

Current Issue: Beat Plastic Pollution



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Environment in News Headlines

From Director's Desk



We are happy to release current issue of our institute's newsletter on the theme, 'Beat Plastic Pollution' on World Environment Day. In last five decades plastic has made in road in our day to day life. From medical devices, electronic gadgets to a bag, its application is everywhere because it is cheap, light weight and can be molded in any form. Since 1957, India's plastic production capacity has increased manifold with over 30,000 plastic processing industries that contribute to 0.5% of the GDP and provide employment to about 0.4 million people. Despite of its importance, the degradation of plastic is a challenge and its careless disposal is leading to pollution in water bodies, land as well as causing deadly diseases viz. cancer due leaching of chemicals in food products from plastic containers or allergies due to inhalation of fumes coming out from the open burning of plastic material.

At this juncture it is imperative to identify sustainable practices for the management of plastic waste. This issue of our newsletter is covering various technologies for conversion of plastic waste to useful products, management aspects for plastic waste as well as ecofriendly plastics. The latest regulations on plastic waste management by central and state government have focused on banning the production and utilization of single use plastics as well as below 50 mm plastic bags. Any rule or regulation on plastic waste management will be effective if it is conveyed effectively to the people and implemented by local authorities with full participation of different stakeholders.

Our institute is contributing towards management and awareness generation on sustainable plastic waste since 2016- 2017 wherein modules have been developed for effective awareness generation on plastic waste management. The efforts were made to train different stakeholders by arranging training programmes in schools. Our faculties are master trainers on Waste Management Rules and are training different stakeholders in different states.

We are releasing the current issue of newsletter to contribute towards the cause of managing pollution due to plastic waste.

Let's take a pledge to not use single use and light weight plastics in our day to day life.

Dr. Seema Mishra



Beat the Plastic Pollution

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Scientists have termed plastics as a marvel of modern chemistry. They have declared discovery and development of plastics as one of the greatest achievements chemistry has ever made. Plastics have transformed the modern world towards a better quality of life. There is hardly any human activity where plastics do not play an important role. From clothing to shelter, from healthcare to agriculture, from transportation to communication, from infrastructure to household application, plastics play a vital role in the human life.

By the middle of Twentieth Century, especially around the period of second world war, many major scientific discovery and inventions took place in the development of many types of plastics although the volume remained at a low sphere. However, since around 1970's, the volume of production of plastics materials increased at a very fast rate and by 2016/17 the world consumption level reached around 300 Mn Tons. While world average per capita consumption of plastics is around 35 Kgs, Indian per capita consumption has reached only at around 12.5 Kgs in 2016 - 17. In comparison per capita consumption in the USA is around 138 kg and that of Western European countries is 116 Kgs. China's per capita consumption stood at around 43 Kgs.

The attributes like light weight yet strong, least energy consumption and minimum emission of pollutants in the air and water during production, inert characteristics,

excellent water resistance and barrier properties, excellent insulation and dielectric characteristics, ease of fabrication into variety of shapes and structure – to name a few, have all made plastics not only a material of choice for an array of applications, use of plastics has become essential in every sphere of our modern life. The long life of plastics products has added to the convenience. Plastics have almost replaced materials such as metal, glass, wood, paper, fiber, ceramics etc. in packaging, automobiles, building construction, biomedical fields, electronics, electrical equipment, appliances, furniture, pipes and heavy industrial equipment. In a nutshell, from agriculture to transport and from aerospace to food packaging, the use of plastics has become an integral part of our modern daily living.

Despite all these positive attributes, plastics are under the scanner. Increased use of plastics packaging has created increased volume of waste. Even though plastics are amenable to recycling yet irresponsible usage and littering habit of the general mass coupled with inappropriate infrastructure for scientific disposal of the plastics waste in many of the underdeveloped and developing countries have created a situation of grave concern of environmental pollution by way of chocking drains, ultimately finding their way to the sea and causing harm to the marine lives which swallow floating plastics and choke to death. Many bird species also face the similar situation. This has led the United Nation Environment Department to

decide that India will be hosting the Global Environment Day Celebration on 5th June (2018) with the theme “Beat the Plastics Pollution”.

The theme focuses on drastic reduction in single use plastics items so that their flow to the sea could be avoided.

Many developed countries have declared zero or negligible landfill status. Most of Western European countries do not have any landfill. All waste that is generated are essentially processed. All recyclable waste either recycled or their energy is recovered. All biodegradable waste is composted or otherwise treated. All plastics waste is scientifically disposed of. If we look into the Indian Scenario, we find that almost all rigid plastics waste gets collected by the informal waste pickers and the same are ultimately recycled. It can be declared without any hesitation that no rigid plastics waste from India find their way to the sea causing harm to the marine life. However, some types of flexible packaging waste are left abandoned due to techno-economic reasons. The technical solution for recycling / energy recovery has since been provided. ICPE in association with cement major M/s ACC Ltd has established scientific protocol for coprocessing of all types of plastics waste in cement kiln (except chlorinated plastics). India is the second largest cement producer in the world manufacturing over 200 Mn Tons of cement per year and consumes around 30 Mn Tons of coal per year as energy input. By replacing 30% coal by plastics waste, it is possible to dispose of about 10 Mn Tons of plastics waste including low-end plastics waste. In fact, India does not have this much plastics waste in the country now. However, collection and transportation of plastics waste to the nearly

100 cement kilns in the country is not an easy job although not an impossible task.

Similarly, use of low-end flexible plastics waste for construction of roads in partial replacement of bitumen has been established and Government of India has given recognition to this development. At the rate of 2 MT per KM of 14 ft wide road, India has vast potential for using up of low-end flexible plastics waste to a considerable extent. ICPE has contributed in this development by constructing several patches of bitumen roads in different parts of the country.

Another method of feedstock recycling viz pyrolysis of polymers into LDO range of hydrocarbon fuel is also a very useful technology in scientific disposal of all types of plastics waste. ICPE has supported this process by setting up of a pilot plant at a residential colony in the heart of New Delhi. As a result, no plastics waste generated in the colony goes to landfill from this colony.

All these measures are part of beating plastics pollution being initiated by ICPE for over a decade now.

However, it needs more clarifications as to what are considered as one-time use plastics products for the consideration of banning (as per UN Environment directive). While thin plastic carry bags can be recognised as one-time use plastic and which are legally banned in India since 2011, thicker plastics bags, which are used many times over a longer period of time, should not be termed as one-time use plastic. While emphasis should be given to avoid very small sized packaging design, restrictions on other designs should not be imposed without considering the overall benefit provided by the product in its life cycle compared to alternatives. Waste which are seen by naked

eyes must be disposed of scientifically, there is no second thought about this. However, in this process it is also important that the environment burden, which is not seen by naked eyes, must also not be allowed to increase when some other alternative designs or products are used. Intra Venous Liquid bottle, biscuit wrapper, coffee and tea packaging, liquid milk pouches – all are single use plastic applications. However, LCA study reveals that flexible milk pouches save 85% energy compared to glass bottle for the packaging of liquid milk.

