IMPACT OF PLASTICS ON ENVIRONMENTAL POLLUTION

***[1]P.Pavani, [2]T.Raja Rajeswari,**
[1]Department of Freshmen Engineering, PVPSIT, Kanuru, Vijayawada, AP.
[2]Department of chemistry, Govt. College for Women (Autonomous), Guntur
***Corresponding author: Email: Pavani.peddi@yahoo.co.in**

ABSTRACT

Thousands of plastic factories are producing tons of plastic goods which are popularly used by the people because of their ease, cheapness and convenience. Due to non-biodegradable nature they cause hazardous negative impact on the environment. Disposal of plastic waste which are major cause of environment pollution becomes carcinogenic to human, birth defects, impaired immunity,endocrine disruption, development and reproductive effect. In addition to dumping of plastic material into marine, a large number of species are known to be harmed or killed which could jeopardize their survival, especially since many are already endangered by other forms of anthropogenic activities. Marine animals are mostly affected through entanglement in and ingestion of plastic litter. Less conspicuous forms,such as plastic pellets and scrubber are also hazardous.

Creating public awareness on the importance of healthy environment, mechanism of controlling the generation of wastes at the source, alternative disposal ways, establishing additional drop-off-areas (land fills) and incineration mechanisms, plastic recycling facilities are also recommended.

Keywords: Plastic goods, hazardous plastic waste , anthropogenic activities.

"Plastic are high molecular weight organic polymers which can be moulded into desired shapes by the application of heat and pressure".

1. INTRODUCTION

The word plastic is derived from the greek (plastikos) meaning capable of being shaped or molded. Plastic that are made up of polymers having only aliphatic (linear) C atoms in their backbone chains. e.g.: poly propylene. Plastics that are made up of heterochain polymers contain O, N, S in their backbone chains, in addition to C. e.g.: poly carbonate. Plastic behaviour of polymers is influenced by their morphology (arrangement of molecules).they are either amorphous or crystalline. Most thermosets are amorphous, while thermoplastics may be amorphous or semi crystalline.

Plastics are a range of synthetic or semi-synthetic polymerization products that can be molded into a permanent object having the property of plasticity. Plastic are found extensive industrial applications. Plastics having a variety of properties are available at present. They have low specific gravities, ease of fabrication, resistance to low thermal and electrical conductivities. Many plastics can take range of colour to enable them useful for decorative purposes.

Plastics are widely used in making electical instruments, telephones, panelling for walls,instrument boards, automoblile parts, lamps, googles, optical instruments, household appliances, etc.

Plastic materials dumped into the earth prevent the production of nutrients in the soil. Because of this, the fertility of the soil is reduced and affects the agriculture sector. When its persistence in the environment can do great harm. It causes immune and enzyme disorders, hormonal disruption leading to endocrinal disorders and even infertility and is also considered as carcinogenic (cancer). Not only human health, it dangerously effects other animal life and alters the environment (air,water and soil) sustainability causing hazardous pollution.

2. CLASSIFICATION

Plastics can devided into two general categories and they are 1.Thermoplastics and 2. Thermosetting plastics

2.1. Thermoplastics: Thermoplastics have either linear or branched structure and can be amorphous or semicrystalline materials. Polymeric chains are held together by weak vander waal's forces or dipole-dipole forces or hydrogen bonding and hence do not have cross-links. Thermoplastic soften on heating and harden on cooling because of weak vander waal's forces. These plastics can remoulded, reshaped and reused. Thermoplastics can be reclaimed from waste .examples for thermoplastic are cellulose derivatives, polyamides, polystyrene, polyvinyls, polyethylenes,etc.

2.2. Thermosetting plastics: Thermosetting plastics have three-dimensional, cross-linked, networked structures in which the polymeric chains are held together by cross-links(strong covalent bonds). These plastics donot soften on heating and they are hard, strong and more brittle. Thermosetting plastics cannot be remoulded and hence cannot be reused.examples for thermosetting plastic are phenolic resins(bakelite), polyesters(terylene), etc.

