EDITORIAL

Durability, lightweight and elasticity make "Plastic'' the most convenient product. It has wide range of application, viz for domestic purpose, hospitals, shops, hotels etc. The uses show that life without plastic is indispensable. The worst thing about plastic is that it is non-biodegradable and the chemicals use for its manufacture may pose a health risk for living being.

Among the plastic items "Plastic bags" are very popular with both shopkeeper as well as consumers because they are cheap, strong, lightweight, as well as an easy means of carrying food as well as other goods but they are responsible for pollution, killing wildlife, and using up the precious resources of the earth (Petroleum). Each year more and more plastic bags are ending up either in the dumping sites or littering the environment as they are not degradable. Once they become litter, plastic bags find their way into our waterways, parks, beaches, and streets. And, if they are burned, they release the toxic fumes into the air. Plastic bags also pose a serious danger to birds and marine mammals that often mistake them for food. Thousands die each year after swallowing or choking on discarded plastic bags. Governments may be working out ways to lessen the impact of plastic bags on the environment, however, each of us should shoulder some of the responsibility for this problem by judicious use of plastics.

ODDS AND ENDS

Catalytic degradation of plastic waste into petrochemicals using Ga-ZSM-5

Catalytic degradation of polyolefin has been carried out using Ga-ZSM-5 in a pilot plant (10 kg/h), with continuous feeding of polyolefin pellets from industrial plastic waste (IPW) and pellets of plastic waste as stipulated in the Containers and Packaging Recycling Law (RLW). As regards the product resulting from the degradation of IPW pellets, liquid compounds accounted for more than 50%. More than 80% of the liquid consisted of aromatics, with more than 90% being benzene, toluene, *o*-xylene, *m*-xylene, and *p*-xylene (BTX). Hydrogen was produced at a level of 3%, this value corresponding to 60% of the total gas volume. It has been confirmed that degradation took place over a period of 460 h, with catalytic cracking under conditions of alternating degradation and regeneration. The liquid yield was more than half of the total product throughout the process of degradation. During degradation, the amount of BTX was observed to decrease slightly, while the amounts of other aromatics and liquids were seen to increase.

With RLW pellets, aromatic yields, including those of BTX, decreased, while those of other liquids, gases, and residues increased beyond the values noted for IPW pellets. Due to the undesirable accumulation of residue on the inner walls of the kiln, the process could only be carried out for up to 170 h.

Fuel, 87/ 17-18, 2008, 3681-3686.

Photodegradation of bisphenol A and related compounds under natural-like conditions in the presence of riboflavin: Kinetics, mechanism and photoproducts

The aerobic riboflavin (Rf)-sensitized photodegradation of the endocrine disruptor 4,4′-isopropylidenebisphenol (bisphenol A, BPA), and of the related compounds 4,4′-isopropylidenebis(2,6-dibromophenol) and 4,4′-isopropylidenebis(2,6-dimethylphenol) has been

studied in water and water–methanol mixtures through visible-light continuous photolysis, polarographic detection of oxygen uptake, stationary and time-resolved fluorescence spectroscopy, time-resolved near-IR phosphorescence detection and laser flash photolysis techniques. Bisphenols (BPs) quench excited singlet and triplet states of Rf, with rate constants close to the diffusion limit. BPs and dissolved molecular oxygen, employed in similar concentrations, competitively quench triplet excited Rf. As a consequence, superoxide radical anion and singlet molecular oxygen (O_2 ($^1\Delta_g$)) are produced by electron- and energy-transfer processes, respectively, as demonstrated by auxiliary experiments employing selective quenchers of both oxidative species and the exclusive $O_2(^1\Delta_g)$ generator Rose Bengal. As a global result, the photodegradation of Rf is retarded, whereas BPs are degraded, mainly by an O_2 ($^1\Delta_g$)-mediated mechanism, which constitutes a relatively efficient process in the case of BPA. Oxidation, dimerization and fragmentation products have been identified in the photooxidation of BPA. Results indicate that BPs in natural waters can undergo spontaneous photodegradation under environmental conditions in the presence of adequate photosensitizers.

Chemosphere, 73/ 4, 2008, 564-571

Suppressing effect of goethite on PCDD/F and HCB emissions from plastic materials incineration

Polyethylene (PE) and polyvinyl chloride (PVC) are the leading plastics in total production in the world. The incineration of plastic-based materials forms many chlorinated compounds, such as polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDD/Fs). In this study the addition of goethite (α-FeOOH) was investigated to determine its suppressing effect on the emission of PCDD/Fs and hexachlorobenzene (HCB) during the combustion of wastes containing PE and PVC. Goethite was being considered since it acts as a dioxin-suppressing catalyst during incineration. Results showed that incorporation of goethite greatly reduced the generation of PCDD/Fs and HCB in the exhaust gas and fly ash. The concentration of PCDD/Fs in flue gas decreased by 45% for lab-scale and 52% for small incinerator combustion experiments, where the goethite ratios in feed samples were 0.54% and 0.34%, respectively. Under the same conditions, the concentration of HCB in flue gas decreased by 88% and 62%, respectively. The present study showed a possible mechanism of the suppressing effect of the goethite for PCDD/F formation. It is likely that iron chlorides react with particulate carbon to form organo-chlorine compounds and promote PCDD/F formation in the gas phase. XRD analysis of combustion ash revealed that the goethite was partially dehydrated and converted to α-Fe_2O_3 and Fe_3O_4 but no iron chlorides formation. Therefore the goethite impregnated plastics can contribute the reduction of PCDD/Fs and HCB in the exhaust gas during incineration of MSW.

Chemosphere, 70/ 9, 2008, 1568-1576.

Enhancing Concrete Strength and Thermal Insulation Using Thermoset Plastic Waste

Structural concrete is the most frequently used construction material in the world because of its known advantageous characteristics. However, concrete has some limitations, such as its low tensile strength, low strength-to-weight ratio and moderate thermal insulation. Improving these characteristics was the aim of a laboratory-based investigation into the behavior of concrete

made in the presence of ground melamine-formaldehyde (MF) thermosetting plastic waste as a sand replacement. The MF is a cross-linked thermoset polymer that cannot be recycled or reprocessed, presenting a serious solid waste disposal problem. The laboratory-based program included tests of tensile and compressive strengths, unit weight and thermal insulation characteristics. The tests were carried out on concrete and mortar with various water-to-cement (w/c) ratios, and sand was replaced by MF at different percentages that ranged from 0% to 60%. The results indicated that replacing sand with MF resulted in a lighter-weight concrete with improved characteristics. In general the strengths were increased as the percentage of MF was increased to reach maximum values at approximately 30% MF. In comparison with control specimens without MF, the strength/weight ratio of concrete was increased by up to 47% and the tensile strength of mortar was increased up to 16%. With regards to thermal insulation, a drop in temperature up to 30% was recorded in specimens with 60% MF. In conclusion, this investigation showed that the addition and reuse of MF in concrete mixes significantly improved the mechanical and thermal characteristics of concrete. This would be an effective approach when added to other protection methods of solid waste, as it addresses the specific waste of MF.

