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PLASTICS AND ENVIRONMENTS

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ENVIS Centre on:

Eco-labelling and Eco-friendly Products

Foreword

Everyone knows that the usage of plastics is increasing in India. Being cheap, light and easily available, plastic products have got acceptance across the country. At the same time, slowly but steadily, enlightened people have also started realizing the hazards of using plastics. Consumer groups in the country have, in particular, raised voice against plastic usage. It is, however, essential to keep on raising the pitch of this voice. Apart from non-degradability of plastics, there are many other points arising out of plastics affecting both human and animal lives. There is a strong need therefore to make known the adverse impact of the use of plastic widely.

This issue of ENVIS-CERC is to be viewed against this background. So many things can be written about this particular subject, but the limitations of space is forcing us to concentrate only on certain major aspects. The main idea is to achieve a phased reduction in the use of non-degradable plastic and set up some feasible quantified goal in this regard and fight till those goals are achieved.

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ECOMARK CRITERIA FOR PLASTIC PRODUCTS

(The Gazette of India, Extraordinary, Part II-Section 3(i), No.170, May, 18, 1996)

GENERAL REQUIREMENTS :

1. All products of plastics shall meet relevant standards of Bureau of Indian Standards pertaining to quality, safety and performance.
2. The product manufacturer must produce the consent clearance as per the provisions of Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981 along with the authorization if required under Environment (Protection) Act, 1986 and the rules made thereunder to Bureau of Indian Standards while applying for the ECOMARK. The manufacturers of plastic wares shall produce documentary evidence with respect to the compliance of regulation under Prevention of Food Adulteration Act, 1954 and Drugs and Cosmetic Act, 1940 and rules made thereunder, wherever necessary.
3. The product must display a list of critical ingredients in descending order of quantity present expressed as per cent of the total. The list of such ingredients shall be identified by Bureau of Indian Standards.
4. The Product packaging may display in brief the criteria based on which the product has been labelled environment friendly.
5. The material used for product packaging shall be recyclable or biodegradable.
6. It shall also be suitably mentioned that Ecomark label is applicable only to the packaging material package if content is not separately covered under Ecomark. It may be stated that the Ecomark is applicable to the product or packaging material or both.



PRODUCT SPECIFIC REQUIREMENTS :

Food, Pharmaceutical and Drinking Water Grade Plastic Products

For the manufacturer of these items, one or more of the virgin material covered in following Indian Standards shall be used :

- 1) IS 10142 : 1982
- 2) IS 10151 : 1982
- 3) IS 10910 : 1984
- 4) IS 11434 : 1985
- 5) IS 11704 : 1986
- 6) IS 2247 : 1988
- 7) IS 12252 : 1987

Food, Pharmaceutical and Drinking Water Grade Plastic Products :

Recycled Plastic Products

This category includes all plastic products as further defined in the following sub-categories :

- a) Horticultural supplies
- b) Produce containers
- c) Office supplies
- d) Non-food containers
- e) Recreational equipment and furniture
- f) Construction materials

Horticultural supplies include all implements, containers and support structures used in gardening activities such as flower pots, garden stakes and berry trays.

Product containers include containers and support structures for use in offices such as presentation folders, file folders and binder covers.

Office supplies include all implements, containers and support structures for use in offices such as presentation folders, file folders and binder covers.

Non-food containers, not for holding the contents, include all containers for non-food products such as detergent bottles, pallets, and reusable packaging containers.

Recreational equipment and furniture include all implements and support structures designed for the recreational market such as play ground equipment and patio tables.

Construction materials include all materials used in the construction of structures whether

stationary or transportable, such as lumber, fencing or shingles.

2.2.1. The plastic products identified in sub-categories from 2.2(a) to 2.2 (e) shall apart from fillers and reinforcing agents, be made from the minimum 90 per cent, by weight, of compatible plastic wastes.

Note: The manufacturer shall provide documentary evidence by way of certificate or declaration to this effect to Bureau of Indian Standards while applying for ECOMARK.

