorption studies were performed and the results revealed that biosorbent demonstrated ability to adsorb the fluoride. Influence of varying the conditions for removal of fluoride, such as the fluoride concentration, the pH of aqueous solution, the dosage of adsorbent, the temperature on removal of fluoride, and the adsorption–desorption studies were investigated. Sorption interaction of fluoride on to algal species obeyed the pseudo first order rate equation. Experimental data showed good fit with the Langmuir's adsorption isotherm model. Fluoride sorption was found to be dependent on the aqueous phase pH and the uptake was observed to be greater at lower pH. Maximum fluoride sorption was observed at operating 30 °C operating temperature. Adsorption–desorption of fluoride into inorganic solutions and distilled water was observed and this indicated the combined effect of ion exchange and physical sorption phenomena. Significant changes in the FT-IR spectra was observed after fluoride sorption which is indicative of the participation of surface function groups associated with hydrogen atoms in the carboxylic groups in sorption interaction. From X-ray photoelectron spectroscopy (XPS) analysis a marginal increase in the area for the binding energy peak at 287.4 eV was observed which could be due to the formation of CF bonds. Thermogravimetric (TGA) analysis of the fluoride loaded sorbent showed that the biosorbent underwent three steps decomposition process when heated from 25 to 100 °C. The maximum weight loss was observed to be between 200 and 400 °C and 700 and 800 °C.

Keywords: Bio sorption; Bio sorbent; Kinetics; Adsorption–desorption; Isotherms; SEM; FT-IR; XPS; TGA

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