

# A Review of Plastic Waste Management Strategies

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## Abstract:

Due to their inherent qualities, including as inertness and low bulk densities, which make them appropriate transport materials and provide little risk of contamination, plastics have been frequently utilised in both water and food packing. Plastic bottles and sachets are now widely used across the nation, but especially in urban areas. The packaging revolt was not supported by an effective plastic waste management strategy, leaving many Indian cities covered with plastic debris, leading to terrible visual issues and other issues with community health. Most wealthy nations now have plastic recycling programmes in place as a result of rising environmental consciousness and declining landfill capacity. Only 5 to 25% of plastic garbage is currently recycled, nevertheless. The study addresses the potential for programmes to manage plastic trash.

**Keywords:** Plastics, packaging, recycling, plastic waste management.

## Introduction:

Almost every area of human activity today has benefited significantly from the use of plastics, including agriculture, medicine, transportation, piping, electrical and heat insulation, packaging, manufacturing of household and electronic goods, furniture, and other items with specialised or everyday uses. Plastics have made a substantial contribution to supporting human life in medical items such as disposable syringes, blister packaging of tablets and capsules, joint replacement prostheses, intravenous (IV) fluid bottles, blood bags, catheters, heart valves, etc. Plastic-made medical gadgets are inserted into people. One of the most significant uses of plastics is in packaging.

In fact, packaging uses account for nearly 40% of all plastic materials worldwide. A sustainable, hygienic, energy-efficient, economical, and environmentally friendly packaging solution has been made possible thanks to plastics. Due to the versatility of plastics, it is now possible to package food items including milk, spices, edible oil, bread, confections, rice, wheat flour, snack foods, and other types of pharmaceuticals in a way that is effective, hygienic, and economical. Plastic is used to package a variety of everyday and specialty products for usage by all people, whether they are wealthy or impoverished, living in urban centres or rural communities.

The synthetic organic polymers that make up plastics are widely utilised in a variety of products, including water bottles, clothing, food packaging, medical supplies, electronics, building materials, etc.[1]. Plastics evolved during the last 60 years into a necessary and adaptable material with a diverse variety of characteristics, chemical makeup, and applications. Although plastic was initially thought to be innocuous and inert, years of environmental plastic waste have resulted in a variety of related issues. Plastic trash pollution is now widely acknowledged to be a significant environmental burden[2,3], particularly in the aquatic environment where plastics undergo prolonged biophysical breakdown[4,5], have severe effects on species[6,7], and have few choices for disposal[5,7,8].

Plastics used for sheeting and packaging are frequently discarded after use, but due to their endurance, they are ubiquitous and persistent in the environment. Although research on the monitoring and effects of plastic wastes is still in its infancy, the reports thus far are alarming.

Plastics based on gasoline are widely used in both the workplace and home environment of humans. These polymers are often landfilled along with municipal solid trash when their useful lives are through. Phthalates, polyfluorinated compounds, bisphenol A (BPA), brominated flame retardants, and repercussions on the environment and public health are only a few of the harmful components found in plastics. Due to the abundance of plastics in electronic garbage (e-waste) and the lack of suitable treatment practises in many nations, this material is becoming a severe environmental and public health hazard on a global scale. Plastic

hazardous chemicals from e-wastes can migrate outside of processing sites and into the environment, according to reports from China, Nigeria, and India[9–11].

### Types of Plastics and their Major Applications:

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)
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)



Figure1: Types of Plastic



Figure 2 : Examples of different types of Plastic

**The various types of plastics and their major applications are as follows:**

**Thermosets:**

Thermoset or thermosetting plastics strengthen on heating, but cannot be remolded or recycled such as Sheet Molding Compounds (SMC), Fiber Reinforced Plastic (FRP), Bakelite etc. are the examples of the same.

**Thermoplastics:**

These types of plastics become soft when heated, they can be moulded or shaped with pressure when in plastic state and, when cooled, they solidify and retain the shape or mould. Some common thermoplastics with their uses and properties are as follows: -

**Polyethylene terephthalate (PET):**

Some common properties are: i. Tough and clear, good strength and stiffness, chemical and heat resistant, good barrier properties for oxygen and carbon dioxide. ii. It is used in packaging, soft drink and mineral water bottles, fibres for clothing, films, food containers, transport, building and appliance industry (as it is fire resistant), etc.

**High density polyethylene (HDPE):**

Some common properties: i. good process ability, excellent balance of rigidity and impact strength, excellent chemical resistance, crystalline, melting point (130-1350C), and excellent water vapour barrier properties. ii. Used for making blow moulded products (various types of containers, water bottles), pipes, injection moulded products (storage bins, caps, buckets, mugs), films (carrier bags), etc.

**Polyvinyl chloride (PVC):**

Its properties are: i. Versatility, energy saving, adaptability to changing time and environment, durability, fire resistance. ii. It is used in industries such as building and construction, packaging, medical, agriculture, transport. Also used for making wires and cables, furniture, footwear, domestic appliances, films and sheets, bottles, etc.

**Low density polyethylene (LDPE):**

Characteristics of LDPE are: i. Easy process ability, low density, semi crystalline nature, low melting range, low softening point, good chemical resistance, excellent dielectric properties, low moisture barrier, poor abrasion and stretch resistance. ii. It is used for making carrier bags, heavy duty bags, nursery bags, small squeeze bottles. Also used in milk packaging, wire and cable insulation, etc.