It is a scientific fact that plastics reduce greenhouse gas emissions compared to the alternatives. On a US national level, to substitute the 14.4 million metric tonnes of plastic packaging in the six packaging categories analysed, more than 64 million metric tonnes of other types of packaging would be required. The substitute packaging would require 80 percent more cumulative energy demand and result in 130 percent more global warming potential impacts, expressed as CO₂ equivalents, compared to the equivalent plastic packaging. This is the report of Franklin Associates conducted for American Chemistry Council. The LCA study would reveal similar result in Indian context too.

Let us beat the plastics pollution by proper awareness on anti-littering and inculcating appropriate waste management system, like the ones already done by many countries. At the same time our actions should not increase overall environmental pollution by promoting alternative products without proper study.





Cement kiln Co-processing Facilitates Sustainable Management of MSW

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Plastic products have become an integral part in our daily life as a basic need. Its broad range of application is in packaging films, wrapping materials, shopping and garbage bags, fluid containers, clothing, toys, household & industrial products, medicinal applications, packaging and storage of food and other perishable items, electronic and electrical applications and building materials etc.

Among these various products, plastics having onetime use tend to get into the Municipal Solid Waste in large quantities because of the convenience in their use and the life style adopted by us. Being non-recyclable, they do not get picked up by the rag pickers. These non-recyclable plastics, along with other non-recyclable wastes such as rexin, rubber, thermocol, contaminated papers, cloth etc. have very slow process of degradation and remain as a cause of concern in the environment for several years. They also cause difficulty in getting the biodegradable materials treated in an efficient manner.

Figure provides the typical constituents present in MSW. The kitchen waste and organics which are biodegradable materials can be treated using composting or bio-methanation technology. The efficiency and ease of treatment of the bio-degradable materials through these technologies is dependent upon the presence of non-bio-degradable materials in it. More the content

of non-biodegradable materials in it less is the ease and efficiency of its conversion into

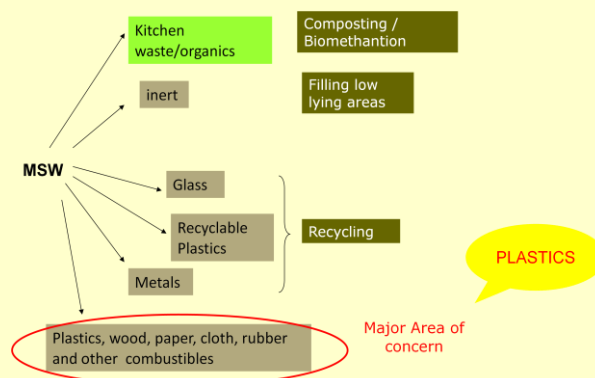


Figure: Constituents of MSW

compost and/or bio-gas.

It is essential therefore to efficiently segregate MSW into bio-degradable, non - biodegradable and hazardous materials, as is specified in the SWM Rules notified by MoEFCC in 2016. The domestic hazardous materials such as e-waste, bio-medical waste, batteries, diapers, sanitary napkins, etc need to be properly treated by sending them to a hazardous waste management site. If these materials are separately packed, then it is easy for them to be properly diverted to such sites and treated.

The non-biodegradable material contain recyclables such as metals, glass & plastics, that have good market value and can be efficiently converted into new products using different recycling processes and hence gets sold. The remaining non-biodegradable material, which is non-recyclable, contains combustibles such as one time use plastics, rexin, rubber, thermocol, contaminated paper & cloth, wood pieces etc. Management of this

balance non-recyclable fraction is the most difficult aspect faced today by the municipalities because if not treated properly, it tends to keep on piling up in the landfills / dump yards causing huge impact on the environment. The best options to treat this fraction is to convert it into RDF and send it to a cement plant for co-processing as an alternative fuel or send it to a waste to energy plant for converting it into electricity.

Cement plant co-processing is a more sustainable and cost effective process than waste to energy option. In waste to energy out of the total resource value present in the

waste, only energy value gets converted to an extent of <30% into electricity. Balance >70% energy and the entire material resource value present in this waste is wasted and needs to be landfilled again. However, co-processing in cement plant gainfully utilizes the 100% of the resource value - both material and energy - present in this waste. Hence, cement plant co-processing is a more sustainable option for management of waste.

Indian cement plants have co-processed >1.6 million Tons of combustible wastes in 2017. Cement kiln co-processing

Table 1

Cement kiln co-processing	Waste to Energy
Cement plants already exist near most of the towns and cities. Only the feeding arrangement needs to be implemented in the kiln.	Waste to energy needs to be built separately.
Cost involved in setting up facility to convert non-recyclable combustible waste into RDF and required feeding arrangement in the cement plant is very less.	Cost involved in setting up Waste to energy plant is very high.
Cement plant does not need additional environmental control measures for pollution abatement. The existing ones are good enough even while treating these wastes.	Waste To Energy plant requires installation of elaborate emission control facilities.
Cement kiln co-processing does not leave any residue for landfilling. The residue gets utilised as Alternative Raw material in the manufacture of cement	The residue from Waste To Energy plant needs to be landfilled.
Co-processing is being implemented successfully of even hazardous materials in >55 cement plants across the country and is gaining momentum. Considering the economic viability of the co-processing option, other cement plants are also gearing up to undertake co-processing of wastes.	Very few (<5) Waste to Energy plants are in operation and the economical viability of the same is still under evaluation.

technology therefore provides a highly sustainable and economically viable option for the management of non-recyclable combustible fraction from MSW thereby

facilitating municipalities in achieving "ZERO WASTE TO LANDFILL" approach.

All previous issues of 'The Environment Management' can be viewed at: [http:// www.siesiem.edu.in](http://www.siesiem.edu.in)



Plastic Water
bottle
manufacturers
produce more
than 2.5 million
tons of carbon
dioxide each year

Every year the world uses 500 billion plastic bags.