3. Disposal of Plastic

When plastics are used, recycled, or disposed of, or left in the environment as litter, they break down and release harmful chemicals. These pollutants include heavy metals such as cadmium and lead, and chemicals such as benzene, dioxins, and other pollutants, which all release harmful toxins into our air, water, and bodies. Right now, most plastic is being wasted sent to landfills or, more likely, incinerators.

Burning plastic in incinerators releases toxic heavy metals and chemicals. Incinerators produce a variety of toxic discharges to the air, water, and ground that are significant sources of powerful pollutants, including dioxin and other chlorinated organic compounds that are well known for their toxic effects on human health and the environment.

Many of these toxins enter the food supply and become more concentrated as they move up through the food chain. In addition to air and water emissions, incinerators create toxic ash—or slag—which contains heavy metals, dioxins, and other pollutants. This toxic ash must be land filled, and the pollutants present in the ash can then leach into groundwater.

In fact, garbage incinerators and medical waste incinerators are two of the largest sources of dioxin identified by the U.S.
Environmental Protection Agency. Dioxin is the common name for a class of 75 chemicals. It is a toxic waste product formed when waste containing chlorine is burned or when products containing chlorine are manufactured. Dioxins are among the most potent synthetic chemicals ever tested, causing cancer and harming our immune and reproductive systems even at very low concentrations.

In landfills, leachate is produced when water picks up toxins as it seeps through the trash. This trash includes plastics of all types, even older plastics that have been proven to be toxic but are still in our landfills. Although landfills attempt to collect this toxic leachate, it also leaks into ground and surface water, releasing pollutants into the environment and causing health risks for humans and wildlife.

4. REGULATION OF PLASTIC INDUSTRY IN INDIA

The growth of plastic small scale processing and reprocessing industries, as other Small Scale Industries (SSI) in India, began in the decade of eighties with the announcement of the new industrial policy. Plastic processing and reprocessing industries are also exempted from monitoring by Pollution Control Board.

With regard to safety guidelines for toys in India, Bureau of Indian Standards (BIS) has published three standards which deals with safety aspects of toys related to mechanical and physical properties, flammability requirements and migration of certain elements (limiting heavy metals in toys). None of these standards give limits for phthalates in children's toys and child care articles. The BIS guideline with regard to toy production is self-regulatory and not mandatory. Toy manufacturers do not register even for the ISI mark for their products and therefore do not follow even the voluntary standards.

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. This has now been replaced by Plastic Waste (Management and Handling) Rules, 2011. Some of the salient features of the new Rules are:

- ban on use of plastic materials in sachets for storing, packing or selling gutkha, tobacco and pan masala,
- no food stuffs will be allowed to be packet in recycled plastics or compostable plastics,
- recycled carry bags to have specific BIS standards, colour to the prescription by the Bureau of Indian Standards (BIS),
- Uniform thickness shall not be less than 40 microns in carry bags etc.

One of the major provisions under the new Rules is the explicit recognition of the rule of waste pickers. The new Rules require the municipal authority to constructively engage agencies or groups working in waste management including these waste pickers. This is the very first time that such a special dispensation has been made.

Municipal or Government authorities and NGOs may play crucial role in recognizing and legitimizing both plastic waste recovery and trading activities and equipping them with state of art designs of waste management technology and system. Developing safe and low cost technology for which SSIs need institutional and scientific support and making mandatory of guidelines related to safety, process and product standards in consultation with plastic associations are one of the few ways. The Municipal authority under new rules is hold responsible for setting up, operationalization and coordination of the waste management system and for performing the associated functions, This will include ensuring safe collection, storage, segregation, transportation, processing and disposal of plastic waste, no damage to the environment during this process, setting up of the collection centers for plastic waste involving manufacturers, its channelization to recyclers, to create awareness among all stakeholders about their responsibilities, and to ensure that open burning of plastic waste is not permitted.