International Journal of Polymeric Materials, 57/7 2008, 635 – 656.

Chitin/Chitosan - Safe, Ecofriendly Packaging Materials with Multiple Potential Uses

Increased and indiscriminate use of plastic packaging films, which are petroleum based, has led to ecological problems due to their total non-biodegradability. Continuous use of plastics in any form or shape has to be restricted and may even be gradually abandoned to protect and conserve ecology. Such awareness, of late by one and all, has led to a paradigm shift to look for packaging films and processes that are biodegradable and therefore, compatible with the environment. Such an approach also leads to natural resource conservation with an underpinning on a pollution-free environment. Thus, the concept of biodegradability enjoys both user-friendly and eco-friendly attributes, and the raw materials are essentially derived from either replenishable agricultural feed stocks (cellulose, starch, and proteins) or marine food processing industry wastes (chitin/chitosan). Their total biodegradation to environment friendly benign products (CO2, H2O/quality compost) is the turning point that needs to be capitalized upon. Polymer cross-linking and graft copolymerization of natural polymers with synthetic monomers are other alternative approaches of value to using biodegradable packaging films. Although complete replacement for synthetic plastics may be impossible to achieve and perhaps even unnecessary, at least for a few specific applications, our attention and efforts are required in the days to come. Though expensive, biopackaging meets tomorrow's need for packaging, especially for a few value added products. It offers an attractive route to waste management, as well. Nonetheless, everyone desires a clean, pollution-free environment in the future.

Food Reviews International, 23/1, 2007, 53-72.

Impacts of temperature on the leaching of organotin compounds from poly(vinyl chloride) plastics - A study conducted under simulated landfill conditions

The aim of the study was to investigate whether organotin-stabilized poly(vinyl chloride) (PVC) products could contribute to the pool of organotins observed in landfill leachates, and if

the possible release could be related to different temperatures and landfill degradation phases. Small-scale anaerobic reactors filled with generic household waste, a mixture of inocula, and different PVC plastics were used in the study and incubated at 20, 37, 55, and 70°C. The reactor units incubated at temperatures of 20-55°C underwent the anaerobic degradation phases that are characteristic for the aging of landfilled waste material. There were, however, differences in the duration of the phases as well as in the total biogas production among the units. Under methanogenic conditions greater losses of organotin compounds were observed as compared to acidogenic conditions. It was shown that the release of organotin stabilizers increases considerably at temperatures above the glass transition of the PVC products. A dealkylation from di- into monoalkyltin species was observed, as well as a possible methylation of inorganic tin. However, the main part of the organotins was adsorbed into the solid waste matrix.

J. Vinyl Addit. Technol., 13:176-188, 2007

Chemical In Plastic Bottles Raises Some Concern

The US National Toxicology Program (NTP) report focuses primarily on the possible reproductive and developmental effects of BPA (such as changes in fertility, birth weight, and the development of certain brain regions), not on cancer. However it does note that in some animal studies, BPA has shown effects on breast and prostate tissue, as well as on how early puberty occurs. These effects could be linked to cancer, the report says, but the authors caution that there is not enough evidence to know whether BPA causes cancer -- in animals or in people. The health effects of BPA are being studied because so many people are exposed to it on a daily basis. The chemical is widely used in plastic water and baby bottles, food packaging, compact discs, and other consumer products; plastics made with BPA usually have the number 7 on the bottom. One survey conducted by the US Centers for Disease Control and Prevention detected BPA in the urine of 93% of people age 6 years and older.

The effects on breast and prostate tissue were seen in baby rats. When pregnant rats were injected with BPA, their female pups showed breast tissue changes that some researchers suspected might eventually progress to breast cancer, and male pups showed prostate tissue changes that researchers thought might eventually lead to prostate cancer. Some studies also showed that female mice entered puberty earlier than normal. In humans, early puberty is linked to higher breast cancer risk. However, the report is careful to explain that these animal results are difficult to apply to humans. For one thing, the studies did not follow the pups long enough to see whether cancer actually developed. Another problem is that while people are primarily exposed to BPA through their diet, the rats and some of the mice were injected with BPA (some mice got oral doses). The different methods of exposure may affect how the body processes the chemical -- and therefore how BPA affects the body. The report concludes that there is "some concern" about the adverse health effects of BPA in fetuses, infants and children. "Some concern" is the third level on a scale of 5; "negligible concern" is the lowest level, while "serious concern" is highest. Even though the evidence isn't conclusive about BPA's link to cancer or other problems, Michael Thun, the American Cancer Society's vice president of Epidemiology and Surveillance Research, says limiting exposure is "prudent."

For those who are concerned about BPA exposure, the US National Institute of Environmental Health Sciences recommends these steps:

- Don't microwave polycarbonate plastic food containers. Polycarbonate is strong and durable, but over time it may break down from over use at high temperatures.
- Polycarbonate containers that contain BPA usually have a #7 on the bottom.
- Reduce your use of canned foods.
- When possible, opt for glass, porcelain or stainless steel containers, particularly for hot food or liquids.
- Use baby bottles that are BPA free.

(Draft NTP Brief on Bisphenol A April 14, 2008)
http://www.sciencedaily.com/releases/2008/04/080422114734.htm

Problems with Plastics

The urethra is supposed to emerge at the tip of the penis, but in 1 out of every 300 baby boys, its opening is elsewhere—sometimes just underneath the head, or midway down the shaft, or even at the base of the scrotum. No one knows what causes the defect, called hypospadias, but studies have shown that widespread chemicals called phthalates can reproduce it in rodents. Phthalates are used widely as softening agents in certain plastics, notably PVC, and are also found in some cosmetics, pharmaceuticals, and a wide range of other products. Scientists classify these chemicals among the "endocrine disruptors," so known for their ability to alter the proper balance of hormones, which play a central role during development.

