ENVIS
Management of Plastics, Polymer Wastes and Bio-polymers and Impact of Plastics on the Eco-system
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Indian Centre for Plastics in the Environment
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Plastics in Conservation of Land, Water, Forests & Energy

Plastics are a unique material that satisfy many endless needs. They have the capability of being moulded to meet specific functional needs for consumers. If a product is made of plastic, there's a reason. And chances are that the reason has everything to do with helping you, in terms of Health, Safety, Performance, Durability and Value. Plastics help make these things possible.

Doing more with less helps conserve resources in many ways. In fact, plastics have played a significant role in conserving scarce resources and this includes energy conservation, water conservation and conservation of natural resources like forests and wood to name a few.

There is an acceptance today that the earth's resources are limited and finite and that it is our responsibility to conserve them for the future generations. Growing environmental awareness is also exerting pressure on industry in general, and the chemical industry in particular, to be pollution conscious and ensure industrial growth and development that is eco-friendly to the extent possible. It is here that plastics and polymers need to be seen in their correct perspective, as capable of helping humankind conserve scarce resources.

Plastics during their entire life cycle not only conserve valuable resources but also lead to less environmental decay. Plastics are the material of choice today because they make it possible to balance modern day needs of higher efficiency with minimal use of fossil fuel resources - making it possible to 'use less, do more'.

Polymers are organic materials that are manufactured from petroleum feed stock, natural gas and oil using processes that are environmentally benign or that can be made more environmentally compatible. Only 3 to 4 percent of oil and gas production goes into the production of plastic while another 2 to 3 percent goes into the processing of plastics. Use of fossil feedstock for plastics therefore results in no additional drain on resources; in fact, in some areas plastics are referred to as by-products of fuel production.

'Plasticulture' in Agriculture

Agriculture is one area where plastics have tremendous potential for good. Applications of plastics in various branches of agriculture like horticulture, crop management, water management and storage is known as Plasticulture. Use of plasticulture is known to increase agricultural growth and production at lower cost, and thus help conserve land. Plastic-based irrigation systems,

greenhouses and lining for canals have played a major role in increasing agricultural and horticultural output worldwide.

Plastics in Conserving Water

Plastics also play a crucial role in using water supply resources more efficiently. In many countries, the Polyethylene pipe is the standard choice for drinking water mains as well as for service mains. The new generation material in the form of PE 80, PE 100 has also made it possible to use thinner pipe walls and reduce the weight and cost per meter of the pipe, for both smooth walled and structured wall pipe system. One of the most water - efficient irrigation systems is **Drip Irrigation.** It uses permanently installed plastic tubes to feed water directly to the roots of orchard trees and other high-value plants. A modified drip irrigation system can be easily rigged by laying plastic tubing on the ground with holes at the appropriate places where the plants or trees are growing. HDPE transmission mains are

economical even up to 630 mm because of their flexibility, smooth inner surface and low modulus of elasticity (low surge pressure). They are, thus, ideal for rural water supply mains. The properties of Polyethylene make the pipelines suitable for areas subject to seismic forces, mining subsidence, and compaction of filled sites.

Water Conservation through canal lining

Canals carry water to distant fields. But 35-40% of the water is lost through seepage in the canal system. This also causes water logging and salinity. A buried membrane in the form of a plastic film for canal lining has been adopted worldwide and found to be useful in preventing loss through seepage.

Plastics conserve our Natural Resources - Forests & Wood

Among environmental issues, deforestation has attracted the most concern. The forest cover in India now stands at a paltry 22% of the total land area, including degraded forestland with less than 40 % crown density and scrubland, against the

ideal 33.33%. Dense forest cover stands at about 2% only. This has happened despite massive afforestation programs and strict Government rules.

If present trends continue, the demand for wood will grow, resulting in the faster depletion of forests. The Central Government has therefore put restrictions on usage of wood by the Public Works Department and asked for the use of substitute products such as plastic windows, doors and partitions. Plastics, as a substitute, are very eco-friendly, light, recyclable, termite free, washable, and help in reducing deforestation.