In India, as part of corporate social responsibility Tamil Nadu Pollution Control Board (TNPCB) is facilitating the disposal of non-reusable plastic waste (carry bags, plastic cups, etc) generated in urban local bodies by co-processing at the cement kilns. Reliance Industries (RIL) in partnership with Gujarat Engineering Research Institute (GERI) constructed a 900 meter road stretch using 5% plastic waste. Non-recyclable plastic waste used in construction of tar road reduced construction cost and improved road life.

5. ENVIRONMENTAL IMPACTS

Environmental impacts are wide ranging and can be both direct and indirect. Direct impacts occur when marine life is physically harmed by marine debris through ingestion or entanglement (e.g., a turtle mistakes a plastic bag for food) or marine debris physically alters a sensitive ecosystem (e.g., a fishing net is dragged along the ocean floor by strong ocean currents and breaks and smothers a coral reef). Environmental impacts can also be indirect, such as when a marine debris cleanup results in ecological changes.

5.1. Direct Environmental Impacts

a. Ingestion: Seabirds, sea turtles, fish, and marine mammals often ingest marine debris that they mistake for food. Ingesting marine debris can seriously harm marine life. For example, whales and sea turtles often mistake plastic bags for squid, and birds often mistake plastic pellets for fish eggs. Moreover, a study of 38 green turtles found that 61 percent had ingested some form of marine debris including plastic bags, cloth, and rope or string (Bugoni et al., 2001).

At other times, animals accidentally eat the marine debris while feeding on natural food. Ingestion can lead to starvation or malnutrition when the marine debris collects in the animal's stomach causing the animal to feel full. Starvation also occurs when ingested marine debris in the animal's system prevents vital nutrients from being absorbed. Internal injuries and infections may also result from ingestion. Some marine debris, especially some plastics, contain toxic substances that can cause

death or reproductive failure in fish, shellfish, or any marine life. In fact, some plastic particles have even been determined to contain certain chemicals up to one million times the amount found in the water alone (Moore, C., 2002).

b. Entanglement: Marine life can become entangled in marine debris causing serious injury or death. Entanglement can lead to suffocation, starvation, drowning, increased vulnerability to predators, or other injury. Marine debris can constrict an entangled animal's movement which results in exhaustion or development of an infection from deep wounds caused by tightening material. For example, volunteers participating in the 2008 International Coastal Cleanup event discovered 443 animals and birds entangled or trapped by marine debris (2008 ICC Report, Ocean Conservancy).

c. Ecosystem Alteration: The direct impacts of marine debris are not limited to mobile animals. Plants, other immobile living organisms, and sensitive ecosystems can all be harmed by marine debris. Coral reefs can be damaged by derelict fishing gear that breaks or suffocates coral. Plants can be smothered by plastic bags and fishing nets. The ocean floor ecosystems can be damaged and altered by the movement of an abandoned vessel or other marine debris.

5.2. Indirect Environmental Impacts

a. Ecosystem Alteration: Efforts to remove marine debris can harm ecosystems. Mechanical beach raking uses a tractor or other mechanical device to remove marine debris from beaches and marine shorelines and can adversely impact shoreline habitats. This removal technique can be harmful to aquatic vegetation, nesting birds, sea turtles, and other types of aquatic life. Beach raking also can contribute to beach erosion and disturbance of natural vegetation when the raking is conducted too close to a dune.

b. Invasive Species: Marine debris can contribute to the transfer and movement of invasive species. Floating marine debris can carry invasive species from one location to another. Invasive species use the marine debris as a type of "raft" to move from one body of water to another. In a study performed by the British Antarctic Survey in 2002, it was estimated that man-made debris found in the oceans has approximately doubled the number of different species found in the subtropics (Barnes, D.K., 2002).