Toxicologists have been studying the effects of various phthalates in animals for decades. Three in particular—diethylhexyl phthalate (DEHP), butyl benzyl phthalate (BBP), and dibutyl phthalate (DBP)—cause a constellation of reproductive defects that includes hypospadias, testicular cancer, reduced sperm quality, diminished penis size, and undescended testicles. The effects, in some cases, seem to extend beyond the male reproductive system. Studies in animals have linked allergic skin lesions and lung malformations to DEHP, which is the most widely produced of the phthalates. Pregnant rodents given high daily doses of DBP tend to lose their fetuses. Not everyone, however, thinks such adverse effects in animals justify concern among people. "Most of the exposures are at doses far higher than what we see in humans," says Marian Stanley, a spokesperson for the Phthalate Esters Panel, an industry group that represents phthalate manufacturers. Major scientific reviews from the National Toxicology Program have concluded the risk the chemicals pose to humans is minimal. Yet, the most concerned scientists counter that emerging evidence does suggest phthalates harm humans. Shanna Swan, an epidemiologist at the University of Rochester, has shown that baby boys born to women with elevated DBP and BBP levels tend to have somewhat demasculinized and slightly smaller genitals. Recent studies in adults have linked high exposure to certain phthalates to low sperm quality and abdominal obesity. Though these studies don't prove cause and effect, some people find the existing evidence alarming enough to act. Many European countries have banned phthalates in certain toys, and a number of American states are considering similar restrictions. Still, avoiding phthalates altogether is more difficult than avoiding BPA, since it's not clear which of the panoply of products containing them contribute most to exposure. The chemicals easily move from sources such as vinyl tiles or shower curtains, so phthalates routinely end up in the air, water, and dust. Pregnant women, children, and couples trying to conceive may have the most to gain from trying to avoid phthalates, scientists say. "The primary risk appears to be to the developing fetus," says Swan.

http://health.usnews.com/articles/health/2008/05/07/more-problems-with-plastics.html

Modification of asphalt by packaging waste-polyethylene

The “white pollution” made of packaging waste polymers and its recycling has become a common issue. Changqing Fang et. al., selected waste milk-packing bag (its main ingredients was polyethylene) for the modification of ordinary oil asphalt. Asphalt was modified with 1, 3, 6, and 9 wt% content of waste-polyethylene. The results showed that the softening point and the freeze-to-crack stress of asphalt increased the penetration and the freeze-to-crack temperature decreased after modification. The comprehensive performance of raw asphalt improved noticeably. Infrared analysis suggests that waste-polyethylene in packaging (WPE) combines the matrix of asphalt through physical mixture modification. The modification mechanism of WPE was studied by the analysis of its micro structure, the characteristics of WPE, the effects of Crack pinning and Silver Shear yield in the decentralized process. Using waste packaging polymers to modify the asphalt proved to be an ideal way, for not only solving the problem of “white pollution”, but also for improving the performance of asphalt.

Polym. Compos., 2008, 29/5, 500 – 505.

Tracking plastic's breakdown products

A rapidly growing body of research has raised concerns about the safety of phthalate plasticizers found in polyvinyl chloride (PVC) products, cosmetics, and medical devices. Now, scientists are gaining new insights by looking not just at the parent compounds but at their metabolites as well. The most widely used plasticizer is DEHP, or di(2-ethylhexyl)phthalate, and millions of tons are produced annually, says Jim Nicell, an environmental engineer at McGill University (Canada). When added to PVC, DEHP lubricates the brittle polymer, providing it with the well-known flexibility that makes it ideal for use in building materials, household furnishings, and medical devices such as intravenous tubes and bags. Because it is not chemically bound to the plastic polymer, fat-loving DEHP readily migrates out of products and is now ubiquitous in the environment. It has been found in human breast milk, blood, and urine as well as house dust, snow, and sewage sludge. The European Commission has classified DEHP as a priority organic pollutant and in 2006 proposed a water quality standard for DEHP of 1.3 micrograms per liter. Denmark limits the concentration of DEHP in sludge used in agriculture to 50 milligrams per kilogram (mg/kg) dry weight.

Environmental fate studies tend to focus on the parent compound, but the unanswered question is, what does it turn into?" Nicell asks. Expecting that DEHP would eventually degrade into CO_2 and water, Nicell and his colleagues at McGill were surprised to find that soil microorganisms break down DEHP into metabolites that exhibit acute toxicity in standard tests. Nicell's new study tracked for the first time the DEHP breakdown products in sewage sludge and found concentrations ranging from 1 to 228 mg/kg. "We don't have a handle on what is the long-term impact associated with exposure to minute concentrations, [when combined with] a whole bunch of other toxins or endocrine disrupters, on the health and reproductive health of organisms," Nicell says. However, a burgeoning body of work on human exposure to DEHP has sprung up during the past 8 years, notes Russ Hauser, an epidemiologist at Harvard University. Humans oxidize DEHP into a different suite of metabolites compared with those from soil microorganisms, starting with MEHP (mono-ethylhexyl phthalate) and followed by four additional oxidative metabolites.

Hauser and his colleagues measured the concentration of DEHP metabolites in urine samples collected from men at an infertility clinic and found a positive association of MEHP with DNA damage in sperm. When we adjusted our statistical models for the oxidative metabolites, we found a strong and consistent signal for MEHP that would otherwise have been missed," Hauser says. Scientists have been able to establish DEHP and its breakdown products as antiandrogenic in rodents, according to Shanna Swan, an epidemiologist at the University of Rochester. Exposure to DEHP in utero puts a damper on testosterone production in fetal male rats, which leads to undescended testicles, penile deformations, and a shorter anogenital distance.

The National Toxicology Program's Center for the Evaluation of Risks to Human Reproduction concluded that DEHP in medical devices raises serious and significant concerns that normal development of the male reproductive tract in humans could be undermined. In 2005, Swan and her colleagues looked for and found shortening of anogenital distance in human male infants, similar to that found in exposed rats; the effect was associated with higher exposures to four phthalates but not to DEHP. Swan is repeating the study with a larger sample size and more DEHP metabolites than in the earlier study. Because of the known reproductive and toxic effects in animals, California has stepped in to regulate DEHP. Beginning on January 1, 2009, California regulators will prohibit manufacturers from using DEHP in any toy or child-care article and will prohibit three other phthalates from being used in any toy or child-care article intended for use by children under 3 years of age, if the item can be placed in a child's mouth. The regulation is nearly identical to one finalized in the EU in 2006. The U.S. Congress is close to approving a bill that would establish a federal ban on phthalates in children's toys.