Plastics & Energy Conservation

Energy is key to modern living and is being consumed at every moment of the day and night in different forms. Much of our energy requirements are based on fossil fuels like coal, oil & natural gas, constituting nearly 80% of the total fuel mix of global commercial energy consumption. Energy consumption in the world has been doubling every 30 years. Over the next two decades, total world energy usage is projected to grow to about 612 quadrillion Btu. *(Source: EIA, World Energy Projection System, 2002).*

But since fossil fuels are a finite source of energy, these resources could last another 50-100 years. This is where Plastics come in.

Products made from plastics, including packaging, reduce our use of these resources (i.e. oil & gas) in the major consuming sectors like energy and transport in many ways. For instance, food production is energy intensive, but minimizing food loss by packaging in plastics is preventing wastage of food and therefore energy. Also, it often takes less energy to convert plastics from a raw material into a finished product than other comparable products

Plastics have been helping in more efficient use of energy in buildings, electric appliances, vehicles, and production processes. From production, through regular use and through good waste management practices, plastics help conserve energy resources.

Source "Plastics for Environment & Sustainable Development"- Prof R P Singh, Indian Institute of Technology, Kharagpur

DID YOU KNOW?

Foam Polystyrene containers consume 30% less energy to make than paper board containers

WATER USE AND YIELD FOR VARIOUS CROPS IN DRIP AND CONVENTIONAL IRRIGATION METHODS

Sr. No.	Crops	Yield (Q/ha) Conventional	Drip Irrigaion	Increased yield in %	Water supplied (cm) Conventional	Drip Irrigation	Increased yield in %
1	Banana	575.00	875.00	52	176.00	97.00	45
2	Grapes	264.00	325.00	23	53.20	27.00	48
3	Mosambi (1000nos.)	100.00	150.00	50	166.00	64.00	61
4	Pomegranate (1000nos.)	55.00	109.00	98	144.00	78.50	45
5	Sugarcane	1280.00	1700.00	33	215.00	94.00	56
6	Tomato	320.00	480.00	50	30.00	18.40	39
7	Cotton	23.00	29.50	27	89.53	42.00	53
8	Ladies finger	152.61	177.24	16	53.68	32.44	40
9	Brinjal	280.00	320.00	14	90.00	42.00	53
10	Water melon	240.00	450.00	88	33.00	21.00	36
11	Bittergourd	153.34	214.71	39	24.50	11.55	53
12	Ridgegourd	171.30	200.60	17	42.00	17.20	59
13	Cabbage	195.00	200.00	02	66.00	26.67	60
14	Papaya	134.00	234.00	75	228.00	73.30	68
15	Radish	70.45	71.86	02	46.41	10.01	77
16	Beet root	45.71	48.87	07	88.71	17.73	79
17	Chillies	42.33	60.00	44	109.71	41.77	62
18	Sweet potato	42.44	50.00	39	63.14	25.20	68

COST ESTIMATE OF MICRO-IRRIGATION SYSTEM FOR DIFFERENT CROPS (DRIP SYSTEM)

Crop Type (Rs.)	Spacing (Mxm)	Cost/ hectare(Rs.)
Mango	9.0x9.0	16,360.00
Tall coconut/ Oil palm/ Litchi	7.5x7.5	18,300.00
Lemon/ Orange/ Guava/ Cashew	6.0x6.0	24,062.00
Pomegranate/ Dwartcoconut/ Ber	5.0x5.0	25,925.00
Dwart banana	2.0x2.0	37,747.00
Banana/ Papaya	2.5x2.5	31,127.00
Hybrid tomato/ Brinjal/ Chilli	1.0x1.0	46.838.00
Betelvine	1.0x0.75	2,48,144.00
Mini Sprinkler		**50,000.00**