2.2.2. The plastic products identified in sub-category 2.2(f) shall apart from fillers and reinforcing agents, be made from the minimum 60 per cent, by weight, or compatible plastic wastes.

Note : This is specified since a higher content of recycled plastic in construction materials is difficult to maintain. A higher content would not allow the end product to achieve structural conformity and performance standards.

BIS is in the process of identifying standards for issuing amendments.

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REDUCING PLASTIC USAGE

REDUCING PLASTIC

You can take steps to reduce the dangers of plastics in your home quite easily. Here are some suggestions to help you to limit your exposure.

Baby's bottle

If you do use polycarbonate bottles, heat them up in warm but not boiling water instead of in the microwave. Replace any that are scratched or cracked. Avoid storing formula or breast milk in plastic bottles. Instead pour the milk into the bottle just before feeding your baby and discard whatever is left over.

Cleaning

Dishwashers and harsh detergents can cause the plastic to break down and also scratch plastic containers making it easier to harbour bacteria. Handwash with warm water and gentle products instead, especially for babies' bottles and breakers.

Cooking and microwaving

A 'microwave-safe' or 'microwavable' label means that a container should not melt or crack in the microwave but does not guarantee that chemicals will not leach into the food when heated. Glass, ceramic, and porcelain containers are microwave-safe but check the manufacturer's specifications for using in an over.



Shopping

Look for companies that make storage containers from safer materials such as glass. Use reusable and durable canvas, cotton, hemp or natural fibre bags instead of plastics. Choose products with minimum packaging, preferably recyclable or biodegradable. Reduce purchases of canned foods and drinks. Choose glass or cardboard containers where possible. Choose natural fabric toys rather than plastic toys for babies and young children.

Storage

Avoid storing liquids or fatty foods such as meat and cheese in plastic containers or clingfilm. Use containers made of glass, porcelain or ceramic. Use glass food jars that you would normally throw out or recycle as storage containers. If freezing food in glass keep the container no more than two-thirds full.

Source: Consumer Choice, June 2009

INDIA IS PLASTIC RECYCLING CHAMP

Indian manufacturers of plastic use 30% of the total plastic waste available in the country against the world average of 22%. As per the data compiled by working group on chemicals and petrochemicals constituted by Planning Commission, Indian average of 30% is the highest in the world. The share of Gujarat's plastic recycling industry in country's total market is around 25%.

Data available with Gujarat State Plastic manufacturers Association says that around 700 tiny, small and medium scale units in the state have annual turnover of around Rs.1,200-1,400 crore. In India, number of units is around 2,300-2,500 with annual turnover of around Rs.5,000-6,000 crore. Apart from that Gujarat plays a crucial role in plastic industry, as around 70% of the polymers such as PVC and Polypropylene are manufactured in the state.

“In India, large number of people is engaged in collection and sorting of plastic waste. This includes rag pickers and scrap dealers and they do this business on small scale and unorganized manner,

which makes it possible for India to use recycled plastic to the best extent possible”, said Navin Trambadia, president of Gujarat State Manufacturers Association. “In Western countries, collection of waste is done through a mechanised process and on large scale which does not allow recycling in small lots”. According to experts, economic condition of the people is also responsible for the highest recycling rate.

“India is a developing country and many people cannot afford products made from virgin plastic. Products made with recycled plastic have lower cost and are in demand from a vast segment of the society, which keeps the momentum going on for plastic recycling industry”, said SB Dangayach, Managing Director of Sintex Industries India Ltd. In India, per capita plastic consumption is 6 kg, which is much lower than the global average of 25 kg and Chinese average of 30 kg. This offers enormous growth potential for the industry.

Ref : DNA Money, 9/4/09, by Sachin Kumar

PLASTIC NEWS

Report analyses plastics' role in greenhouse gas reduction

The contribution that plastics materials make to the reduction of greenhouse gases is prominent in a detailed report by top consultants McKinsey, supported by Oko Institut, and sponsored by the International Council of Chemical Associations.

The analysis, presented in a 105-page report, aims to compare the emissions by the chemical industry with the benefits of its products in use after a detailed life cycle analysis.