Plastics - the Modern Menace to Oceans

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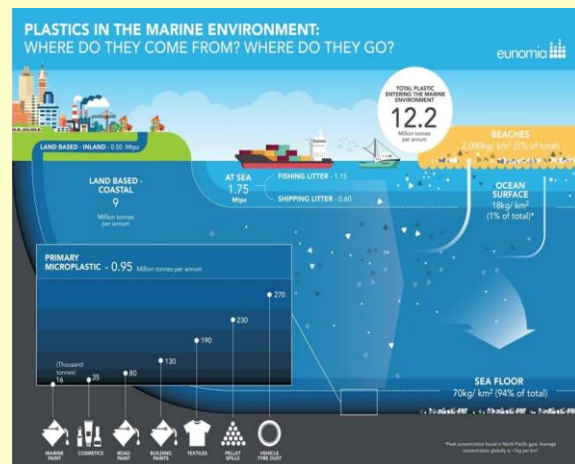
Plastic was invented in 1907 by a Belgian gentleman who happened to be living in New York State at the time. He developed plastic as a way to cope with endangered materials, such as ivory, and to present the world with a more cost effective and viable production option. He probably never thought that his invention would cause so much chaos in our oceans a little over 100 years later! Our society has morphed into a throwaway culture, where we discard items that are no longer of use to us. Unfortunately, most of these items end up in the ocean via illegal dumping or through run-off in storm drains and waterways. While about 20% of all plastic in the ocean comes from boats, approximately 80% comes from our very own backyards!



Dumping of Garbage and Plastics into the sea is a bane of the modern world. In today's world, every human being generate 1.2 kgs of waste per day, by 2025 this is going to become 1.4 kgs. 90% is non-biodegradable. Garbage generation has become a global menace. If plastics are a dangerous discovery, dumping plastics into the sea is a crime against marine life. Ocean is the last place for garbage dumping.

The Great Pacific Garbage Patch

Dumping of garbage into the seas has created floating islands of garbage which are not only effecting marine life but also are becoming navigational hazards. According to GarbagePatch.net, about seven billion pounds of non-recyclable plastic is produced every year around the world. Only 7% of all of the plastic that is consumed annually is actually recycled. The rest of the plastic waste ends up in places like the Great Pacific Garbage Patch. The Great Pacific Garbage Patch is a unique vortex of plastic debris that floats in the ocean between the Western Coast of the United States and Hawaii. While much of the rubble lurks beneath the surface of the sea, the vortex is large, complex, and continues to devastate our marine environment.



The Great Pacific Garbage Patch is Massive!

There is approximately seven million tons of debris in the Great Pacific Garbage Patch and that it is roughly nine feet deep. More than 80% of the debris that makes up this

famous garbage patch originates from the land, while 20% comes from oil platforms, boats, and work. The Great Pacific Garbage Patch is a great big pool of debris that has undoubtedly caused some serious issues with its immense size and ongoing growth.

There are 5 gigantic garbage patches worldwide!



The five patches are called gyres, which are large systems of moving ocean currents. These currents move in a circular motion and are propelled by wind patterns around the world and the forces created by the Earth's rotation. The **five largest ocean gyres** include the Indian Ocean gyre, the North Atlantic Gyre, the North Pacific Gyre, The South Atlantic Gyre, and the South Pacific Gyre. Each ocean gyre circles a large area of relatively stationary water. Drifting debris can accumulate in these areas over the course of many years with little to no movement outside of the gyre. These areas are referred to as the 'garbage patches'.

No one Knows How Much Garbage is in the Patch!

The center of the **Great Pacific Garbage Patch** patch is about 386,000 square miles around and spans more than one million square miles in length. There is thought to be more than seven million tons of weight in the North Pacific gyre! United Nations

Environment Program claims that there are approximately 46,000 pieces of plastic for every square mile of ocean throughout the world.

More than 70% of the Debris Lies on the Ocean Floor!

While much of the plastic that is located in these gyres are smaller and can hardly be seen by the naked eye, there are a number of larger items that end up on the ocean floor. Since plastic does not break down like wood or bone, for instance, it can spend years wreaking havoc on the ocean floor. It affects the entire food chain, from the larger bottom-feeders to seals, seagulls, and crabs. No one knows just how much plastic is located on the ocean floor or just how much it has affected our marine environment because few studies have been done to this date.

The Garbage Patch is Too Big and Too Costly to Clean Up!

If the Great Pacific Garbage Patch causes so many problems for us and the world around us, why don't we just clean it up? The reality of the situation, however, is that the Great Pacific Garbage Patch is too large, too complex, and too costly to fix. Not only would it take a lot of manpower and oil to actually get that far out into the ocean, but it would also take a ton of equipment to adequately clean up the mess.

It is Growing at a tremendous rate!

The Great Pacific Garbage Patch was first stumbled upon in 1997, by a Sea Captain named Charles Moore, who while sailing from Hawaii to the mainland ran into the North Pacific Gyre where noticed that there were several, small pieces of plastic and other debris floating in this one particular area. Moore now calculates that there is more than 100 million tons of debris in the ocean, which would have doubled or tripled over the years having started with 0.002g/m² of plastic debris. In just nine

years, the amount of plastic present on the surface of the water doubled. The number continues to grow. Our oceans will contain more plastic than fish by the year 2050

It Presents a Significant Danger to Marine Life!

Astonishingly, it is estimated that more than one million marine birds and more than **100 thousand marine mammals** die as a result of getting tangled up in or ingesting plastic in the ocean. Seals and turtles, for instance, get tangled up in the debris which leads to suffocation or strangulation and, ultimately, death. When ingested, plastic tricks their digestive systems into thinking that they are full as their stomachs are not able to differentiate the plastic from their regular food which leads to sickness, starvation and, ultimately, death. Larger pieces of plastic are causing blockages in their systems, making it hard to swallow, breathe, digest, or extricate waste leading to death. Can you



It Threatens Food Chains - *Do you want to eat plastic eating fish?*

Fish and other marine mammals are ingesting a ton of plastic, most of which contains high levels of very harmful chemicals, which are passed on through the food chain. And can cause significant problems for our health and sustained wellbeing. If fish are feeding on plastic, rather than plankton, as it is more readily available, the food chain will get thrown out

of gear with devastating consequences on what we eat, how we eat, and how we take manage our health.



Plastics Leach and Absorb Harmful Pollutants!

Plastics also leach and absorb harmful pollutants and chemicals such as polycyclic aromatic hydrocarbons and organochlorine pesticides which not only endanger the sea creatures that consume them, but the humans who then consume those sea creatures, as well. More than 50% of all of the plastic debris contains some form of PAH. The Great Pacific Garbage Patch not only interrupts the flow of the food chain, but can have devastating effects on marine and terrestrial life of all shapes and sizes.



Conclusion

Despite popular belief, the Great Pacific Garbage Patch is not a huge, floating debris field of plastic. While it is certainly

humungous, more than two times the size of Texas in US or area of the entire North India, it contain a lot of plastic and is wreaking havoc on the marine environment and the world around us. We must put our minds together to brainstorm better, more sustainable alternatives that won't cause so many problems for the world around us. Together, we can prevent these horrifying facts from becoming monumental and dire realities that will change the world we know and love.

