HAZARDOUS WASTE MANAGEMENT IN INDIA: PLASTIC WASTE A HUGE THREAT TO ECOLOGY

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ABSTRACT:

There are various plastic waste management strategies however, the present management progress is not sustainable, and plastic waste dumping in landfills is still the most commonly employed strategy. Being nonbiodegradable, plastic waste dumping in landfills creates several environmental and human health problems. Numerous research studies have been conducted recently to determine safe and ecologically beneficial methods of plastic waste handling. The present paper speaks about, the types of plastics, legislative framework of hazardous waste management and various plastic waste management strategies and their environmental benefits, recent statistics of plastic waste and some of suggestions are also been discussed. It has been concluded that among the six plastic waste management techniques (landfills, recycling, pyrolysis, liquefaction, road construction and tar, and concrete production), road construction and tar and concrete production are the two most effective strategies. This is due to significant benefits, such as ease of localization, decreased greenhouse gas emissions, and increased durability and sustainability of manufactured materials, structures, and roadways.

Key Words: Hazardous Waste, Waste Management, Plastic Waste.

Introduction

Hazardous waste in India has been defined as "any substance, excluding domestic and radioactive wastes, which because of its quantity and/or corrosive, reactive, ignitable, toxic and infectious characteristics causes significant hazards to human health or environment when improperly treated, stored, transported and disposed". In India, a comprehensive legislative framework has been in place for over a decade for addressing various issues related to hazardous waste management. However, on the implementation front there is a significant backlog. The present article discusses the status of hazardous waste generation and

management in India, examines select case studies and identifies policy issues that warrant attention.

Various Types of Waste

- **Hazardous Waste** means any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment.
- **Solid Waste** means and includes solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities.
- **Plastic Waste** means any plastic discarded after use or after their intended use is over.
- **Extended Producer's Responsibility** means the responsibility of a producer for the environmentally sound management of the product until the end of its life.
- E-Waste means electrical and electronic equipment, whole or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment and repair processes.

Types of Plastics

The Society of the Plastics Industry, Inc. (SPI) introduced its resin identification coding system in 1988 at the urging of recyclers around the country. The seven types of plastic include:

1. Polyethylene Terephthalate (PETE or PET)

2. High-Density Polyethylene (HDPE) Figure: Types of Plastic

3. Polyvinyl Chloride (PVC)

4. Low-Density Polyethylene (LDPE)

5. Polypropylene (PP)

6. Polystyrene or Styrofoam (PS)

7. Miscellaneous plastics (includes: polycarbonate, polylactide, acrylic, acrylonitrile butadiene, styrene, fiberglass, and nylon)

Plastics are generally categorized into two types[1] :

• **Thermoplastics**: Thermoplastics or Thermo-softening plastics are the plastics which soften on heating and can be moulded into desired shape such as PET, HDPE, LDPE, PP, PVC, PS etc.

• **Thermosets**: Thermoset or thermosetting plastics strengthen on heating, but cannot be remoulded or recycled such as Sheet Moulding Compounds (SMC), Fiber Reinforced Plastic (FRP), Bakelite etc. are the examples of the same.

Nowadays, an alternate to Petro-based plastic carry bags/films has been introduced i.e. compostable plastics (100% bio-based)carry-bags/films conforming IS/ISO: 17088.The Plastic Waste Management (PWM) Rules 2016 also encourage the use of compostable carry-bags and products by exempting minimum thickness criteria of 50µm.Further, as per provision 4 (h) of PWM Rules, 2016, the manufacturers or sellers of compostable plastic carry bags shall obtain a certificate from the Central Pollution Control Board (CPCB) before marketing or selling their products. The manufacturers/sellers of compostable carry bags/products are required to apply to CPCB as per Standard Operating Procedure (SOP) available on CPCB's Website[2].

Salient features of Plastic Waste Management (PWM Rules), 2016

• These rules shall apply to every Waste Generator, Local Body, Gram Panchayat, Manufacturer, Importer, Producer and Brand Owner.

• Carry bags made of virgin or recycled plastic, shall not be less than fifty microns in thickness. The provision of thickness shall not be applicable to carry bags made up of Compostable plastic, complying IS/ISO: 17088.

• Waste Generators including institutional generators, event organizers shall not litter the plastic waste, shall segregate waste and handover to authorized agency and shall pay user fee as prescribed by ULB and spot fine in case of violation.