Plastics' biggest contribution on this basis lies in insulation, the study found, with 40% of all identified CO₂ savings generated across the insulation materials field. After evaluating 25 examples, the McKinsey team calculate that foam insulation generated 10m tones of CO₂ emissions but resulted in nearly 2.5bn tones of CO₂ “abatements”.

Also scoring well on the greenhouse gas saving list are plastic packaging, automotive plastics and plastics employed in piping, the report shows. In the automotive sector, for example, the ratio of emission abatements to CO₂ generation in manufacture came

out at around 2, after a study of a small sample of uses.

Phthalates case premature breast development in girls says a Puerto Rican Study

Girls with prematurely developing breasts were found to have seven times the amount of phthalates in their blood than the control group in a Puerto Rican study. Phthalates are just one of dozen of chemicals environmentalists and scientists have been scrutinizing recently as possible environmental toxins, carcinogens and endocrine disruptors, which mimic the female hormone estrogen.

As early as 1979, pediatric endocrinologists were reporting a baffling increase in the number of young girls entering premature sexual development on the small Caribbean Island. Girls as young as 23 months were developing breast buds and their estrogen levels were spiking shockingly early.

When researchers began studying the effects of environmental chemicals, they identified phthalates a substance used to soften plastics as a possible culprit.

In their report *The Environment, Cancer and You*, the Canadian Cancer Society also says exposure to phthalates poses a cancer risk, especially among young children.

Plastics Waste : Environmental Issues and Challenges

We have become so accustomed to the ubiquitous presence of plastic that it is difficult to envision life when woods and metals were the primary materials used for consumer products. Plastic has become prevalent because it is inexpensive and it can be engineered with a wide range of properties. Plastics are strong but lightweight, resistant to being degraded by chemicals, sunlight, and bacteria, and are thermally and electrically insulating.

Plastics also can be custom-designed for innumerable uses, including polyethylene terephthalate for soda bottles, high-density polyethylene for milk bottles, polypropylene for ketchup bottles, expandable polystyrene for egg crates, low-density polyethylene for plastic bags, and polyvinyl chloride (PVC) for water pipes. They can be molded into many shapes, including intricate small parts, and can be drawn into thin fibres. Some can be foamed to produce high-bulk materials such as Styrofoam, further increasing their thermal insulation properties.

Plastics are essentially a byproduct of petroleum refining. In plastics production, the components of oil and natural gas are heated in a “cracking” process, yielding hydrocarbon monomers that are then chemically bonded into polymers, which are long-chain molecules. Different combinations of monomers produce polymers with different characteristics.

The basic backbone of a hydrocarbon polymer is a chain of carbon atoms, with hydrogen atoms branching off the carbon spine. Some plastics contain other elements as well. For example, Teflon contains fluorine, PVC contains chlorine, and nylon contains nitrogen.

As with all materials, there are environmental costs and benefits associated with the use of plastics. Plastics replace natural materials, including ivory and wood. Synthetic fibers also

provide a substitute for cotton, a water-and energy-intensive crop. The use of plastic materials in cars and airplanes reduces their weight and therefore increases their fuel efficiency. The insulating capacity of plastics such as Styrofoam reduce the amount of energy required to heat and cool homes.

There are, however, environmental impacts associated with the production and disposal of plastics. The wastes involved in the manufacturing of plastics have to be handled according to the state and federal regulations.

One of the most significant environmental problems associated with plastics is the improper disposal of plastic goods by consumers. The use of plastics has enabled the development of innumerable disposable products, which has increased the amount of trash that is disposed. Although paper accounts for most of the trash in landfills by volume, plastics account for 25% of all waste in landfills when buried.

A significant amount of plastic, however, is not properly disposed in landfills and makes its way into the environment. Plastic does not biodegrade quickly which **means it** remains in the environment for a very long time. Plastic trash has made its way to coastal ecosystems and the ocean, presenting a danger to marine and birdlife.

World's annual consumption of plastic material has increased from around 5 million tones in 1950s to 100 million tones today.