Each year, at least 8 million tonnes of plastic end up in the oceans, the equivalent of a full garbage truck every minute.

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In the last decade, we produced more plastic than in the whole last century.



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- Eligibility: M.Sc. or M.Phil. in Environmental Science or other related fields.



The Health Risks of Plastic and Safe Plastic Use Practices

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The evidence is growing continually that chemicals leached from plastics used in cooking and food/drink storage are harmful to human health. The most disturbing of these are hormone-mimicking, endocrine disruptors, such as bisphenol A (BPA) and phthalates.

The health risks of plastic are significantly amplified in children, whose immune and organ systems are developing and are more vulnerable. The evidence of health risks from certain plastics is increasingly appearing in established, peer-reviewed scientific journals.

The **plastic polycarbonate - used for water bottles** and various other items requiring a hard, clear plastic - **is composed primarily of BPA**. Scientific studies have linked BPA to health problems that include chromosomal and reproductive system abnormalities, impaired brain and neurological functions, cancer, cardiovascular system damage, adult-onset diabetes, early puberty, obesity and resistance to chemotherapy. Exposure to BPA at a young age can cause genetic damage, and BPA has been linked to recurrent miscarriage in women.

Thousands of chemical additives added to plastics - one type commonly added to plastics are "plasticizers," a softening agents making it easier for polymer chains to move and be flexible.

For example, commonly used and extremely toxic plastic polyvinyl chloride (PVC) can

contain up to 55% plasticizing additives by weight. These are generally phthalate chemicals. Phthalates are known to disrupt the endocrine system as well, and have been linked to numerous health conditions including cancers.

TIPS for Safer Plastic Use and Less Waste

Plastic has become a part and Partial of our daily routine. It is not possible to live without Plastic, however there are certain ways which can be adopted may reduce its ill effects.

- **For water - try and avoid plastic bottled water.** Non-plastic reusable water bottles (stainless steel, glass) are now very easy to find - they reduce plastic waste, as well as exposure to toxins, and they save you money the more you use them.
- **Avoid polycarbonate baby bottles and sippy cups, which contain Bisphenol A (BPA).** For baby bottles, try and use glass, polyethylene or polypropylene instead. Sippy cups made of stainless steel, or of polypropylene or polyethylene are safer. Be sure to check the bottle or cup to be sure of the type of plastic it contains. As for baby bottle nipples, try and use natural rubber or silicone which do not leach the carcinogenic nitrosamines that can be found in synthetic latex rubber.
- **REFUSE disposable, single-use plastics...** When going out or travelling,

get in the habit of carrying your own reusable bag, bottle, coffee mug, take-out food container, utensils, glass or stainless steel straw.

- **While using plastic water bottles, minimize their use and exposure to temperature extremes.** Plastic bottles made from PETE #1 or HDPE #2 are intended for single use only. Avoid cleaning them with strong detergents which can degrade the plastic and increase leaching - try and use a natural biodegradable detergent.
- **Avoid heating plastic food and drink containers.** This stresses the plastic causing it to degrade faster and thus making it more susceptible to leaching chemicals. If you must use a plastic bottle or container, avoid heating food or drink in it, especially in the microwave. Even if the container says "microwave safe," that does not mean it won't leach chemicals. If the plastic is showing signs of wear – scratched, worn, cloudy, sticky, cracked – recycle it.
- **Avoid putting fatty or acidic food and drink in plastic containers.** Fats and acids (tomato or lemon-based foods) are more likely to cause the plastic to leach chemicals into the foods. When fatty foods are heated in the microwave there may even be a residue left on the plastic (such as a reddish ring with tomato sauce).
- **Avoid freezing plastic food and drink containers.** This stresses the plastic causing it to degrade faster and thus making it more susceptible to leaching chemicals. If the plastic is showing signs of wear – scratched, worn, cloudy, sticky, cracked – recycle it.
- **Use plastic wraps with caution.** Some plastic cling wraps are made of polyvinyl chloride (PVC, #3) and should be avoided if at all possible.
- **Avoid plastic dishes and utensils for meals.** Plastic disposable dishes and

utensils are usually made of polystyrene (PS, #6), which should be avoided because it leaches phthalates. Alternatives include glass, ceramic, wood, stainless steel, bamboo, and lacquer ware.

- **Use plastic wraps with caution.** Some plastic cling wraps are made of polyvinyl chloride (PVC, #3) and should be avoided if at all possible. Plastic wraps should not be used in the microwave, but if you have no choice, try to keep the plastic from touching the food. Alternatives include wax paper, paper towels, or using a plate to cover food.
- **Try and use alternatives to plastic packaging and storage containers.** Cloth, paper or cardboard boxes are possibilities for transporting groceries. Stainless steel and glass food storage containers are available. Buy in bulk as much as possible to avoid packaging. Leave plastic packaging of fresh fruit and vegetables at the store to show the store it is unnecessary and wasteful.
- **Avoid the large blue chemical drums for water storage.** These are almost always made of polycarbonate (PC, #7) and leach BPA. If you must use them, then once you have the water at home, transfer it to a non-plastic storage container. For storing large quantities of water, glass and stainless steel containers and dispensers are available

50% of the plastic that we use
is single-use or disposable



SIES INDIAN INSTITUTE OF ENVIRONMENT MANAGEMENT

(Recognized by University of Mumbai)

M.Sc. in Sustainable Development and Environment Management (M.Sc. SDEM)

(Affiliated to Garware Institute of Career Education and Development, University of Mumbai)

Academic year 2018 – 19

Admission process starts in May 2018

Sustainability will be the biggest job sector in near future. Professionals with training in sustainable environment management would be required in public/ private sector for environmental planning, environmental status evaluation, environmental legislation with focus on implementation, monitoring and auditing practices.

M. Sc. Sustainable Development and Environment Management (SDEM) is a multidisciplinary job oriented course which addresses these requirements. It equips individuals to solve problems in these fields at source rather than at the end - of - pipe interventions.

Eligibility: B. Sc. / B.E. degree or equivalent

Duration: Two year- Full Time

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- Highly experienced faculty and high faculty/ student ratio
- State of the art well equipped laboratory for practicals
- Industry centered curriculum with emphasis to develop sustainability professionals
- Interdisciplinary approach
- Innovative pedagogy
- Focus on innovation through project activities and industrial training
- Linkages with various stakeholders like industry, NGOs, consultancy and government departments
- Focus on improving individual skills
- Specialized library
- Placement assistance provided



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Biodegradation of Plastics

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Disposal of plastic has become one of the biggest environmental issues today. One of the major reasons behind this problem is the non-degradable nature of plastic. It is said that it takes more than 400 years to degrade plastic. In recent years, however, many new microorganisms particularly bacteria and fungi have been discovered which produce certain enzymes which have the capacity to modify and degrade the recalcitrant synthetic polymers. Enzymes such as laccases, polyester hydrolases, peptidases, ureases are known to play an important role in the biodegradation. These enzymes are produced by species of *Pseudomonas* sp., *Ideonella* sp *Rhodococcus* sp. *Phanerochete* sp., *Tramatus* sp.etc. A single organism may not effectively bring about the degradation, hence usually a consortium or mixture of bacteria are used. Biodegradation is a biochemical process during which naturally occurring microorganisms in the environment convert the polymer into substances such as water, CO₂ and biomass. It can take place under aerobic or anaerobic conditions.