The U.S. Food and Drug Administration (FDA) in 2002 recommended that hospitals use alternatives to DEHP-containing plastics for vulnerable populations such as premature baby boys, mothers pregnant with male fetuses, and boys nearing puberty, says Ted Schettler, science director for the Science and Environmental Health Network, an advocacy organization. To date, FDA has resisted calls from a coalition that includes the American Medical Association and leading hospitals to require manufacturers to label medical devices that contain DEHP. Given how much is known about the risks of DEHP from animal data and that

we have some understanding of the molecular mechanisms, serious thought must be given to how to reduce human exposure, Hauser says. "Health Care Without Harm has a position stating that people shouldn't be exposed to DEHP and that we should be moving away from PVC medical devices to those made out of alternative materials," Schettler adds.

http://pubs.acs.org/subscribe/journals/esthag-w/2008/jun/science/jp_plasticizers.html

Are plastic bags on the way out?

China has joined other countries in the growing global trend to phase out plastic bags. China will ban the manufacture, sale, and use of plastic bags less than 0.025 millimeters (mm) thick, and firms that flout the new rule will face fines. The government wants to encourage people to return to carrying cloth bags and baskets. shops in China will no longer offer their customers free plastic bags, although they will be able to sell bags thicker than 0.025 mm because they tear less easily and are less likely to be discarded.

Australia's environment minister has also announced his wish to ban all plastic shopping bags by the end of 2008, and New York City voted to require large stores to collect and recycle all used plastic bags and to sell cloth or reusable ones. Last year, San Francisco became the first U.S. city to ban plastic bags; stores there can offer only biodegradable alternatives made from potato starch or cornstarch.

In 2002, Bangladesh became one of the first countries to ban plastic bags, because the bags were found to clog drains during monsoon flooding. A year before, Bombay (India) introduced a ban for similar reasons. Ireland's "plastax" on carrier bags, established in 2002, has been credited with sharply reducing demand for plastic bags in that country. Parts of South Africa, Bhutan, and Taiwan have also passed legislation to discourage plastic bag use. Europe is following suit, but while governments debate taxes and bans, a town in Devon (U.K.) organized its own campaign and now claims to be the first European town to be free of plastic bags. Paris banned all non reusable bags in 2007, and all German stores must pay a recycling fee if they wish to offer them.

http://pubs.acs.org/subscribe/journals/esthag-w/2008/jan/policy/mb_plasticbags.html

Up-Cycling of PET (Polyethylene Terephthalate) to the Biodegradable Plastic PHA (Polyhydroxyalkanoate)

PET is a petrochemical based plastics that contribute greatly to the convenience of everyday life. Like other petrochemical plastics, the success of PET as a convenience bulk

commodity polymer has led to post consumer PET products becoming a major waste problem. The conversion of the petrochemical polymer polyethylene terephthalate (PET) to a biodegradable plastic polyhydroxyalkanoate (PHA) is studied by Shane T. Kenny et. al. PET was pyrolised at 450 °C resulting in the production of a solid, liquid, and gaseous fraction. The liquid and gaseous fractions were burnt for energy recovery, whereas the solid fraction terephthalic acid (TA) was used as the feedstock for bacterial production of PHA. Strains previously reported to grow on TA were unable to accumulate PHA. We therefore isolated bacteria from soil exposed to PET granules at a PET bottle processing plant. From the 32 strains isolated, three strains capable of accumulation of medium chain length PHA (mclPHA) from TA as a sole source of carbon and energy were selected for further study. These isolates were identified using 16S rDNA techniques as *P. putida* (GO16), *P. putida* (GO19), and *P. frederiksbergensis* (GO23). *P. putida* GO16 and GO19 accumulate PHA composed predominantly of a 3-hydroxydecanoic acid monomer while *P. frederiksbergensis* GO23 accumulates 3-hydroxydecanoic acid as the predominant monomer with increased amounts of 3-hydroxydodecanoic acid and 3-hydroxydodecenoic acid compared to the other two strains. PHA was detected in all three strains when nitrogen depleted below detectable levels in the growth medium. Strains GO16 and GO19 accumulate PHA at a maximal rate of approximately 8.4 mg PHA/l/h for 12 h before the rate of PHA accumulation decreased dramatically. Strain GO23 accumulates PHA at a lower maximal rate of 4.4 mg PHA/l/h but there was no slow down in the rate of PHA accumulation over time. Each of the PHA polymers is a thermoplastic with the onset of thermal degradation occurring around 308 °C with the complete degradation occurring by 370 °C. The molecular weight ranged from 74 to 123 kDa. X-ray diffraction indicated crystallinity of the order of 18−31%. Thermal analysis shows a low glass transition (−53 °C) with a broad melting endotherm between 0 and 45 °C.

Environ. Sci. Technol, 2008 (available online)

Plastic waste and PET bottles being burnt on the Pampa-Sannidhanam trekking path.

Burning of plastic waste on the Pampa-Sannidhanam trekking path is posing a health hazard to scores of pilgrims in Sabarimala. A huge quantity of waste, mostly plastic and PVC waste and empty Poly Ethylene Teraphthalate (PET) bottles, are collected from the trekking path by workers of Sabarimala Sanitation Society (SSS) and dumped outside the barricade on either

side of the trekking path, particularly along the Neelimala-Appachimedu stretch. The waste is burnt in the open. Though instructions have been issued to dump the plastic waste in separate pits dug at different points on the wayside, the SSS workers are largely unaware of this. It is the responsibility of the supervisory staff to make them aware of the hazardous effects of burning plastics.

Alexander George, State Pollution Control Board (PCB) engineer at Pampa, said burning of plastic carry bags produced toxic gases. He said the SSS authorities as well as traders had been given special instructions not to burn it in the open. According to Mr. George, PET bottles should be crushed after single use. If such bottles are continuously used, it could cause health problems, as certain substances in the material may dissolve in the water. Thomas P. Thomas, environmentalist and Botany professor, says burning of plastics and PET bottles releases dioxins, which can harm the immunity and reproductive systems.

http://www.nlsenlaw.org/copy_of_news/burning-of-plastic-waste-poses-health-hazard

Avoiding Hazards of Plastic Containers

Scientists debate the toxicity of chemicals in plastic, it is best to take precautions to protect your family's health. Below are five simple steps to limit exposure to potential health threats from plastic bottles and other food containers.

Choose Safer Plastics

The first thing to do when considering whether to purchase a food or beverage packaged in plastic is to flip the product over. On the under surface you will find a recycling triangle with a number inside. That number will help you determine how safe the plastic container is. As a rule of thumb, choose 2, 4, or 5 to stay alive.

Carry It with You

Most disposable drink containers are made of #1 plastic, called PETE. This is just an OK plastic. It is not as toxic as polycarbonate #7, which leaches a hormone disruptor known as Bisphenol A (BPA) into its contents. Nor is it as toxic as #3, polyvinyl chloride or #6, polystyrene. However, PETE plastic leaches antimony, which interferes with your body's ability to detoxify itself, a function that is vital in today's toxic world.