The quantum of solid waste is ever increasing due to increase in population, developmental activities, changes in life style, and socio-economic conditions. Plastics waste is a significant portion of the total municipal solid waste (MSW). It is estimated that approximately 10 thousand tons per day (TPD) of plastics waste

is generated. I.e. 9% of 1.20 lacs TPD of MSW in the country. The plastics waste constitutes two major category of plastics (i) Thermoplastics and (ii) Thermoset plastics. Thermoplastics, constitutes 80% and thermoset constitutes approximately 20% of total post-consumer plastics waste generated in India. The Thermoplastics are recyclable plastics which include Polyethylene Terephthalate (PET), Low Density Poly Ethylene (LDPE), Poly Vinyl Chloride (PVC), High Density Poly Ethylene (HDPE), Polypropylene (PP), Polystyrene (PS) etc. However, thermoset plastics contains alkyd, epoxy, ester, melamine formaldehyde, phenolic formaldehyde, silicon, urea formaldehyde, polyurethane, metalised and multi-layer plastics etc. The environmental hazards due to mismanagement of plastics waste include the following aspects :

Littered plastics spoils beauty of the city and choke drains and make important public places filthy ;

Garbage containing plastics, when burnt may cause air pollution by emitting polluting gases ;

Garbage containing mixed with plastics interferes in waste processing facilities and may also cause problems in landfill operations ;

Recycling industries operating in non-conforming areas are posing unhygienic problems to the environment.

Main Features of the Plastics Manufacture and Usage (Amendment) Rules, 2003

Regulation of plastics waste, particularly manufacture and use of recycled plastics carry bags and containers is being regulated in the country as per Recycled Plastics Manufacture and Usage Rules, 1999 and as amended in 2003. According to these Rules :

No person shall manufacture, stock, distribute or sell carry bags made of virgin or recycled plastic bags which are less than 8 x 12 inches in size and having thickness less than 20 microns.

No vendor shall use carry bags/containers made of recycled plastics for storing, carrying, dispensing or packaging of food stuffs ;

Carry bags and containers made of recycled plastic and used for purposes other than storing and packaging food stuffs shall be manufactured using pigments and colorants as per IS 9833:1981 entitled "List of pigments and colorants for use in plastics in contact with food stuffs, pharmaceuticals and drinking water".

Recycling of plastics shall be undertaken strictly in accordance with the Bureau of Indian Standard specification IS 14534:1998 entitled "The Guidelines for Recycling of Plastics".

Manufactures of recycled plastic carry bags having printing facilities shall code/mark carry bags and containers as per BIS specification : IS 14534 : 1998 (The Guidelines for Recycling of Plastics)

No person shall manufacture carry bags or containers irrespective of its size or weight unless the occupier of the unit has registered the unit with respective SPCB/PCC prior to the commencement of production.

The prescribed authority for enforcement of the provisions of these rules related to manufacturing and recycling is SPCB in respect of States and the PCC in Union Territories and for relating to use, collection, segregation, transportation and disposal shall be the District Collector/Deputy Commissioner of the concerned district.

Ref: Parivesh, CPCB

Adverse Health Effects of Plastics

In addition to creating safety problems during production, many chemical additives that give plastic products desirable performance properties also have negative environmental and human health effects. These effects include

- * Direct toxicity, as in the cases of lead, cadmium, and mercury
- * Carcinogens, as in the case of diethylhexyl phthalate (DEHP)
- * Endocrine disruption, which can lead to cancers, birth defects, immune system suppression and developmental problems in children.

Chemical Migration from Plastic Packaging into Contents

People are exposed to these chemicals not only during manufacturing, but also by using plastic packages, because some chemicals migrate from the plastic packaging to the foods they contain. Examples of plastics contaminating food have been reported with most plastic types, including Styrene from polystyrene, plasticizers from PVC, antioxidants from polyethylene, and Acetaldehyde

from PET.