DEMAND FOR WOOD IS EXPECTED TO GROW FOR ALL THE SECTORS:

Total projected demand for wood (million cubic meters)

Industry	1998	1999	2000	2005	2010	2015	2020
Paper & paper board	4.49	4.48	4.48	8.96	15.4	26.64	35.84
Construction	13.6	14.6	15.9	19.4	22.1	26.3	28.5
Packaging	4.36	4.49	4.62	5.54	6.4	7.55	9
Furniture	2.25	2.38	2.52	3.36	4.62	5.9	7.53
Automobile	0.17	0.18	0.19	0.28	0.41	0.5	0.87
Agricultural implements	2.06	2.12	2.33	2.5	2.5	2.5	20
Others	24.99	26.3	27.68	33.88	43.66	53.67	51.06
Total	51.92	54.55	57.72	73.92	95.09	123.06	152.8

ENERGY REQUIRED BY DIFFERENT PACKAGING MATERIALS

Product & Input	Total Energy (MJ)
1 kg Pulp from Cut Timber	28.59
1 kg Base Paper from Standing Paper	83.91
1 kg. Coated Paper from Standing Timber	99.95
1 kg of PET bottles from PET Resin	13.20
1 kg of PE Bottles from PE	11.00
1 kg of Glass Bottles from Glass	18.50
1 kg of Three Piece Tin Can from Tin	62.00

Source: ENERGY & PACKAGING - Boustead & G.F. Hancock, Ellis Harwood Press

News You Can Use

INTERNATIONAL

European Plastics manufacturers support use of plastic bags

A recent statement from the Association of Plastics Manufacturers in Europe (APME) clarifies their position on the thorny issue of whether plastic bags, a major component of litter, should be banned. They acknowledge that, when discarded without thought, plastic bags do indeed represent one of the most visible forms of litter, and which have also been associated with harming wildlife and blocking drains. However, they point out, the ubiquitous plastic bag, provided free by the supermarket or fast-food outlet, does represent a very efficient use of resources compared with most alternatives, as it serves its purpose with a minimum of material and cost.

The challenge is to modify public behaviour so as not to litter, and encourage where possible re-use (e.g. as garbage bag) prior to either controlled disposal or - preferably - energy recovery. Other possibilities that they promote include the use of stronger, reusable bags that are replaced free of charge after the initial purchase, thereby facilitating collection for mechanical recycling.

Manufacturers argue that a ban on plastic bags will not solve the general problem of litter, and claim this may lead to the introduction of other materials, which have overall a more negative impact on the environment. The plastics industry is committed to supporting proactive schemes and promoting best practices, which can help to solve the littered bag problem and alleviate litter in general.

The document goes on to detail APME's position on the potential for resource savings and modifying littering behaviour, and manufacturers argue that it is the industry that is best placed to identify areas for improvement and determine feasible solutions.

Source: Waste Management World
http://www.jxj.com/wmw/index.html

ICPE in the Media

DID YOU KNOW?

53 billion units of electricity are saved annually due to Plastics applications

New Zealand tackles plastic waste on farms

In a workshop held in May this year prominent figures from the New Zealand farming sector and plastics companies got together to try and find solutions to the problems that farmers face when disposing of waste farm plastics. As part of this initiative, the Zero Waste New Zealand Trust will carry out a three-year study into the safe management and disposal of farm plastics.

The study will aim to develop better options for farmers and growers than some of the current, unsustainable waste disposal practices. Funding for the study has been provided by the Sustainable Management Fund of the Ministry for the Environment. The problem has been made more acute by a proposal from the Ministry for the Environment to prohibit the burning of plastics on farms which has, to date, been the most common method farmers have used for dealing with waste plastics.