5.3. Economic Impacts

Marine debris can harm three important components of our economy: tourism, fishing, and navigation. Economic impacts are felt through loss in tourism dollars and catch revenue, as well as costly vessel repairs.

a. Tourism: Marine debris is unsightly and unwelcoming to beachgoers, which can result in lost revenue from tourism. In severe cases, marine debris can even cause beach closures. The costs to remove and dispose of the marine debris can be high and the loss of tourism dollars can be even higher. In an attempt to stop the draining of trash to the ocean, the Los Angeles County's Department of Public Works and the Flood Control District spends $18 million each year on street sweeping, catch basin cleanouts, cleanup programs, and litter prevention and education efforts (L.A. County Boards of Supervisors Staff Report, 2007).

b. Fishing: Fisheries experience significant economic impacts from marine debris. Commercial fisheries are impacted when commercial fish and shellfish become bycatch in lost fishing nets or other fishing gear. This type of bycatch can result in both immediate losses in the standing stock of available seafood, and decreases in the long-term sustainability of the stock due to negative impacts on its reproductive ability. For example, the Gulf States Marine Fisheries Commission has predicted blue crab ghost fishery leads to a loss of up to 4 to 10 million crabs a year in Louisiana alone (Virginia Institute of Marine Science, 2006). Fisheries also can be financially affected when fishing gear and vessels are entangled or damaged by marine debris. The high cost of replacing fishing gear and vessels, as well as loss of days at sea for fishing, can cause small fisheries to go out of business.

c. Navigation: Floating marine debris is a navigational hazard that entangles propellers and clogs cooling water intake valves. Repairing boats damaged by marine debris is both time consuming and expensive.

6. Harm to Marine Wildlife

Countless marine animals and sea birds become entangled in marine debris or ingest it. This can cause them serious harm and often results in their death. There is still relatively little information on the impact of plastics pollution on the ocean's ecosystems (Quayle, 1992; Wilber, 1987). There is however an increasing knowledge about their deleterious impacts on marine biota (Goldberg, 1995). The threats to marine life are primarily mechanical due to ingestion of plastic debris and entanglement in packaging bands, synthetic ropes and lines, or drift nets (Laist, 1987, 1997; Quayle, 1992). Since the use of plastics continues to increase, so does the amount of plastics polluting the marine environment. Robards et al. (1995) examined the gut content of thousands of birds in two separate studies and found that the ingestion of plastics by seabirds had significantly increased duringthe 10–15 years interval between studies. A study done in the North Pacific (Blight and Burger, 1997) found plastic particles in the stomachs of 8 of the 11 seabird species caught as bycatch. The list of affected species indicates that marine debris are affecting a significant number of species (Laist, 1997). It affects atleast 267 species worldwide, including86% of all sea turtle species, 44% of all seabird species, and 43% of all marine mammal species (Laist, 1997). The problem may be highly underestimated as most victim are likely to go undiscovered over vast ocean areas, as they either sink or are eaten by predators (Wolfe, 1987). There is also potential danger to marine ecosystems from the accumulation of plastic debris on the sea floor. According to Kanehiro et al. (1995) plastics made up 80–85% of the seabed debris in Tokyo Bay, an impressive figure considering that most plastic debris are buoyant.

The accumulation of such debris can inhibit the gas exchange between the overlying waters and the pore waters of the sediments, and the resulting hypoxia or anoxia in the benthos can interfere with the normal ecosystem functioning, and alter the

make-up of life on the sea floor (Goldberg, 1994). Moreover, as for pelagic organisms, benthic biota is likewise subjected to entanglement and ingestion hazards (Hesset al., 1999)