Among the factors controlling migration are the chemical structure of the migrants and the nature of the packaged food. In studies cited in Food Additives and Contaminants, LDPE, HDPE, and polypropylene bottles released measurable levels of BHT, Chimassorb 81, Irganox PS 800, Irganix 1076, and Irganox 1010 into their contents of vegetable oil and ethanol. Evidence was also found that acetaldehyde migrated out of PET and into water.

Recommendations

Find alternatives to plastic products whenever possible. Some specific suggestions:

- * Buy food in glass or metal containers; avoid polycarbonate drinking bottles with Bisphenol A
- * Avoid heating food in plastic containers, or storing fatty foods in plastic containers or plastic wrap.
- * Do not give young children plastic teethingers or toys
- * Use natural fiber clothing, bedding and furniture
- * Avoid all PVC and Styrene products

<i>Plastic</i>	<i>Common Uses</i>	<i>Adverse Health Effects</i>
Polyvinyl chloride (#3PVC)	Food packaging, plastic wrap, containers for toiletries, cosmetics, crib bumpers, floor tiles, pacifiers, shower curtains, toys, water pipes, garden hoses, auto upholstery, inflatable swimming pools	Can cause cancer, birth defects, genetic changes, chronic bronchitis, ulcers, skin diseases, deafness, vision failure, indigestion, and liver dysfunction
Can cause cancer, birth defects, genetic changes, chronic bronchitis, ulcers, skin diseases, deafness, vision failure, indigestion, and liver dysfunction	Softened vinyl products manufactured with phthalates include vinyl clothing, emulsion paint, footwear, printing inks, non-mouthing toys and children's products, product packaging and food wrap, vinyl flooring, blood bags and tubing, IV containers and components, surgical gloves, breathing tubes, general purpose labware, inhalation masks, many other medical devices	Endocrine disruption, linked to asthma, developmental and reproductive effects. Medical waste with PVC and phthalates is regularly incinerated causing public health effects from the release of dioxins and mercury, including cancer, birth defects, hormonal changes, declining sperm counts, infertility, endometriosis, and immune system impairment.
Polycarbonate, with Bisphenol A (#7)	Water bottles	Scientists have linked very low doses of bisphenol A exposure to cancers, impaired immune function, early onset of puberty, obesity, diabetes, and hyperactivity, among other problems (Environment California)

<i>Plastic</i>	<i>Common Uses</i>	<i>Adverse Health Effects</i>
Polystyrene	Many food containers for meats, fish, cheeses, yogurt, foam and clear clamshell containers, foam and rigid plates, clear bakery containers, packaging "peanuts", foam packaging, audio cassette housings, CD cases, disposable cutlery, building insulation, flotation devices, ice buckets, wall tile, paints, serving trays, throw-away hot drink cups, toys	Can irritate eyes, nose and throat and can cause dizziness and unconsciousness. Migrates into food and stores in body fat. Elevated rates of lymphatic and hematopoietic cancers for workers.
Polyethylene (#1 PET)	Water and soda bottles, carpet fiber, chewing gum, coffee stirrers, drinking glasses, food containers and wrappers, heat-sealed plastic packaging, kitchenware, plastic bags, squeeze bottles, toys	Suspected human carcinogen
Polyester	Bedding, clothing, disposable diapers, food packaging, tampons, upholstery	Can cause eye and respiratory-tract irritation and acute skin rashes
Urea-formaldehyde	Particle board, plywood, building insulation, fabric finishes	Formaldehyde is a suspected carcinogen and has been shown to cause birth defects and genetic changes. Inhaling formaldehyde can cause cough, swelling of the throat, watery eyes, breathing problems, headaches, rashes, tiredness
Polyurethane Foam	Cushions, mattresses, pillows	Bronchitis, coughing, skin and eye problems. Can release toluene diisocyanate which can produce severe lung problems
Acrylic	Clothing, blankets, carpets made from acrylic fibers, adhesives, contact lenses, dentures, floor waxes, food preparation equipment, disposable diapers, sanitary napkins, paints	Can cause breathing difficulties, vomiting, diarrhea, nausea, weakness, headache and fatigue
Tetrafluoroethylene	Non-stick coating on cookware, clothes irons, ironing board covers, plumbing and tools	Can irritate eyes, nose and throat and can cause breathing difficulties

Sources: Centers for Disease Control Report, "National Report on Human Exposure to Environmental Chemicals," 2001. *Dadd, Debra, Home Safe Home, Penguin Putnam, New York, 1997. , * Ecology Center Plastic Task Force Report, Berkeley, CA, 1996. * Goettlich, Paul, "What are Endocrine Disruptors?," 2001 * National Resources Defense Council website, "Endocrine Disruptors FAQ," 2001.