Various factors such as the hydrophobicity, degree of crystallinity, surface topography and molecular size of the synthetic polymers limit the biodegradability. Polymers with hydrolysable chemical bonds in their backbone such as PET and PUR are more susceptible to biodegradation than PE, PS, PP and PVC. Abiotic factors such as UV irradiation, oxygen, temperature as well as the presence of chemical oxidants play a crucial role in the degradation of PP and PE in the environment. Micronization or formation of microplastics having size between 0.25 and 0.5 mm markedly improve

their subsequent degradation by a bacterial polyester hydrolase by increasing the accessible surface area for the enzyme. Biodegradation can be enhanced by pretreatment such as partial solubilization of the polymers.

Use of bio-based raw material such as corn starch, potato starch, soybean protein and cellulose has been used as an alternate strategy to produce biodegradable plastic.

With all this studies and optimizations, composting, aerobic degradation and anaerobic digestion have become standard techniques of biodegradation of plastic. The treatment time has reduced to around 6 – 8 months for more than 90% degradation.

Scientists world over, however, are engaged in conducting research for the recovery of chemical feedstocks that can be used for the production of virgin polymers in a closed loop recycling process. This will be considered as the most sustainable option to solve the plastic waste problem.

About 60-90 per cent of marine litter is made up of plastic polymers, plastic bags, fishing gear and food and beverage containers.



Beat the Plastic Pollution-It Is in Our Hands

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**With a plastic pen in hand
Which has a plastic refill in it
I sip my tea filled in a plastic cup
The tea powder of which was filled in a
plastic jar
finding a solution to plastic reduction
seems to be far.**

When I first thought of writing an article on the plastic pollution I started to think as to how I should be addressing the problem. I am sure there would be many writers addressing the problem scientifically and putting forth all the technical aspects of it. Working in the social sector, I thought of addressing the problem socially. To simplify we can largely divide the human population into three categories.

- People who have nothing to do with the issue and feel that it is someone else's job to solve it.
- The second type who look at the problem as avenue to research and find out some valuable solution which would be beneficial.
- The third type who try to look at the root of the problem and thus look at eliminating the problem from the source.

The first kind of people who are not interested in solving the problem may turn out to be the trouble makers and a lot of consistent awareness and education needs to

be done on an ongoing basis. This is needed as this population is quite high and in spite of all efforts the magnitude of the problem will remain high. Efforts by 2nd category of people who are keen to find solution to the problem are a must. These include groups who have used waste plastic to make fuel, or roads or even houses. Their approach is to find an immediate solution so that present threats can be mitigated. The end product is beneficial and may also help to save virgin resources. But the most important is the 3rd category who wants to eliminate the problem from the root. They question the basis of plastic its birth, its need and also need to marginalize the production and usage to indispensable products only. Like for eg plastic invention has created revolution in the hospital industry and thus can't be eliminated similarly use of plastic in technological world or for transport of electricity etc are all the good uses of plastic. But the rampant use of plastic just because it is convenient needs to be tackled through consistent efforts to reduce the problem rather than finding a solution to it. As if every time we find solutions to a problem, we are in turn allowing the problem to persist. By finding a new product we are also not sure what kind of new problem we are giving birth to. Thus the real effort needs to be in the direction of reducing the problem from source.

NGOs and socially oriented individuals and groups have been focusing their efforts in this direction. Their efforts are more emotionally driven and educational in nature and thus are long lasting. Green Shoppe which is a platform for self sustaining NGOs manufacturing environment friendly products has a whole banner "Shop with Cloth" dedicated to this cause. Presently Green Shoppe has bags made of different material like (paper, cotton, jute, up cycled flex and denim material) in the range from Rs 10-300 from around 8 NGOs to its credit so that people from all strata can make a shift to a more eco friendly lifestyle. With a little shift in the mindset and conscious effort to protect mother earth we can all make a positive difference.

"BEAT THE PLASTIC POLLUTION,
GREEN SHOPPE IS THE
SOLUTION."

As per the analysis of plastic debris on beaches in Mumbai, Down to Earth reported on an average, 68.83 items are littered per square metre at four beaches—Juhu, Versova, Dadar and Aksa. About 41.85 per cent of the litter comprises microplastics ranging in size from 1m to 5m. The highest quantity of microplastics was seen in Juhu beach (55.33 per cent) followed by Versova, Dadar and Aksa. Recreational and religious activities are major contributing factors for the abundance of plastics in these beaches.

Disclaimer:

Editors have taken utmost care to provide quality in this compilation. However, they are not responsible for the representation of facts, adaptation of material, and the personal views of the authors with respect to their compilation.



SIES INDIAN INSTITUTE OF ENVIRONMENT MANAGEMENT
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Disposable Carry Bag: Convenience of Inconvenience

Nilima Shirodkar

PGDSEM, SIES IEM, Nerul, Navi Mumbai

shirodkarnilu@gmail.com

Disposable Carry Bag is apparently convenient, but considering this from the environment point of view, disposable carry bags have proven to be a major source of pollution. According to a research from the Environmental Protection Agency, it is estimated that around 5 billion disposable carry bags are commonly used and thrown around the world every year. Thousands of bags thrown in the trash are lying in the landfill and garbage dumps and polluting environment & ecosystem.

Fossil fuels are used in the manufacturing of plastic bags. Fossil fuel companies are among those who have ploughed more than \$180bn since 2010 into new “cracking” facilities that will produce the raw material for everyday plastics. If the production of fossil fuel companies remains the same, the production of plastics will increase by 40% in the next few years and the risk of pollution will increase further.

Plastic production and consumption at global level is increasing on a large scale and it has a negative impact on the environment. The waste produced from plastic accumulates in the ocean as well as

on the dumping ground, and this waste is consumed by sea animals as well as other animals on land and eventually they die.

In each of our kitchens, cupboards, we have stored plastic bags, but have you ever thought of how many bags you have used so far? Do you know what is the impact of the bags that you throw in the trash?