6. Ingestion of plastics

A study done on 1033 birds collected off the coast of North Carolina in the USA found that individuals from 55% of the species recorded had plastic particles in their guts (Moser and Lee, 1992). The authors obtained evidence that some seabirds select specific plastic shapes and colors, mistaking them for potential prey items. Shaw and Day (1994) came to the same conclusions, as they studied the presence of floatingplastic particles of different forms, colors and sizes in the North Pacific, finding that many are significantly under-represented. Carpenter et al. (1972) examined various species of fish with plastic debris in their guts and found that only white plastic spherules had been ingested, indicating that they feed selectively. A similar pattern of selective ingestion of white plastic debris was found for loggerhead sea turtles (Caretta caretta) in the Central Mediterra- nean (Gramentz, 1988). Amongseabirds, the ingestion of plastics is directly correlated to foraging strategies and technique, and diet (Azzarello and Van-Vleet, 1987; Ryan, 1987a; Moser and Lee, 1992; Laist, 1987, 1997).For instance, planktivores are more likely to confuse plastic pellets with their prey than do piscivores, there fore the former have a higher incidence of ingested plastics (Azzarello and Van-Vleet, 1987). Plastics ingestion and polychlorinated biphenyls Over the past 20 years polychlorinated biphenyls (PCBs) have increasingly polluted marine food webs, and are prevalent in seabirds (Ryan et al., 1988).Though their adverse effects may not always be apparent, PCBs lead to reproductive disorders or death, they increase risk of diseases and alter hormone levels (Ryanet al., 1988; Lee et al., 2001). These chemicals have a detrimental effect on marine organisms even at very low levels and plastic pellets could be a route for PCBs into marine food chains (Carpenter and Smith, 1972; Carpenter et al., 1972; Rothstein, 1973; Zitko and Hanlon,1991; Mato et al., 2001).

7. Entanglement in plastic debris

Marine debris which is known to cause entanglement includes derelict fishing gear such as nets and mono-filament line and also six-pack rings and fishing bait box strapping bands. This debris can cause death by drowning, suffocation, strangulation, starvation through reduced feeding efficiency, and injuries. Particularly affected are seals and sea lions, probably due to their very inquisitive nature of investigating objects in their environment. Whales, dolphins, porpoises, turtles, manatees and seabirds have all been reported to have suffered from entanglement. Many different species of whale and turtle have been reported to have been tangled in plastic.

Entanglement in plastic debris, especially in discarded fish inggear, is a very serious threat to marine animals. Accordingto Schrey and Vauk (1987) entanglement accounts for 13–29% of the observed mortality of gannets (Sula bassana) at Helgoland, German Bight. Entanglement also affects the survival of the endangered sea turtles (Carr, 1987), but it is a particular problem for marine mammals, such as fur seals, which are both curious and playful (Mattlin and Cawthorn,1986).Youngfur seals are attracted to floating debris and dive and roll about in it (Mattlin and Cawthorn, 1986). They will approach objects in the water and often poke their heads into loops and holes (Fowler, 1987; Laist,1987). Though the plastic loops can easily slip onto their necks, the lie of the long guard hairs prevents thestrapping from slipping off (Mattlin and Cawthorn,1986). Many seal pups grow into the plastic collars, and in time as it tightens, the plastic severs the seal's arteries or strangles it (Weisskopf, 1988). Ironically, once the entangled seal dies and decomposes, the plastic band is free to be picked up by another victim (DOC, 1990;Mattlin and Cawthorn, 1986), as some plastic articlesmay take 500 years to decompose (Gorman, 1993;UNESCO, 1994).