BIODEGRADABLE PLASTICS

Biodegradable plastics are plastics that will decompose in the natural environment. Biodegradation of plastics can be achieved by enabling microorganisms in the environment to metabolize the molecular structure of plastic films to produce an inert humus-like material that is less harmful to the environment. They may be composed of either bio-plastics, which are plastics whose components are derived from renewable raw materials, or petroleum-based plastics. The use of bio-active compounds compounded with swelling agents ensures that, when combined with heat and moisture, they expand the plastic's molecular structure and allow the bio-active compounds to metabolize and neutralize the plastic.

A potential disadvantage of biodegradable plastics is that the carbon that is locked up in them is released into the atmosphere as a greenhouse gas carbon dioxide when they degrade, though if they are made from natural materials, such as vegetable crop derivatives or animal products, there is no net gain in carbon dioxide emissions, although concern will be for a worse greenhouse gas, methane release. Of course, incinerating non-biodegradable plastics will release carbon dioxide as well, while disposing of it in landfills will release methane when the plastic does eventually break down.

So far, these plastics have proven too costly and limited for general use, and critics have pointed out that the only real problem they address is roadside litter, which is regarded as a secondary issue. When such plastic materials are dumped into landfills, they can become "mummified" and persist for decades even if they are supposed to be biodegradable.

However, certified biodegradable plastics require a specific environment of moisture and oxygen to biodegrade, conditions found in professionally managed composting facilities. There is much debate about the total carbon, fossil fuel and water usage in processing biodegradable plastics from natural materials and whether they are a negative impact to human food supply. Traditional plastics made from non-renewable fossil fuels lock up much of the carbon is permanently trapped inside the plastic lattice and is rarely recycled.



Applications and uses of Biodegradable Plastics

Biodegradable plastics are a new generation of polymers emerging in the market. Biodegradable plastics have an expanding range of potential applications, and are driven by the growing use of plastics in packaging and the perception that biodegradable plastics are "environmentally friendly", their use is predicted to increase. However, issues are also emerging regarding the use of biodegradable plastics and their potential impacts on the environment and effects on established recycling systems and technologies.

There is an extensive range of potential applications. Some of these include : Film including over wrap, shopping bags, waste and bin liner bags, composting bags, mulch film, silage wrap, landfill covers, bait bags and cling wrap, flushable sanitary products, sheet and non-woven packaging, bottles, planter boxes and fishing nets, food service cups, cutlery, trays and straws.

Environmental benefits of biodegradable plastics

There are several identifiable environmental benefits that may potentially be derived from the use of biodegradable plastics compared to conventional petroleum-based plastics. They are:

Compost derived in part from biodegradable plastics increases the soil organic content as well as water and nutrient retention, while reducing chemical inputs and suppressing plant disease.

Biodegradable shopping and waste bags disposed of to landfill may increase the rate of organic waste degradation in landfills while enhancing methane harvesting potential and decreasing landfill space usage. Biodegradable landfill covers may also considerably extend landfill life.

The energy required to synthesize and manufacture biodegradable plastics is generally much lower for most biodegradable plastics than for non-biodegradable plastics. The exception is PHA biopolymers which consumer similar energy inputs to polyethylenes. New feedstock for PHA should lower the energy required for their production.

Biodegradable plastics also offer important environmental benefits through, in many cases, the use of renewable energy resources and reduced greenhouse gas emissions.

Ref. : wikipedia, the free encyclopedia

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