A little bit information about a plastic bag that you are using every day:

1. 160,000 plastic bags are used every second worldwide.
2. Every year 5 trillion plastic bags are produced.
3. A plastic bag is used for only 12 minutes on an average.
4. 267 animal species have to suffer from adverse effects of plastic
5. In the ocean, plastic pollution causes 100,000 sea animals to die every year.

We need to think about the serious impact of plastic bags on the environment and the kind of world we are creating for our future generation.



SIES IIEM DEDICATED TO ENVIRONMENT MANAGEMENT THROUGH R & D AND OUTREACH ACTIVITIES



ABOUT SIES IIEM

- SIES IIEM was established in 1999. It has been contributing in the fields of R&D activities and Academics in the areas of Environment Management and Biotechnology.
- IIEM is recognized by Department of Scientific and Industrial Research for research activities and has successfully completed various research projects with funding from DST, BRNS, DBT, ICMR, MOEFCC, MMREIS and several other agencies.
- IIEM also conducts consultancy services, organizing seminars, workshop and providing community service through research and creating awareness.



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- Chemical parameters
- Microbial parameters: Total Coliform Test, *E. coli*, Fecal streptococci Manganese
- Heavy Metals: Lead, Copper, Nickel, Iron, Cadmium, Zinc, Aluminum

Soil Quality Index for Agricultural and Landscape Applications

- Physical parameters
- Chemical parameters
- Major Nutrients
- Minor Nutrient
- Secondary Nutrients

Waste Management

- Training programs
- Characterization of Solid Waste for Composting and Vermicomposting
- Compost Quality Index (Physical, Chemical & microbial parameters and seed quality index)
- Testing, characterization and standardization of bio-fertilizers from
 - N fixers
 - P Solubilizers – PSB, AMF

GIS based Environmental Planning and Management

- Natural resource mapping
- Groundwater recharge study
- Site selection
- Database management
- Training Program

Sustainability Solutions for Mitigation of Climate Change Vulnerability

Biomass Characterization for Physical, Chemical and Biochemical Parameters

- ❖ Moisture content
- ❖ Nitrogen
- ❖ Phosphorus
- ❖ Potassium
- ❖ Crude protein
- ❖ Lignin
- ❖ Cellulose
- ❖ Hemi-cellulose
- ❖ Fibers
- Antimicrobial and Antioxidant Testing Screening and Evaluation of Bioactivity of Synthetic Chemicals and Natural Compounds

Natural Capital Assessment Services

Implementation of Natural Capital and Ecosystem Services Concept

- Integration of business practices and decision making with natural capital and ecosystem services concept.
- Assessment of Natural Capital and Ecosystem Services
- Qualitative and quantitative approaches
- GIS mapping
- Foot printing
- Stakeholder engagement
- Land Use and Biodiversity Opportunity Mapping Training and Capacity Building

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Support in the development of CSR strategies for industries	Linkages with NGO partners
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BRNS Popular Science Lectures at SIES IEM

Two popular science lectures were conducted at SIES Indian Institute of Environment Management on 7th April, 2018 at the auditorium of School of Packaging. Dr. Maheh Zingde, an independent environmental consultant to industries spoke on 'Coastal Zone of India and its Management'.

The 7500 km long coastline of India is endowed with an extensive network of back waters, estuaries, creeks and bays several of which (as well as the open coast) sustain specialized ecosystems like mangroves habitats, coral reefs and seagrass meadows. The coast is also blessed with vast sandy beaches, rocky shores, extensive mudflats and chains of sand dunes. The coastal area has vital oil, gas and mineral deposits. In addition, the coastal zone has high potential for wind, tidal, wave and ocean thermal energy. Fishing in India is a major industry in its coastal states, employing over 14 million people. India is a major supplier of fish in the world with exports to nearly 100 countries. The coastal areas of the country are also conducive for brackish water aquaculture.

The Government of India has established an environmental, legal and institutional framework to meet the challenges of environmental and ecological degradation. Among the several acts promulgated to protect the environment and ecology, the Environment (Protection) Act 1986 is the pivotal legislation with respect to the protection of ecology in the coastal zone of India. Two important notifications issued under this act are the Coastal Regulation Zone (CRZ) Notification (1991, 2011) and

the Environmental Impact Assessment Notification (2006). The former regulates developments in the coastal zone defined in the notification and specifies the permitted and prohibited activities in the CRZ, while, the latter makes prior environmental clearance mandatory for specified development activities in the Country. Dr. Zingde said that several mangrove areas are declared reserved or protected forests under the Forest (Conservation) Act (1980) and many bio-rich coastal and marine areas have been protected as national parks and wildlife sanctuaries under the Wild Life (Protection) Act of 1972.

Dr. Faby Sunny, a senior scientist from BARC, Mumbai spoke on 'Environmental medelling: A tool for environmental impact assessment'. Environmental impact assessment (EIA) can be defined as the systematic identification and evaluation of the potential impacts of proposed projects, plans, programs, or legislative actions relative to the physical, chemical, biological, cultural, and socio-economic components of the total environment. The prime purpose of the EIA process is to encourage the consideration of the environment in planning and decision-making to ultimately arrive at actions that are more compatible with the environment. Environment comprises of the biosphere, atmosphere, hydrosphere and geosphere. In order to better understand environmental systems, to predict their behaviour and to develop effective management strategies it is necessary to bring together ecological, socio-economic and technological aspects of environmental problems. Some most often used tools to secure such an

interdisciplinary analysis of numerous factors are the modelling techniques. Environmental Models are important tools in environmental studies and management. Dr. Sunny also said that the models can also be used to stimulate consensus-building among various experts and to facilitate more explicit and comprehensible communication of findings to decision-makers.

Dr. Surkha Zingde, President, IWSA spoke about the various activities of IWSA and Dr. Seema Mishra, HOD, SIES Indian Institute of Management delivered the welcome address. Dr. Zingde released the e-magazine of the institute. About 40 participants attended the programme.



Dr. Mahesh Zingde and Dr. Faby Sunny delivering Lectures at SIES IIM.
Dr. Surekha Zingde releasing Volume IV issue 1 of the e-magazine of SIES IIM.

About 60-90 per cent of marine litter is made up of plastic polymers, plastic bags, fishing gear and food and beverage containers.



Beat the Plastic - Administratively

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Plastic is material consisting of any of a wide range of synthetic or semi-synthetic organic compounds that are malleable and so can be molded into solid objects. The term “plastics” includes materials composed of various elements such as carbon, hydrogen, oxygen, nitrogen, chlorine, and sulphur. Plastics are typically organic polymers of high molecular mass and often contain other substances. They are usually synthetic, most commonly derived from petrochemicals, however, an array of variants are made from renewable materials such as polylactic acid from corn or cellulose from cotton linters. Plastics typically have high molecular weight, meaning each molecule can have thousands of atoms bound together. Plastics, also called polymers, are produced by the conversion of natural products or by the synthesis from primary chemicals generally coming from oil, natural gas, or coal. Due to their low cost, ease of manufacture, versatility, and imperviousness to water, plastics are used in a multitude of products of different scale, including paper clips and spacecraft. They have prevailed over traditional materials, such as wood, stone, horn and bone, leather, metal, glass, and ceramic, in some products previously left to natural materials.