Once an animal is entangled, it may drown, have itsability to catch food or to avoid predators impaired, orincur wounds from abrasive or cutting action of attached debris (Laist, 1987, 1997; Jones, 1995). Accord-ing to Feldkamp et al. (1989) entanglement can greatly reduce fitness, as it leads to a significant increase in energetic costs of travel. For the northern fur seals(Callorhinus ursinus), for instance, they stated that net fragments over 200 g could result in 4-fold increase in the demand of food consumption to maintain body condition. The decline in the populations of the northern sealion (Eumetopias jubatus), endangered Hawaiian monkseal (Monachus schauinslandi) (Henderson, 1990, 2001)and northern fur seal (Fowler, 1987) seems at least ag-gravated by entanglement of young animals in lost or discarded nets and packing bands. Plastic ''scrubbers'' Studies (Gregory, 1996; Zitko and Hanlon, 1991)have drawn attention to aninconspicuous and previ-ously overlooked form of plastics pollution: smallfragments of plastic (usually up to 0.5 mm across) de-rived from hand cleaners, cosmetic preparations and airblast cleaningmedia. The environmental impact ofthese particles, as well as similar sized flakes from de-gradation of larger plastic litter, has not been properly established yet.

8. THE CAUSES AND EFFECTS OF THE USE OF DISPOSABLE PLASTICS

The durable, lightweight and easy to go of the non-biodegradable plastic bags and water bottles are becoming unavoidable to use in many day-to-day activities of the societies of developing countries like Ethiopia, and of which is often re-used many times and discarded causing problems for human, animal and the environments where it deposited. Some of the major sources of environmental problems like Ethiopia include sewage and run-off related plastics, materials from recreational/social gathering users, and materials disposed of at open landfills from each household activity.

Plastic materials originating from each source is either transported by wind, flood and human drains toward water bodies, or is mixed with the farm (agricultural) lands. In developed countries, poor awareness of societies on plastic materials, poor collection of waste materials and their treatments, high run-off and floods due to rain are important pointed sources of plastic materials, namely plastic bags and water bottles, from/to the environment (agricultural farmlands, surface waters) which undermines soil and water qualities and threatens human and biodiversity.

9. TOXICITY IMPACT OF PLASTIC BAGS AND WATER BOTTLES

Accumulation of plastic bag wastes causes environmental pollution that can be manifested in number of ways such as deterioration of the natural beauty of an environment (Andrady 2003), death and entanglement of marine animals (Azzarello and Van Vleet 1987; Hofmeyr et al. 2006; Lithner et al., 2009), blockage of sewerage systems of cities and towns in developing countries (Adane and Muleta 2011) which in turn creates foul smells and favourable habitats for mosquitoes and other vectors that could spread various diseases like mosquitoes (Ellis et al. 2005), reduce percolation of water and proper aeration of agricultural soils which in turn results in a reduction of productivities of such fields (Njeru 2006).

Furthermore, in several poor and developing countries like Ethiopia, plastic bags are frequently used to carry food items and plastic water bottles as storage of different beverages like water, and soft drinks; food items like oil, milk, honey and other local food items and petroleum products such as benzene, Kerosene and naphtha. This practice can cause serious health problems due to some carcinogenic agents and cross contamination by microorganisms (Cliver 2006; Gerba et al. 2009; Kontominas et al. 2006; Lin et al. 2009). Moreover, it is common to use plastic bags for disposing of human and other domestic wastes which makes human health more risky as compared to "open" disposal of these wastes (Njeru 2006).

9.1. Health Implications: The Plastic We Use Can Harm Us The things that make plastic so attractive to manufacturers and consumers are the same things that make it so harmful to our health and the environment. You can make plastic in any size, shape, texture, and color. It can be flexible or hard. It can be light (like foam) or heavy. You can even give it a scent. Why? Everything made of plastic starts with a resin (or two, or many) made from petroleum that is combined with any number of chemicals that are relatively untested for safety, such as plasticizers, lubricants, pigments, and stabilizers, to give each item its unique characteristics. Think about the thousands upon thousands of plastic items—bottles, toys, to-go containers, Frisbees, medical supplies, car bumpers, foam, and more all with a unique recipe. And all this plastic has been created faster than we are able to learn about how it affects our environment and bodies.