[1] Source: Toolkit on Plastic Waste Management Rules 2016
[2] http://cpcb.nic.in/Plastic_waste.php

• **Local Bodies** shall encourage use of plastic waste for road construction or energy recovery or waste to oil or co-processing in cement kilns etc. It shall be responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of the plastic waste either on its own or by engaging agencies or producers

• **Gram Panchayat** either on its own or by engaging an agency shall set up, operationalize and coordinate for waste management in the rural area under their control and for performing the associated functions, namely, ensuring segregation, collection, storage, transportation, plastic waste and channelization of recyclable plastic waste fraction to recyclers having valid registration; ensuring that no damage is caused to the environment during this process; creating awareness among all stakeholders about their responsibilities; and ensuring that open burning of plastic waste does not take place.

Recent Statistics of Plastics waste

According to the reports for year 2017-18, Central Pollution Control Board (CPCB) has estimated that India generates approximately 9.4 Million tonnes per annum plastic waste, (which amounts to 26,000 tonnes of waste per day), and out of this approximately 5.6 Million tonnes per annum plastic waste is recycled (i.e. 15,600 tonnes of waste per day) and 3.8 Million tonnes per annum plastic waste is left uncollected or littered (9,400 tonnes of waste per day)[3] .

Out of the 60% of recycled plastic[4] :

• 70% is recycled at registered facilities

• 20% is recycled by Unorganized Sector

• 10% of the plastic is recycled at home.

While these stats are 38% higher than the global average of 20%, there is no comprehensive methods in place for plastic waste management. Additionally, there is a constant increase in plastics waste generation. One of the major reasons for this is that 50% of plastic is discarded as waste after single use. This also adds to increase in the carbon footprint since single use of plastic products increase the demand for virgin plastic products.

Plastic Waste Management

[3] Source: UNIDO Report- Recycling of Plastics in Indian perspective by Dr. Smita Mohanty
[4] Source: http://cpcb.nic.in/Plastic_waste.php

Landfilling

Approximately 10% of household waste is plastics and mostly end up on the landfill. Even though landfilling is the commonest waste management conventional approach in many countries, however, scarcity of space for landfills is becoming a major problem. For example, historically, landfilling was attractive in the UK because it is relatively cheap and simple without necessarily requiring treatment, cleaning or separation. In 1999, 65% (8.4 million tonnes per annum) of the overall household waste recoverable plastics were sent to landfill in Western Europe , but at present in the UK, plastic waste landfilling is the least favoured waste management option. There is a growing environmental and public health concern about the potential effects of landfills because of the types and quantities of toxic chemicals and their potential for leaching at landfill sites. It is now a government policy in the UK to reduce the amount of wastes landfilled (e.g. Landfill Directive European Commission 1999/31/EC) which has been difficult to materialize as an estimated 60% of England's municipal wastes is still sent to the landfills compared to an estimated of 20% and 37% in Germany and France, respectively.

Environmental pollution and risks to public health can be reduced if the landfills are well-managed, although there are possibilities of soil and groundwater contamination by disintegrated plastic byproducts and additives that can persist in the environment on long-term basis.

Plastic incineration

An alternative to landfilling of plastic waste is incineration, but growing concerns exist about the potential atmospheric release of hazardous chemicals during the process. For instance, plastic waste fumes release halogenated additives and polyvinyl chloride, while furans, dioxins, and polychlorinated biphenyls (PCBs) are released from incineration of plastics into the environment. The disadvantage of combustion of plastics is the air pollution caused by the noxious fumes released into the atmospheres. The combustion heater of the flue systems is permanently damaged by plastics during plastic incineration and the products of this plastic combustion are detrimental to both humans and the environment. Compounds of low molecular weight can vaporize directly into the air thereby polluting the air and based on their varieties, some may form a combustible mixture, while others may oxidize in solid form**.**

Incineration of plastics is usually accompanied with the formation of chark, and the coking extent is dependent on the conditions of incineration. Gaseous release in the process of plastic and plastic composite products incineration are very dangerous. For example, Table 2 shows the compounds release during the incineration of PVC and the health effects of these compounds. In the process of incineration of plastics, soot, ashes and different powders are produced, which eventually settles on plants and soil, with the potential to migrate to the aquatic environment. Rainfall can make some of these toxic compounds to sink into the soil, contaminate the ground water or absorbed by plants growing on this soil, thus, becoming incorporated into the food chain. Some of these plastic incineration products can chemically react with water and the resulting compounds can alter the pH thereby change the functioning of aquatic ecosystems.