In developed economies, about a third of plastic is used in packaging and roughly the same in buildings in applications such as piping, plumbing or vinyl siding. Other uses include automobiles (up to 20% plastic), furniture, and toys. In the developing world, the applications of plastic may differ — 42% of India's consumption is used in

packaging. Plastics have many uses in the medical field as well, with the introduction of polymer implants and other medical devices derived at least partially from plastic. From the utility point of view they can be classified into four main categories: thermoplastics, thermosets, elastomers and synthetic fibers. The thermoplastics all have repeat units, the smallest section of the chain that is identical. We call these repeat units as unit cells. The vast majority of plastics, about 92%, are thermoplastics.

The success and dominance of plastics starting in the early 20th century led to environmental concerns regarding its slow decomposition rate after being discarded as trash due to its composition of large molecules. Toward the end of the century, one approach to this problem was met with wide efforts toward recycling. However recycling gives you lower grade of plastic. Further low return prices do not motivate end user for recycling.

Options thought useful for beating plastic : Ban Manufacturing, Deposit Return Scheme, Single use tax, Extended producer responsibility, Fines to user, disposer. The present Maharashtra regulation covers all options in one or other sector.

Plastic taxes and deposits not the sustainability answer, claims circular economy expert.

Deposit Return Schemes

The Deposit Return Scheme (DRS) concept hit the UK news headlines at the end of March. It is expected to cover single-use glass and plastic bottles, and steel and

aluminium cans. Similar schemes in Europe have been successful in achieving high recycling rates for PET bottles, aluminum cans and glass. They encourage users to recycle packaging for which they recover a small deposit and there is no additional cost to consumers. Norway is a good example of a successfully implemented DRS. In Oslo, it is estimated that 93 percent of all single-use packaging is collected via Infinitum's 3500 reverse vending machines. Consumers receive approximately 2.5 Krone (€0.26) for a two-liter plastic bottle. Overall, Infinitum has a 97 percent hit rate on recycling, including its manual collectors which operate in addition to the DRS. The DRS will generate very high-quality material for recycling because unlike curbside collections, you can control exactly what is collected. This is especially important when producing food-grade rPET. With material from curbside collections, the food grade PET is mixed with non-food grade PET, which makes it harder to achieve the maximum allowed 5 percent non-food PET. Richard McKinlay believes that DRSs should increase recycling rates for the materials included in the scheme, most likely PET bottles and aluminum cans. However, these already have a comparatively high recycling rate compared to other packaging, so any increase in overall rates will be marginal at best.

Single-use plastics tax

A tax on single-use plastics is more of a driver to reduce unnecessary packaging items, says McKinlay. This tax could also be used to increase recycling rates if the money goes into setting up new collection and recycling infrastructure. It's also difficult: putting a tax on all "single-use" plastic is not fair, he believes. When packaging is necessary, such as for meat,

rice, pasta – everyday essentials – it would not be fair to tax this and pass the cost on to the consumer, says McKinlay. This could affect those on low incomes as they have no choice but to pay it. In some cases, plastic packaging is the best option for protecting the product. Other packaging materials, such as glass or aluminum, do not necessarily have greater environmental benefits: glass, for example, is heavier so transporting it has a higher carbon impact than plastic film. The single-use plastics tax could be effective on products where there is a viable alternative for consumer use, such as reusable coffee cups. In this case, the consumer can choose to bring a reusable cup and avoid paying the tax; or if they prefer the convenience of not bringing a cup, they can pay the tax, which is then used to pay for the recovery and recycling of the single-use packaging.

Extended Producer Responsibility

McKinlay concludes that both approaches have their merits. They could help improve recycling rates, but not significantly in his view. He believes a more effective solution would be Extended Producer Responsibility schemes that would encourage brands to design for end of life in exchange for reduced compliance fees, and so improve the "recyclability" of their packaging. He tells *FoodIngredientsFirst* that "the DRS is good but it will never be collecting massive tonnages of material and the tax on plastic can just be unfair at times, for example of essential consumer items. EPR can be used to encourage the brands, retailers and converters to design for recycling, like a set fee for all packaging and then if you can demonstrate that it's been designed for future life then perhaps you pay less tax." "If you use the money from the taxes to invest in the infrastructure for collecting

and sorting of the material, then you will encourage the recycling sector. If you're also encouraging the brands and converters to use recycled materials, then it will provide a secure market for recycling. One of the biggest problems is when the virgin prices drop below the rate of recycled material and cause recyclers to go bust."

McKinley is of the opinion that, most importantly, behavioural change from consumers and industry is the key to unlocking economic and environmental benefits for all. There needs to be an understanding from the consumer that plastic can have a value, but it needs to be kept clean, and you shouldn't be putting nappies and dirty food packaging in your recycling. There needs to be more focus of higher quality sourcing facilities. There needs to be an appreciation that the whole operation will cost money nobody will get rich off recycling packaging waste. There need to be economic and legislative drivers from the government to push Recycling. Role of packaging in fighting food waste must not be forgotten Plastic and other packaging types serve a vital function in delivering the food we need. He thinks if we see plastic-free food aisles we will see a big spike in food waste.

Indian Culture and Present Scenario

India traditionally had environmental friendly life style. Use of natural products in food industry as packaging, quality preservation, serving material, reuse and recycling of materials was part of culture. Rather use and throw was not practised unless unavoidable. Over a period of time lifestyle has changed. We have started non trusting items which are not packed. Packaging is designed always for minimal cost and thus plastic has superseded all

earlier packaging materials. There was also a culture of rag pickers who would pick up plastic waste from households and sell it to wholesaler who would in turn send it further upto recycler at some price increment at every step. This sector though informal was quite strong in urban india. But it has reduced as production of new plastic is cheaper than recycling it. Further reuses of plastic material like bags, containers for domestic purpose was quite common especially in middle and lower class of society. However today prices of plastic packaging are so negligible that its reuse is not considered a wise option. The total custom duty on import of raw material of plastic including gst is 29.8% for insulating fitting while it is 23.2 for other plastics. Gst for plastic products ranges from 5% for polybags to 18% for plastic bags , resins poly ethylenes, Furniture, Pvc floorings, interlocking mats etc. were earlier in 28% gst is 12% on raw materials. There is 5% gst on plastic scrap while Waste, parings and scrap, of plastics HSN Code 3915 Rate(%) : 18 Waste, parings and scrap of rubber (other than hard rubber) and powders and granules obtained therefrom HSN Code 4004. Rate(%) : 18 Hard rubber (for example ebonite) in all forms, including waste and scrap; articles of hard rubber HSN Code 4017 Rate(%) : 28 so recycling isn't cheap.