Safer Baby Bottles

Choose a silicone nipple and a glass bottle from manufacturers like Evenflo or BPA-free plastic bottles such as those made by Born Free (Newbornfree.com). Remember never to heat liquids in plastic.

Think Outside the Bottle

Although plastic bottles are in the limelight right now because they may leach toxic chemicals, the same worrisome chemical leaches out of the lining of canned foods. This is why it is important to rinse the contents before eating food out of cans.

The foods with the highest contamination include canned soups, pastas, and infant formula. It is also wise to avoid canned varieties of acidic foods like tomato sauce and fatty foods like tuna fish. Powdered varieties of infant formula are less likely to contain harmful chemicals than the premixed liquids.

Rewrap

Commercial plastic wrap is usually made out of PVC, which leaches toxic chemicals like dioxin into food. Simply remove the wrapping and place it in safer food packaging such as unbleached parchment paper, PVC-free cling wrap (available at natural food stores), or a glass container. You may wish to cut off the outer layer of fatty foods, such as cheese, to further reduce your exposure.
http://en.epochtimes.com/n2/health/avoiding-hazards-plastic-containers-4855.html

DID YOU KNOW ?

- Biphenol A, di(2-ethylhexyl) phthalate and butyl benzyl phthalate are endocrine disruptor.
- Polyvinyl chloride leaches di (2-ethylhexyl) phthalate (DEHP) or butyl benzyl phthalate (BBzP), depending on which is used as the plasticizer or softener.
- Cooperative Research Centre (CRC) for International Food Manufacture and Packaging Science develop a biodegradable plastic, known as Plantic.
- Decomposition of plastic bags takes about 1000 years.

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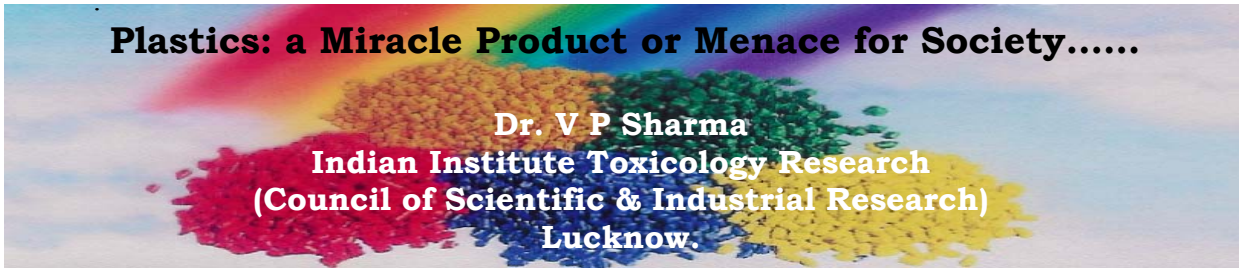


Plastic and polymeric products are one of the wonderful gifts of modern science. The application of plastic and polymeric products has increased worldwide enormously during last few decades. They have become an integral and indispensable part of our daily life. They are being used in packaging and storage of all kinds of foodstuffs, pharmaceuticals and water transportation. Packaging is a critical part of our daily life. It has to meet the demands of changing consumption, locations and occasions. Consumer packaging must not only appealing on a super market shelf through its look but also has to protect the contents during distribution and handling. Plastic packaging materials or wraps and containers play an important role in protecting our food against spoilage and contamination.

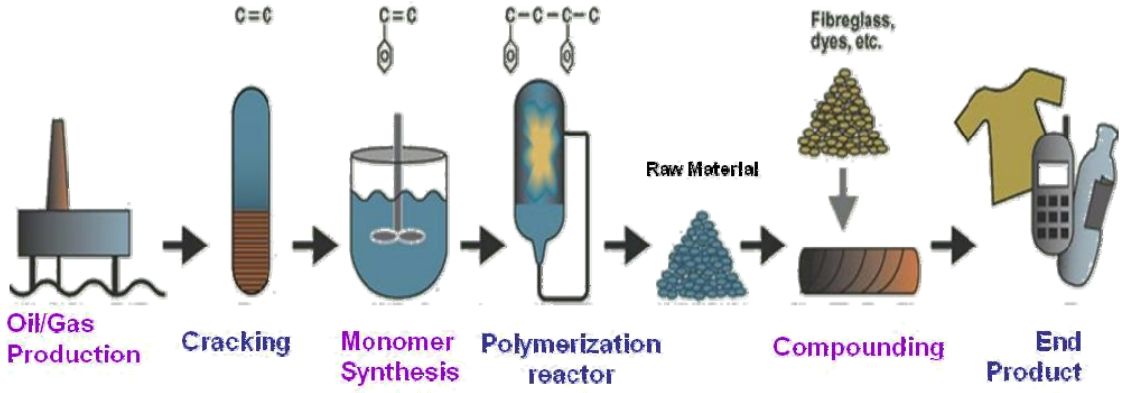
In the present scenario, 33% of plastic is being used for the packaging purpose, 20% in building construction, 10% in electrical and electronics items, 7% in automobiles and other transportation modes, 5% in agriculture and 25% in the other sectors such as furniture, house wares, mechanical, engineering, floor sheet, laminates etc. About 50% of the total plastic consumed in the packaging sector and most of it ends up as plastic waste. Food safety is a growing concerns among consumers as plastics are used for variable food packaging systems and may pose adverse health implications, if they are not manufactured as per guidelines.

Plastics have created new horizons in latest areas of nanotechnology and biosensors for monitoring of environmental pollutants. The application of polymeric products for packaging of life saving fluids and fabrication of implants and health care products is praiseworthy. Aliphatic polyesters

prepared by ring opening polymerization of lactones are now used as bioresorbabale devices in surgery (orthopedic devices, sutures, stents, tissue engineering and adhesion barriors) and in pharmacology (control drug delivery). Plasticized plastic containers possesses a number of advantges which makes it the material of choice for medical and more particularly for blood contact applications. Its salient features are ability to be welded together by high frequency – which enables the production of leak-free products and offers infinite design possibilities, steam sterilizability even at 121^{O}C, its favorable cost/performance ratio and its bulk density offering low storage and distribution costs. Most of our essential requirements such as water, milk, spices, pickles and biomedical items along with several other products are packed in plastic and polymeric packaging materials. Polymeric materials are also used in information technology, building construction, recreational activities, transportation, defence etc.