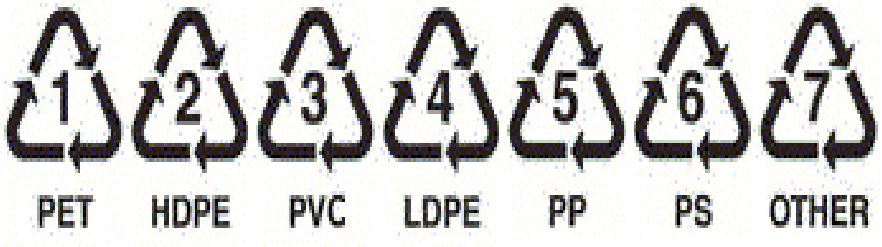
Over 82,000 synthetic chemicals are registered for use in commerce. The vast majority of these chemicals are untested.Under the Toxic substances control Act, which regulates industrial chemicals in the U.S., the Environmental Protection Agency (EPA) has required safety testing on *only 200* of these chemicals. Of those, only five—including asbestos and dioxin—have been banned from manufacturing.This does not mean that other chemicals or other plastics are entirely safe; they just haven't been studied. To compound matters, current testing typically involves one chemical at a time, but many problems occur only when different chemicals interact in the manufacturing process, the product, or our bodies.

BPA and phthalates are just two substances that have attracted a lot of attention because of their now-known harmful effects. BPA is a common synthetic chemical found in plastics–food and beverage can linings and other consumer products—that interferes with human hormones. We know that phthalates, a class of chemicals used to soften plastics and to carry fragrance in many everyday products, have been linked to birth defects and are harmful to the reproductive system.

Some chemicals, like BPA and phthalates, can leach into food and drinks to possibly affect human health. Polycarbonate, PVC, and styrene have also been shown to leach toxic chemicals. Leaching increases when plastic comes in contact with oily or fatty foods, when the plastics are heated, and when plastics get old or scratched.

The triangle, in the recycle code of plastic, indicates that the plastic material is recyclable, and each number inside the triangle indicates a specific type of plastic as follows:

1. Polyethylene terephthalate: Safe and recyclable, plastic bottles and containers made of it used for water, juice, soft drinks and peanut butter
2. Polyethylene terephthalate: Safe and recyclable, plastic bottles and containers made of it used for water, juice, soft drinks and peanut butter packaging.
3. High-density polyethylene: Safe and recyclable,used for the manufacturing of packages for shampoo, detergents and milk, as well as plastic toys. It is safer than any other plastic material especially the transparent type.
4. Polyvinyl chloride: Harmful and toxic if used for long time. It is commonly abbreviated PVC and used in the manufacturing of plumping pipes, bathroom curtains, toys, and transparent plastic wraps for meat and cheese. It is widely used because of its cheap price, so it is considered the most dangerous type of plastic.
5. Low-density polyethylene: Proportionally safe, recyclable, used for the manufacture of CDs, bottles and grocery bags.
6. Polypropylene: One of the best and safest types of plastic, suitable for cold and hot liquids and other products, unharmful, used in manufacturing of food containers, plates, medicine bottles and all food related products. It is recommended that all food containers should be made of this substance, especially children's food containers used for school meal packaging, and water bottles reused for multiple times.
7. Polystyrene: Dangerous and unsafe, used for burger, hotdog and teacups packaging.It looks like the cork and was being used in the international fast food chains in our region until recently, although the USA has prohibited the use of it for 20 years. MacDonald's also has stopped using
8. it since 1980, so let us be cautious of this material that is still being used here in fast food and popular restaurants. This material has impact on the ozone layer because it is made of harmful Chloro Floro Carbon gas (CFC).
9. 7. Others:Such material does not come under any category of the abovementioned
10. types of plastic. It can be mixture or compound of the six international companies started to produce toys and baby-feeding bottles made of it.