To curb the plastic, apart from adopting customer or producer end options of encouraging recycling which are very difficult to succeed in a multilayered society in India, banning certain manufacturing activities or making it costly by changing taxation and pricing policy and encouraging other industries will be administratively very easy and will have more success. Merely plastic bags or water bottles do not

contribute to plastic waste. It is everywhere ball pens, car parts, toys, plumbings and fittings, show lights, flexes. Rather plastic has a major defect it can not be retrofitted or repaired like traditional materials like wood, iron etc. it has to be replaced and that's why it cannot be put to similar use. It needs to be either treated where it forms a lower grade or has to be thrown which generates litter causing environmental issues. Therefore simultaneously discouraging entry of throw away type of products or importing raw material for plastic or even its production from pre material ie petrochemicals need to be discouraged. Rather use of available material for longer time like cars, cell phones, televisions, computers which also contain lot of plastic should be encouraged. Retrofitting for upgraded version needs to be considered a better option than buy back. Rather the buy back packages which are introduced to motivate buying and promote production are invariably without any mechanism to restrict waste generation. Discouraging only few types of plastic will not solve the problem in real sense unless a country or state decides to leave it as fast as and as far as possible. It needs to be remembered that polythene bags and bottles are just tip of iceberg and only by concentrating on them success will not be achieved. Remember not plastic but plastic waste is real problem. We need not beat plastic we reduce it and its waste administratively.

Ref: Basics of Plastic Manufacturing - American Chemistry Council, Plastics Industry Producer Statistics Group, 2005, Goods & Services Tax on Plastic Granules in India Lookup Latest GST Rates on Plastic Granules in India. GST is Applicable from 1 July 2017.

Custom duty on Plastic Raw Material in India After GST – Both from Export Genius, Plastic wikipedia

Costlier raw material hikes up plastics prices –Business Standard, GST rates on plastic products to affect MSMEs-Business Line

GST Rate & HSN Code for Polymers, Polyethylene, Cellulose - Chapter 39 – Cleartax

Plastic taxes and deposits not the sustainability answer, claims circular economy expert - *By Joshua Poole*
<https://www.caclubindia.com/forum/what-is-the-tax-rate-for-plastic-scrap--430033.asp>

US\$13 billion a year is the cost of environmental damage as plastic wreaks havoc on fisheries, marine ecosystems and economies

Facts about plastics and Images contributed by Ms. Nilima Shirodkar, PGDSEM, SIES IIM

Environment in News Headlines

Maharashtra to impose ban on plastic and thermocol products

Maharashtra state issued the Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) notification on March 23, 2018 that banned the manufacture, use, storage, distribution, sale, import and transportation of various kinds of plastic items. It is the 18th state in India to impose such a ban. The ban covers a wide range of articles made of plastic and thermocol, including, bags, dishes, cups, glasses, bowls, forks, spoon, straw, containers, small PET bottles and decoration items. However, The ban was brought under the Maharashtra Non-Biodegradable Garbage (Control) Act enacted in 2006.

Source: Times of India, March 16, 2018

Scientists accidentally create mutant enzyme that eats plastic bottle

Scientists have created a mutant enzyme that breaks down plastic drinks bottles – by accident. The breakthrough could help solve the global plastic pollution crisis by enabling for the first time the full recycling of bottles.

The new research was spurred by the discovery in 2016 of the first bacterium that had naturally evolved to eat plastic, at a waste dump in Japan. Scientists have now revealed the detailed structure of the crucial enzyme produced by the bug.

The international team then tweaked the enzyme to see how it had evolved, but tests showed they had inadvertently made the molecule even better at breaking down the PET (polyethylene terephthalate) plastic used for soft drink bottles. “What actually turned out was we improved the enzyme, which was a bit of a shock,” said Prof John McGeehan, at the University of Portsmouth, UK, who led the research. “It’s great and a real finding.” The mutant enzyme takes a few days to start breaking down the plastic – far faster than the centuries it takes in the oceans. But the researchers are optimistic this can be speeded up even further and become a viable large-scale process.

“What we are hoping to do is use this enzyme to turn this plastic back into its original components, so we can literally recycle it back to plastic,” said McGeehan. “It means we won’t need to dig up any more oil and, fundamentally, it should reduce the amount of plastic in the environment.”

Source: The Guardian, April 16, 2018

Large-scale Uranium Contamination of Groundwater Resources in India

New data shows occurrence of uranium in Indian groundwater. Avner Vengosh, a professor of geochemistry and water quality at Duke’s Nicholas School of the Environment and his team compiled data on groundwater uranium from 16 Indian states. The data showed a high prevalence of uranium concentrations above the World Health Organization provisional guideline value of 30 µg/L across India. Using geochemical and uranium isotope data, they suggested factors that may drive high uranium concentrations in groundwater, including uranium content in aquifer rocks, oxidation state, and groundwater chemistry that promotes the formation of soluble uranyl carbonate complexes. While the primary source of uranium is geogenic, anthropogenic factors such as groundwater table decline and nitrate pollution may further enhance uranium mobilization. These findings suggest the need for revision of the current water quality monitoring program in India, evaluation of human health risks in areas of high uranium prevalence, development of adequate remediation technologies, and, above all, implementation of preventive management practices to address this problem.

Source: Environment Science Technology Letters, May 2018

Rise in Ozone Pollution in Delhi

The Centre for Science and Environment (CSE) analysed data from 29 stations in NCR and found that from February to May, the number of days when the ozone standard was breached showed an increasing trend. In 90% of the stations, the recorded ozone levels exceeded the norm at some point. Since even short-term exposure to ozone is believed to be harmful, standards are set for shorter time durations compared to other pollutants — 180 micrograms/ cubic metre (1-hour average) and 100 µg/m³ (8-hour average). Ozone is not a primary pollutant. It is formed through photochemical reactions involving pollutants like nitrogen oxide and Volatile Organic Compounds (VOCs) that take place in the presence of sunlight. Vehicles are a major source of these precursor pollutants, experts said. India earlier reported the highest number of ozone-pollution related deaths globally, 2.54 lakh in 2015. Therefore, the rise in ozone is a major concern.

Source: CSE, June 2018

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Forthcoming Events

Training program on ‘Plastic Waste Management’ on 15th June 2018 at MGM University, Kalamboli and SIES Campus on 7th July 2018.

Articles, photos etc. are invited for next issue (July-September, 2018) of the Newsletter on the theme ‘Waste Management Technologies’

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