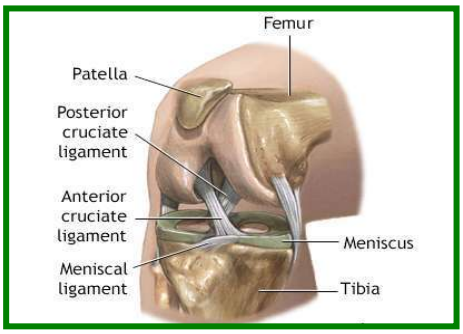
Plastics are extremely complex chemical compound. It is composed of various monomers such as ethylene, vinyl chloride, styrene, and additives like plasticizers, stabilizers, colourants, flame retardants etc.to design as per tailor made specifications. The monomers are bonded into chains called polymers or plastic resins. Different combinations of monomers yield resins with special properties and characteristics. Each resin has attributes that make it best suited to a particular application. Plastics which are commonly used for packaging are PET – polyethylene terphthalate, HDPE – high density polyethylene, LDPE – low density polyethylene, PP - polypropylene, PS – poly styrene. The commonly available plastic is non-biodegradable. Finished plastics and polymeric products being inert is normally not harmful to human health. The plastic additives may not migrate above permissible limits under simulated test conditions and temperature if the plastic items are branded and manufactured as per guidelines of national and International regulatiory organisations viz ISO, OECD, EPA, USP, WHO, IP and BIS following

good laboratory practices (GLP). Beside the quality of the product it is essential that it is used for the purpose it has been fabricated or designed. It should not be used for the storage or carrying the food material which is not recommended.



Schematic Representation of Plastic Manufacturing

Plastics play a very important role in ensuring the delivery of the drug in appropriate concentration to the target site. Many of the tablets are coated with thin plastics to increase its palatability and to prevent deactivation in the stomach for drugs intended to be released in the intestine for absorption. The drug plastic interaction is an area of great interest, the plastic devices are used as health care products made up of variable chemical composition. The application areas include a wide spectrum including dentistry, contact lens, blood bags, artificial organs, sutures, catheters, syringes, surgical drapes etc. The biggest potential growth is anticipated in the development of new plastic systems for implantation in the human body. Some examples of implants include orthopedic implants, cardiac valves, pace maker, tubes, intraocular lens, sheet implants etc. The concept of extra ordinary prosthesis – Jaipur Foot has brought smile to thousands of cases which suffered from amputation of limbs.



Biomaterials elicit a specific functional response and can be used to engineer tissues/organs like skin, cartilage, bones, fat etc. Composites of poly-hydroxy-butyrate (PHB) have been manufactured and are being investigated as bioactive, biodegradable matrices to guide and support tissue in-growth. Their biocompatibility and evaluation to understand if they pose any toxic effects is of great relevance. New products are also being synthesized for manufacturing biodegradable polymers. How-so-ever there is a need for assessing its biodegradability and making it cost effective.

Guidelines, Regulatory Requirements and Need of Suitability Assessment

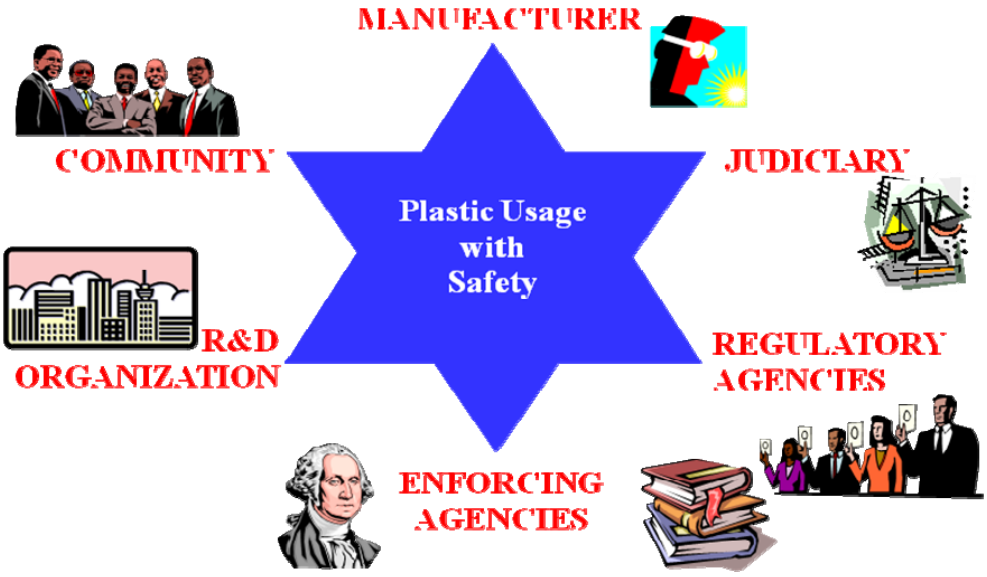
The regulatory guidelines and specifications have been prepared by Bureau of Indian standards, Organization for Economic Cooperation and Development and Pharmacopoeias of several countries. The standards and specifications used by plastic industries are updated periodically to meet the quality and demands of specific properties especially in health care including food and pharmaceutical products. The issue of waste disposal and management associated with use of plastic in health care has become a vital issue. Plastics are inert materials and generally do not pose health hazards but some of the additives like plasticizers, stabilizers, colourants and fillers may leach out under simulating conditions causing adverse toxic effects. Phthalates are a group of colourless, odourless liquids, which are used as plasticizers. Phthalates have very low volatility, do not readily dissolve in water and are not persistent in the environment. The primary usage of phthalates is to soften the plastic. New formulations are being used for application such as medical

tubing, blood bags, foot wear, flooring and wall covering, electrical cable insulation, clothing and toys. The most commonly used phthalates are di-2-ethylhexylphthalate (DEHP), di-iso-nonyl phthalate (DINP), di-iso-decyl phthalate (DIDP), di-butyl phthalate (DBP). DEHP plasticized medical devices have become vital to modern healthcare products. DEHP is also used in non-polymer materials such as lacquers, paints adhesives, fillers and printing inks. However, DEHP is not chemically bound to PVC and migrates out from plastic items with time and use. Plasticizers in general and phthalates in particular, are currently the subject of considerable media, legislative and scientific debate. Concerns regarding plasticizers have been raised on a variety of topics at regular intervals ever since the early 1980's. These have included environmental effects, oestrogen mimicking, phthalates in toys and most recently exposure via bio-medical devices. As a consequence, phthalates have been found every where in the environment and is universaly considered to be an ubiquitous environmental contaminant leading to hepatic and reproductive toxicity. Phthalates long term toxicity has been well documented in animal models. It has also been found to produce developmental effects in males and reproductive tract effect in females. The metabolites of phthalates exihibit a genotoxic effect in human mucosal cell of the upper aerodigestive tract and in lymphocytes in vitro. According to the another school of thought the environmental impact of phthalates is considered to be low due to their ready biodegradability and low toxicity.