**Polypropylene (PP):**

Properties are: i. Low density, excellent chemical resistance, environmental stress resistance, high melting point, good process ability, dielectric properties, low cost, creep resistance. ii. Used for making bottles, medical containers, pipes, sheets, straws, films furniture, house wares, luggage, toys, hair dryer, fan, etc.

**Polystyrene (PS):**

Some of the properties of polystyrene are: i. Glassy surface, clear to opaque, rigid, hard, high clarity, affected by fats and solvents. ii. Used for making electrical and communication equipments e.g. plugs, sockets, switch plates, coil forms, circuit boards, spacers and housings. Also used for making containers, toys, wall tiles, baskets, cutlery, dishes, cups, tumblers, dairy containers, etc.

**Others plastics:** There are many other types of plastics except these six types, often used in the engineering sector. Examples include polycarbonate (PC), nylon, and acrylonitrile butadiene styrene (ABS).

**Plastic Waste Management (PWM Rules), 2016:**

The Government of India notified Plastic Waste Management (PWM) Rules, 2016 on 18th March, 2016, superseding Plastic Waste (Management & Handling) Rules, 2011. These rules were further amended and named as 'Plastic Waste Management (Amendment) Rules, 2018.

### **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.

### **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

### **Producer, Importers and Brand Owners**

need to work out modalities for waste collection system for collecting back the plastic waste within a period of six months in consultation with local authority/State Urban Development Department and implement with two years thereafter.

### **State Pollution Control Board (SPCB)/ Pollution Control Committee (PCC)**

shall be the authority for enforcement of the provisions of PWM Rules, 2016, relating to registration, manufacture of plastic products and multi-layered packaging, processing and disposal of plastic wastes.

Concerned Secretary-in-charge of Urban Development of the State or a Union Territory and concerned Gram Panchayat in the rural area of the State or a Union Territory shall be the authority for enforcement of the provisions of PWM Rules, Rules relating to waste management by waste generator, use of plastic carry bags, plastic sheets or like, covers made of plastic sheets and multilayered packaging.

### **District Magistrate or Deputy Commissioner**

shall provide the assistance to PCBs/PCCs, Secretary-in- Charge, Urban Development Department and Gram Panchayat under his jurisdiction, whenever required for enforcement of provisions of PWM Rules, 2016.

### **Reduce, Reuse, Recycle, and Recovery**

Consumers and retailers alike choose plastic bags because they are practical, lightweight, robust, affordable, and hygienic for transporting food and other goods. After use, the majority of these are recycled, however some end up in landfills and rubbish piles. Plastic bags can contaminate our streets, parks, and waterways after becoming littered. Even though plastic bags only make up a small portion of all litter, they nonetheless have a big impact. Plastic bags can affect both aquatic and terrestrial creatures and cause visual pollution issues.

Due to their bulk and propensity to take a very long time to completely decompose, plastic bags are particularly prominent components of the litter stream. Many carry bags become unattractive litter in parks, gardens, streets, and trees, which not only looks bad but can also harm wildlife like birds and small



mammals. Bags that make it to the ocean run the risk of being mistaken for jellyfish by marine mammals and sea turtles, which would be disastrous. Billion bags are discarded annually in affluent nations, the most of which have only been used once. The main issue with plastic bags is that they take a long time to decompose in the environment. The ordinary plastic carrier bag is used for five minutes on average, but it takes 500 years for it to degrade.

## Reduce

Plastic, of course, presents a special difficulty because it is not biodegradable and consequently persists much longer than other types of waste. A few simple actions in daily living could help keep plastics from entering the waste stream. Some of these actions could be:

### 1. Discourage the use of disposal plastics

The majority of plastic products we use on a daily basis—grocery bags, plastic wrap, throwaway cutlery, straws, coffee cup lids—are only used once before being thrown away. Keep track of how frequently we use these things and switch to reusable alternatives. Before it gets ingrained, we only need a few occasions to carry our own bags to the store, silverware to the office, or travel mugs to the office tea facilities.

### 2. Minimize Buying Water

Nearly 20 billion plastic bottles are discarded in the trash each year. establishing a routine of carrying a reusable bottle and drinking water from reliable sources at work, home, and in the office.

### 3. Minimize use of Plastics Cutlery

Using metal utensils regularly in place of plastic cutlery would help reduce the amount of plastic that is discarded in trash each year.

### 4. Purchase item Secondhand

The newer items comes with lot of packaging materials instead try to use secondhand 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

In the modern setting, managing plastic waste has taken on significant importance. In India, a number of programmes are being put into place to lessen the effects of plastic trash. One such plan for managing plastic product waste is recycling. Current trends show a noticeably higher percentage of recovery and recycling of plastic trash, which is both environmentally and economically sensible. These trends are anticipated to continue, but there are still some substantial obstacles due to technological constraints as well as economic or societal difficulties surrounding the collection of recyclable garbage and the replacement of virgin material. Recycling used plastic trash is a practical strategy to enhance the environmental performance of the polymer sector, especially when combined with initiatives to expand the specification and use of recycled grades as substitutes for virgin plastic.

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