Source: Waste Management World
http://www.jxj.com/wmw/index.html

Plastic Bones thrill doctors to the marrow

Doctors may one day use various prototyping techniques to build replacements for bones destroyed by injury or disease. The Office of Naval Research in Virginia- USA has pioneered techniques for making Plastic parts from digital designs and biomedical engineers are developing Plastic Plugs, to replace pieces of damaged bones. Also, Ceramic parts will play a role in this rehabilitative surgery: and experts say that this technique is likely to receive FDA approval in the next 4 years.
(Source: BusinessWeek, June 23, 2003)

INDIA

A little sugar and bacteria helps make plastics biodegradable

Unsatisfactory ways of disposal of plastic waste have led to myriad problems from various quarters. Anjani Varma of the Chemical Engineering division of the National Chemical Laboratory, Pune has found an eco friendly non-toxic way to biodegrade high volume, commonly used plastics like shopping bags, disposable cups and packaging material.

There has been considerable research work to find the right kind of additives, which could help in degradation of polymers. Many of these additives can leach out and in the process adversely affect the desirable properties of the polymer. The polymer chain is first made chemically functional for sweet bonding with sugar especially carbohydrate sugar like lactose, glucose and sucrose. They are then chemically and randomly hooked to this functional polymer chain. While utilizing the carbohydrates as nutrients for their growth, the bacteria also utilized part of the polymer molecule, thus accelerating the process of its biodegradation. The model polymer that the researchers worked on was polystyrene.

This process has been developed indigenously as in-house research by the National Chemical Laboratory and their preliminary research findings have been published in the November 2002 edition of the 'Chemical Communications'.

(Source: The Indian Express, Mumbai, June 8, 2003)

DID YOU KNOW?

Plastic bags require one third less energy to make than paper bags

Plastic waste to ensure road durability

Bangalore based KK Plastic Waste Management Pvt Ltd and a team of engineering experts led by C.E.G Justo from Bangalore University has developed a new way of using plastic waste for road construction.

The Bangalore Mahanagara Palike (BMP) which has initiated recycling of dry waste as part of its new cleanliness campaign is also considering a proposal of using plastic waste to asphalt roads.

K Ahmed Khan and K Rasool Khan, proprietors of the firm, claim to be pioneers of the technology in India. "It has been used in Canada and Brazil but we are the first to use it in India" they said.

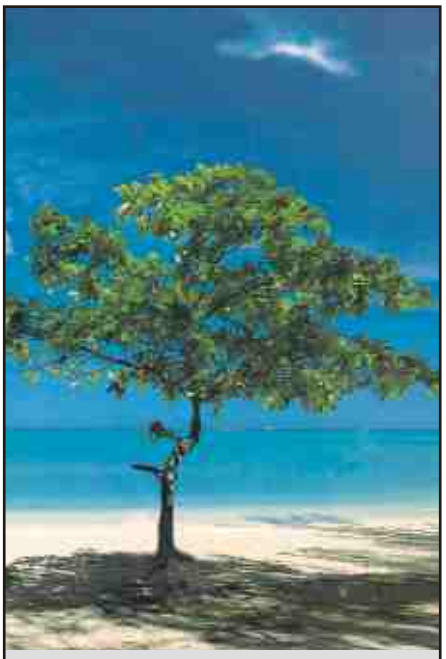
This is how the work was done: Melted plastic is mixed with bitumen in a particular ratio with the plastic acting as a strong 'binding agent' for tar, making the asphalt last longer. A stretch of road made with plastic waste mix is found to be three times better than conventional roads. The company picks up the plastic waste from rag pickers at Rs 6/kg and it is then segregated, pulverized and added to bituminous concrete mixes in a blender designed by the company.

The firm had submitted to the BMP to sell its patented plastic waste compound, “KK Polyblend” for asphalting roads. The firm would be allowed to take plastic waste from city’s daily garbage collection.

On a pilot basis the firm has already laid over 35 km of roads in Bangalore and experts from Bangalore University Centre for Transportation Engineering have tested the strength and durability of the roads. The Central Road Research Institute has evaluated the experiment and the results have been encouraging.