With respect to chemicals classified, as endocrine disruptor there is a concern regarding bioaccumulation of one or multiple chemicals within the body. Even though life time exposure may be low, bioaccumulation could result in concentrations enough to pose adverse effects. Many chemicals may interact to produce additive effects. Even though exposure to any one particular

chemical is relatively small, we may be exposed to complicated mixture of many hormone-modulating chemical throughout ours lives, which together have potential to create an adverse effects. Keeping in view the extensive use of plastic and polymeric products, it is a matter of great concern among the environmentalists that what preventive measures can be adopted for preventing pollution due to plastics. Issue of disposal and waste management associated with use of plastic in health care has become quite a vital issue. Plastics are inert materials and generally do not pose health hazards but some

of the additives like plasticizers, stabilizers, colourants and fillers may leach out under simulating conditions causing adverse toxic effects.The toxicolgical effect may be significant in children and aged persons due to low immunity and prolonged exposure. Plastic and polymeric products must be evaluated adequately from toxicological point of view to ensure that they do not cause any adverse health effects. Moreover, the plastic and polymeric products should be used only for the specific purposes for which it has been manufactured. techniques Plastic waste management generally adopted are: reuse, recycle, recover, land-fill and incineration.



Plastic products should be used judiciously and they should be manufactured as per requirement of regulatory guidelines. They should be screened for their suitability for specific purpose prior to marketing or advocating against plastics. Plastics and polymeric products can serve as a boon and if applied without proper disposal or recycling methods may detoriate the environment and create ill effects for human health.

CURRENT CONCERNS

Non bio-degradable plastic has become a major concern. City infrastructure like sanitation, water supply and rivers are being badly affected by plastic waste. They polluted the ground water through leaching of toxic substances, choke open drains, sewer lines and even the stray cattle foraging them for food. The carcinogens is likely to be generated during chemical reactions that take place in plastic materials, due to temperature variations. They are reported to enter human body, through food items like pickles, fatty or liquid items, packed in non-food grade and coloured plastic bags. The regular intake of such food items containing contaminants, is very hazardous to health over a period of time.

In the light of environmental and health risks, one should take care while using food items wrapped in plastic bags, for shopping use cloth or paper bags. Little efforts can save our lives and environment.

REGULATORY TRENDS

The HP Non-biodegradable Garbage (control) Act 1995, introduced by the Government of Himachal Pradesh envisages prohibition of throwing or deposing plastic articles in public places and to facilitate the collection through garbage in identifiable and marked garbage receptacles for non-biodegradables, placed at convenient places. The Ministry of Environment and Forests has issued the criteria developed by CPCB in association with the Bureau of Indian Standards for labeling 'plastic products' as 'Environment-friendly' under its 'Ecomark' scheme. One of the requirements for plastic products is that the material used for packaging shall be recyclable or biodegradable.

In 1999, the Indian Centre for Plastic in the Environment (ICPE) was set up to address various social, environmental and technical issues, with a specific emphasis on waste, and to offer technical and practical solutions. Alongside ICPE, the Indian government, together with the municipal corporation, is putting considerable efforts into making citizens aware of the importance of the proper disposal and collection of dry waste, with particular attention paid to plastic waste.

Plastic waste recycling in India is undertaken by informal operators, including rag pickers, intermediaries, transporters and re-processors, with rag pickers forming the backbone of the waste collection system. Waste collecting is a well-established urban-survival tactic in metropolitan cities in India. In 2003, the Recycled Plastics Manufacture and Usage (Amendments) rules further added that no person should manufacture carry bags or containers irrespective of their size/weight unless they have registered with the State Pollution Control Board/Pollution Control Committee.

The Bureau of Indian Standards Sub-Committee PCD 12:1 has been formulating guidelines, codes and specifications for recycling of plastics. Two documents viz. 'Guidelines for Recycling of Plastics', and 'Recycled Plastics for manufacturing of products - Designation' have been finalized by BIS. Indian standard specifications for various plastics products, used for critical applications, like plastic piping system, water-storage tanks, packaging for food articles etc., a clause is included which reads "no recycled plastics waste shall be used". An exercise has also been carried out by the Ministry of Environment and Forests in association with the Bureau of Indian Standards to include use of recycled plastics wastes wherever appropriate in the manufacture of plastic products and this shall be specified accordingly in the relevant Indian Specifications.

The Prevention of Food Adulteration Department of the Government of India has issued directives of various catering establishments to use only food-grade plastics, while selling or serving food items. Rules have specified use of 'food-grade' plastics, which meet certain essential requirements and are considered safe, when in contact with food. The intention is to preventing possible contamination, and to avert the danger from use of recycled plastics

ON THE LIGHTER SIDE

- A mosquito cried out in pain:
  "A chemist has poisoned my brain!"
  The cause of his sorrow
  was DDT

- A chemist walks into a pharmacy and asks the pharmacist, "Do you have any acetylsalicylic acid?"
  "You mean aspirin?" asked the pharmacist. "That's it, I can never remember that word."

- A Chemical is a Substance that:
  An organic chemist turns into a foul odor.
  An analytical chemist turns into a procedure.
  A physical chemist turns into a straight line.
  A biochemist turns into a helix.
  A chemical engineer turns into a profit.

ON THE WEB

http://www.ejnet.org/plastics/pvc/
Polyvinyl Chloride (PVC). General Info. Center for Health, Environment and Justice: PVC: The Poison Plastic -- The Campaign for Safe, Healthy Consumer…….

http://mpcb.mah.nic.in/plastic/plastic.php
Plastic Waste Management information……..

www.tandf.co.uk/journals/titles/00914037.html - 25k -

The International Journal of Polymeric Materials meets this need. It also is a journal of record and provides a forum on new and old materials.....

BOOK STOP

Recycling textile and plastic waste

Editor: A R Horrocks
Publisher: Woodhead Publishing Limited
ISBN-13: 978 1 85573 306 0

Recycling and recovery strategies; municipal waste; turning environmental concern into real profit; reclaimed fibres, the sources and usage; industrial waste water minimisation and treatment; the fibre industry and waste management; recycling of plastic fibres and packaging waste; key lessons for plastic recycling; nonwovens from recycled waste; recycling zeftron carpets; cotton waste reclamation; recycling in the far east; the production of high tenacity tapes from waste polypropylene; the role of process stabilisers in recycling polyolefins; recycling carbon fibre-PEEK composites; the eco movement; waste: the politics and philosophies; dyestuffs: the myths explored and problems solved; environmental husbandry.