Recycling of plastics

Reprocessing of recovered plastic scraps or wastes into usable products is called plastic recycling. Most plastics are non-biodegradable in nature hence, the fundamental work is reduction of waste emissions, effective management and recycling of resulting wastes. Recycling of plastics is a major aspect of the worldwide efforts in minimizing the yearly 8 million tonnes of plastics in the waste stream entering the Earth's ocean [8,40]. According to Hopewell, plastic recycling terminology is complex due to varieties of recovery activities and recycling. There are four main categories of recycling which are: primary (which involves the mechanical reprocessing of plastics into a new product with equivalent properties), secondary (which involves the mechanical reprocessing of plastics into a product with lower properties), tertiary (which involves the recovery of the chemical constituents of the plastics) and quaternary (which involves energy recovery from the plastics).

In comparison to the lucrative metal recycling but similar to the low value of glass recycling, recycling of plastics is often more challenging because of low density and low value. Also, there are several technical issues to deal with when recycling plastic. Melting together of different plastic types often cause phase-separation similar to oil and water, and they set in these layers. The resulting phase boundaries is responsible for structural weakness in the final product(s), which has limited the application of this polymer blends. This is the case with polyethylene and polypropylene, which are the two plastics commonly manufactured, and therefore has limited their use for recycling. Of recent, block copolymers

have been proposed as a form of macromolecular welding flux or molecular stitches in other to overcome this challenge of phase-separation during plastic recycling.

There can be increase in the percentage of plastics with the possibility of full recycling instead of the large quantity generated as wastes if package good manufacturers reduce their mixing of packaging materials and eliminate contaminants. In view of this, a design guide has been issued by the Association of Plastics Recyclers for recyclability of plastics. There has been an increase in the volume of post-consumer plastics recycled since 1990, although it is still incomparable to other items like corrugated fibreboard (approximately 70%) and newspaper (approximately 80%) . For example, in US, the post-consumer plastic wastes generated in 2008 was approximately 33.6 million tons, out of which 6.5% (2.2 million tons) were recycled, while 8% (2.6 million tons) and 86% (28.9 million tons) were burned and landfilled, respectively.

Some governments use policy to encourage postconsumer recycling, such as the EU Directive on packaging and packaging waste (94/62/EC). This subsequently led Germany to set-up legislation for extended producer responsibility that resulted in the die Gru¨nePunkt (Green Dot) scheme to implement recovery and recycling of packaging. In the UK, producer responsibility was enacted through a scheme for generating and trading packaging recovery notes, plus more recently a landfill levy to fund a range of waste reduction activities. As a consequence of all the above trends, the market value of recycled polymer and hence the viability of recycling have increased markedly over the last few years, globally in 2015, about 9% of the 6.3 billion tons plastic wastes generated had been recycled, while 12% and 79% were incinerated and landfilled, respectively. However, in 2016, the global rate of recycling grew to about 14% of the total generated plastic waste. Major contributors to this increment include countries like Japan, where plastic waste recycling rose from 39% (1996) to 83% (2014) according to their Plastic Waste Management Institute.

Suggestions for reduction of plastics

Plastic, of course, is uniquely problematic because it’s non-biodegradable and therefore sticks around for a lot longer than the other forms of waste. Few small steps in day to day life would help to keep plastics a possible out of the waste stream. Some of these steps may include

1. Discourage the use of disposal plastics, Ninety percent of the plastic items in our daily lives are used once and then abandoned: grocery bags, plastic wrap, disposable cutlery, straws, coffee-cup lids. Take note of how often we rely on these products and replace

them with reusable versions. It only takes a few times of bringing our own bags to the store, silverware to the office, or travel mug to office tea areas before it becomes habit.

2. Minimize Buying Water Each year, close to 20 billion plastic bottles are thrown in the trash. Making a habit of using reusable bottle in the bag, use of water from office, home and work areas where the quality of the water can be trusted
3. Minimize use of Plastics Cutlery Making a habit of using metal utensils instead of plastic cutlery would help saving a lot of plastics that is thrown in thrash every year.
4. Purchase item Second-hand The newer items comes with lot of packaging materials instead try to use second hand materials until it is very necessary
5. Support a bag Tax or Ban Support legislations and by laws which put taxes on ban of single use plastics.

Conclusion

The rapid growing plastic production leading to plastic waste is outpacing environmental waste management and available landfills for waste disposal, contributing to climate change. Climate change has adversely affected the environment and its inhabiting creatures in recent years. Damage to Ecosystems. Plastic pollution can cause significant damage to ecosystems. When plastic waste accumulates in an area, it can disrupt the balance of the ecosystem and harm plant and animal life. Additionally, plastic waste can release harmful chemicals into the environment, leading to further damage. Reducing, reusing and recycling waste helps save landfill space by keeping useful materials out. The amount of energy and natural resources needed to produce or collect the raw materials and manufacture the product are reduced.

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