10. RESEARCH NEEDS: Biodegradable Plastics- Although traditional plastics can be reused or recycled, they take many decades and even more than two hundred years to decompose, leading to serious environmental problems.The solution for this problem is to produce oxo-biodegradable plastics (oxo-bio) by using the degradable to water (D2W) additive during the standard production process of plastics. The impact of the additive is therefore negligible and there is no special training required for workers. There is no change involved to the standard plastics manufacturing processes and no impactThese are an answer to many of the problems due to the single use conventional plastics. One of the common constituents of biodegradable plastics is polyhydroxyalkanonate (PHA). It is similar to conventional plastics in all aspects with the additional quality of being able to naturally decompose and break into natural and safe byproducts. Hence if all plastics in the city waste was biodegradable, it could simply be allowed to decompose along with the food and other non recyclable but biodegradable articles like wet paper and cotton fibers. Hence, without much human intervention, these plastics would be able to find a safe end to their existence. The issue to think about here is again, the cost and feasibility. Since the technologies to manufacture biodegradable plastics is relatively new and not widely prevalent, the production cost is higher. In fact, the energy spent on the production of such plastics is also found to be slightly higher than. Therefore, further research in areas of more cost effective and energy efficient manufacturing methods for biodegradable plastics is the call of the hour.

10.1. Bioplastic: it's a type of biodegradable plastic derived from biological substances rather than petroleum. bioplastics are not derived from petroleum products. However, that does not imply that bioplastics can naturally decompose like biodegradable plastics. The prime benefit is that it gives some respite to our depleting petroleum reserves. However, that's not completely true, because the manufacturing process requires energy which often comes from fossil fuel. Hence, further research should focus on developing bioplastics that are both biodegradable and also energy efficient to produce.

10.2. Recycling techniques: This deals with the tonnes of plastic waste that is choking earth. So in addition to developing smarter plastics that takes the place of conventional plastics, we also need to deal with the immense quantities of toxic wastes already out there and hurting humans and the environment. Smarter sorting of Municipal Solid Wastes, more energy efficient ways of getting rid of the plasticizers from these items and increasing the scale of this entire process is very vital to overcome this challenge.

Recent reports of discovery of certain fungi and bacteria that hasten degradation of conventional plastics has received a lot of media and scientific attention. The research efforts are rightly guided in determining that in this process, the byproducts of this natural way of decomposition is safe for the environment and the there are no hidden adverse consequences of this approach.

It's also heartening to note that, research studies have tried to utilize waste plastics as additives to road building material because of the common petrochemical origin of tar and plastics.

11. ALTERNATIVES TO CURB THE WIDE USE OF PLASTIC

1. Use paper or cloth bags instead of plastic bags.
2. Reuse plastic bags for many times to reduce consumption, and hence curbing the production of them.
3. Use glass containers such as Pyrex.
4. Use of plastic bags can be reduced through codification by imposing heavy taxes or fees on the production of them.
5. Compliance with proper criteria and standards on the production of plastic bags makes the bags thicker, more durable and biodegradable.
6. Reduce the use of plastic-wrapped products.
7. Mothers should be cautious not to use plastic bottles for feeding their babies.
8. Do not buy plastic toys which children can chew, and replace them with toys made of natural materials.
9. Do not buy or use plastic cups, plates or spoons, especially the disposable single-use ones.
10. If you select between different plastic products, choose the product that can be reused or recycled.
11. Do not take more plastic bags than you need when shopping.
12. n case you buy a product in a plastic can or bottle, reuse it for other purposes instead of disposal
13. Avoid using plastic cups made of rigid polystyrene in drinking tea, coffee and other hot drinks. Use paper or glass cups instead. 2

12. CONCLUSIONS

To raise public awareness, the regional and national different levels of educational curriculums must include the waste management systems from the grass-roots as information resources. In addition to creating public awareness on the importance of a healthy environment, mechanisms of controlling the generation of wastes at the source, alternative disposal ways, establishing additional drop-off areas (landfills) and incineration mechanisms, plastic recycling facilities are also recommended. Helping communities to reduce their exposures to health toxicants will increase the likelihood for a healthy society and clean environment for the coming generations.

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