Biodegradable polymers for industrial applications

Editor: Ray Smith
Publisher: CRC Press
ISBN: 9780849334665
ISBN-10: 0849334667

The vast majority of plastic products are made from petroleum-based synthetic polymers that do not degrade in a landfill or in a compost-like environment. Therefore, the disposal of these products poses a serious environmental problem. An environmentally-conscious alternative is to design/synthesize polymers that are biodegradable.

Biodegradable polymers for industrial applications introduces the subject in part one by outlining the classification and development of biodegradable polymers with individual chapters on polyhydroxyalkanoates, polyesteramides and thermoplastic starch biodegradable polymers and others. The second part explores the materials available for the production of biodegradable polymers. Polymers derived from sugars, natural fibres, renewable forest resources, poly(lactic acid) and protein-nanoparticle composites will be looked at in detail in this section. Part three looks at the properties and mechanisms of degradation, prefacing the subject with a chapter on current standards. The final part explores opportunities for industrial applications, with chapters on packing, agriculture and biodegradable polycaprolactone foams in supercritical carbon dioxide.

Biodegradable polymers for industrial applications explores the fundamental concepts concerning the development of biodegradable polymers, degradable polymers from sustainable

sources, degradation and properties and industrial applications. It is an authoritative book that will be invaluable for academics, researchers and policy makers in the industry.

Degradable Polymers, Recycling, and Plastics Waste Management

Author: Albertsson
ISBN: 9780824796686
ISBN-10: 0824796683
Publisher: CRC Press

Based on the International Workshop on Controlled Life-Cycle of Polymeric Materials held in Stockholm, this work examines degradable polymers and the recycling of plastic materials. It highlights recent results on recycling and waste management, including topics such as renewable resources, degradation, processing and products, and environmental issues.

Handbook of Toxic Properties of Monomers and Additives

Author(s) - Victor O Sheftel
ISBN: 9781566700757
ISBN-10: 1566700752
Publisher: CRC Press

Covering nearly 800 potential food and water contaminants, this comprehensive handbook is a complete encyclopedia of the toxic effects of plastic ingredients. It is international in scope, covering all available toxicological data that fits existing requirements, including Russian toxicology data previously unknown to the west. The handbook will be helpful when evaluating toxic properties of plastic materials currently in use. It also provides a perspective on materials containing previously investigated ingredients. The handbook extends beyond the realm of toxicology by including information on a number of the widespread food and water contaminants, heavy metals, and solvents. It will also be helpful when evaluating toxic properties not only of existing materials but also of future materials that contain previously investigated ingredients.

CONFERENCES

International Conference on Energy and Environment

19-21 March, 2009
Email: conferencechair@enviroenergy2009.org
convener@enviroenergy2009.org

An International Conference on Energy and Environment, Enviro-Energy 2009, is being conducted by the National Institute of Technology, Kurukshetra, India. The Conference aims at addressing the challenges in the emerging areas of energy and environment to achieve sustainable development. The Conference, Enviro-Energy 2009, shall provide a useful forum to academicians, technologists, entrepreneurs and policy makers worldwide for exchange of concepts and emerging technologies in the fields of energy and environment. The Conference shall attempt to evolve an agenda for environmental policies, identification of green technologies and their subsequent implementation for sustainable development.

Polymer Chemistry Conference 2009

4-7 February, 2009

The Ocean Maya
Playa del Carmen
Mexico
http://www.zingconferences.com/z.cfm?c=53

The meeting will focus on the latest advances in Polymer Chemistry, through the work of established and emerging researchers, presenting the most recent developments in their fields. The scientific programme will cover the recent progress in polymer synthesis, functional polymers and polymeric architectures, and their application in soft nanotechnology and medicine. It will also be a unique opportunity to hear from some of the future leaders in Polymer Chemistry, and to network with fellow researchers in a relaxed atmosphere.

Polymers

June 21-26, 2009
Mount Holyoke College
South Hadley, MA
http://www.grc.org/programs.aspx?year=2009&program=polymers

The Polymers 2009 conference assembles an international community for the presentation of recent advances in polymer synthesis, physical characterization, and performance in several complementary emerging technologies. Polymers continue to enable many emerging technologies including tissue regeneration, drug and gene delivery, biomedical technologies, alternate energy, smart surfaces and interfaces, and electro-active devices.

MINI PROFILE OF BISPHENOL A

Synonyms: Bisferol A, 2,2-Bis-4'-Hydroxyfenylpropan, 2,2-Bis(P-Hydroxyphenyl)Propane, 4,4'-Bisphenol A, BPA, P,P'-Dihydroxydiphenyldimethylmethane.

CASRN: 80-05-7

Molecular Formula: C_{15}-H_{16}-O_2

Molecular Weight: 228.29

Properties: Crystallizes as prisms from dilute acetic acid and as needles from water, Mild phenolic odor, B Pt: 220 deg C at 4 mm Hg**,** M. Pt: 150-155 deg C, Specific Gravity: 1.195 at 25 deg C/25 deg C, Soluble in acetic acid, aq alkaline soln, alc, acetone, In water solubility, 120 mg/L at 25 deg C.

Uses: Intermediate in manufacture of epoxy, polycarbonate, phenoxy, polysulfone and certain polyester resins; flame retardants, rubber chemicals.

Toxicity Data:

ORL-MAM LD50 6500 mg kg^{-1}
ORL-RAT LD50 3250 mg kg^{-1}
ORL-MUS LD50 2400 mg kg^{-1}

IPR-MUS LD50 150 mg kg^{-1}
ORL-RBT LD50 2230 mg kg^{-1}
ORL-GPG LD50 4000 mg kg^{-1}

Route	**Symptoms**	**First Aid**	**Target Organ**
Inh	Irritating to respiratory passages.	Remove to fresh air.	Respiratory Tract
Cont	Causes skin & eye irritation. May cause Sensitization by skin contact.	Remove contaminated clothing. Wash skin with water using soap if available. Flush eye with water If persistent irritation occurs, obtain medical attention.	Skin and Eye

Handling and Storage: Keep away from heat, hot surfaces, sparks, and flame. Establish good housekeeping practices. Remove dust accumulations on a regular basis by vacuuming or gentle sweeping to avoid creating dust clouds. Do not empty directly into flammable solvents or in the presence of flammable vapors. Storage temperature: <= 60 °C