Some of the advantages of this technology is that the need to repair the road will be less, rainwater will not seep through because of plastic in the tar and the use of two tonnes of polyblend using plastic will help reduce non-biodegradable waste. They say this technology will lead to less road repair.

(Source: The Hindu, Bangalore June 9, 2003)



ICPE Activity

Academicians Meet in Kolkata - Plastics for Environment and Sustainable Development, June 16, 2003

The Academicians Meet held in Kolkata on June 16, 2003 pointed out that plastic products are not a threat, when recycled. Talking on the occasion Prof Dr Shekar Chaudhary, Director, IIM Kolkata said, "the ease and use of plastic have made the use of material unavoidable. The more advanced a nation, the greater is the plastic consumption and we as a society must work towards solving the problem".

DID YOU KNOW?

20 million trees are saved with yearly production of 50 million plastic chairs and 15 million plastic crates

Views & Interviews

An interview with Dr R A Mashelkar, Director General, CSIR & Secretary, Department of Scientific and Industrial Research (Govt. of India) interview during the launch of ICPE's eco-assesment study "Plastics for Environment & Sustainable Development" in New Delhi on May 2, 2003.

Dr Mashelkar, can you elaborate on the four Rs?

Dr. Mashelkar: When we look at plastics, we talk about plastics for environment and not plastics against or versus environment. And this is possible because of the 4 R's- **Reduce, Reuse, Recover and Recycle.** To that we can add a fifth R, which is typically Indian, and that is **Repair.** I have seen it with my own eyes; somebody repairing a plastic bucket, our economy being what it is the requirement of the lowest strata of the society.

What do you think about people's attitude to waste?

Dr. Mashelkar: In each of the R's- there are 2 things that are required, Attitude as well as Technology. One without the other will not do. If you are talking in terms of Reuse, you must have an attitude towards Reuse. You must not say to yourself 'I am not a consumption society', 'I am not a throw away Society', I must make the best use of what I have in hand which has been produced with so much of resources. So it requires a mental attitude and secondly it has to be backed up by technology in order to do it in the best possible way so that you really have a product which can be as good as what was created by the virgin plastic. It requires Attitude plus Technology.

Can you share with us your Indonesian experience?

Dr. Mashelkar: It all depends upon individual attitude. When I was in Indonesia, relaxing in a hotel, near a small swimming pool some Japanese children were swimming. A dry leaf fell into the pool, and one child after struggling for ten minutes, picked that dry leaf and went all the way to the little corner and threw it in the bin, and then came back and continued swimming.

What does it tell you? You are talking about the citizen of the 21st century, you are talking about somebody who is a responsible citizen, and therefore I believe that this Attitude problem has to do something with your responsibility to the society. If we develop that, why plastics, every other problem can be taken care of.

Will we ever have biodegradable plastics?

Dr. Mashelkar: In the long run, maybe. It's too distant a dream. Today, they are 4-5 times more expensive than the normal commodity polymer that we have. But there are technological breakthroughs that are on the anvil. You have people looking at genetically modified micro-organisms that will work under favorable conditions, which will give high productivity and therefore the cost will come down. But let's realize, let's not have false dreams, out of 130 million tonnes of total consumption of plastics barely 3,00,000-4,00,000 tonnes per annum are based on these, so it's a very small percentage indeed. So before they start occupying a large space it's going to be a long time and the second point is everything should not be biodegradable. In fact there are short life cycle applications of plastics, which should be biodegradable, but there are others, which we'd like them to last forever.

India can benefit from plastics provided the Attitude and Technology issues are brought on board and there can be a 'Golden Age', a 'Golden Indian Age' of Plastics-where we can lead the rest of the world, not only in terms of production as we have gone up by a factor of 10, during the last ten years: but by demonstrating to the rest of the world as to how we can be a responsible society which shows the rest of the world how those 5 R's can be actually put into practice.

DID YOU KNOW?

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