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Plastic Waste and Management: An Environmental Issue

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Abstract:

Plastics have been important discovery in the history of mankind. Plastic and polymer have become a part of our life today. Plastics remain in widespread use and in many cases are effective and environmentally friendly. But this also led to problems as well and some kinds of plastic usage become nuisance causes severe environmental degradation. No doubt, plastic is too good for consumers use as it is more durable but burning release very harmful toxic carcinogenic gases which cause damage to our environment. Plastic industry not only harms our environment but also deplete the fossil fuel. As plastic consumption is increasing day by day, obviously plastic waste will also increases automatically. Now the question arises, how plastic waste to be managed. It is either recycled or need to use updated technologies for the management of wastes. Plastic can be recycled and used in various useful products. One truth is that plastic recycling is carried out by informal units which run on outdated technologies, unskilled labour. Moreover with the recycling process, the problem is difficult to automate. Plastic waste industry also supports the idea of converting into energy by incineration. This also solves the problem of waste management. Plastic waste management in developed countries is gradually becoming a mature industry in the need of fundamental improvement that allows reaching higher levels of recovery and recycling.

1. Introduction

Plastics are one of the wonderful inventions of the 20th century. The world without plastics is unimaginable. In 1862, first man-made plastics were derived from cellulose, discovered by Alexander Parkes. But first completely man-made plastics were Bakelite, discovered by New York Chemists Baekeland in 1907. Rayon, Cellophane, Nylon, PVC, Saran, and Teflon were subsequently discovered in the 20th century. Since 1950, Plastics have grown into a major industry that affects all of our lives which provide packaging materials to textile and new technology such as TV, cars, computers. Plastics have replaced traditional material like cloth, paper for packing and carry bags because of the low cost. As the urbanization increased growth and consumption of plastics also increased and also plastic waste. The plastics waste is now considered as an Environmental Hazard due to “Throw away culture”. This throw away culture results in drainage blockage create unhygienic condition spreading of waterborne disease in all cities. Littering reduces rain water percolating. Soil fertility down due to land filling with plastic bags. In big oceans, life of fish and other animals is under risk due to throw away culture of plastics into the sea.

2. Plastics Consumption

The growth of plastics in India is increasing at a remarkable rate .In India, growth rate is 17% as compared to elsewhere in the world. In India, one third of the population is below the poverty line and lack financial sources to buy costly things. The rising needs of the middle class and poor people with the use of plastics is made available at a cheaper rate as compared to glass or metals According to Industrial body, Plastics production may touch 12.75 million tons by 2012 India may become number 3 in plastics usage by 2015.

Polymer	1995-96	2001-02	2006-07
Polyethylene(PE)	823	1835	3267
Polyvinylchloride(PVC)	489	867	1282
Polyethylene Terephthalate(PET)	34	140	289

Table 1: Increase in Trend of Plastic Consumption (Thousand Tons)
Source: National Plastic Waste Management Task Force Report (1997)

Among all the plastic goods, PET bottles and carry bags are major culprits. All plastic goods after useful life become waste. PET bottles has potential market in various items like soft drinks, mineral water, edible oil, jars, pharmaceutical small bottles, country liquor etc. The rise in PET may attributed to no availability of clean drinking water to middle and upper class people. PET is continuously maintaining a growth rate of at least 25% every year and it is predicted that it will double in next three years. (Economic Times)

3. Plastic Waste Generation

Plastic waste generation is based on socioeconomic condition, climatic condition, and urbanization in cities. More urbanization, more resources and may produce more solid waste. Approximately 10 thousand tons per day (TPD) of Plastic waste is generated i.e. 9% of 1.20 lac TPD of municipal solid waste in the country. The Plastic waste content in MSW in average 1.5 Kg/per person. About 60% of plastics waste is collected for recycling and remaining 40% is not collected and left on the site as a litter.

Sl. no.	Component	Wet weight in India (%)			Developed countries
		1971-72	1996	2005	
1.	Paper	4.44	2.91-6.43	8.13	28-60
2.	Plastic	0.69	0.28-0.78	9.22	2-8
3.	Metal	0.50	0.32-0.80	0.50	3-13
4.	Glass	0.40	0.35-0.94	1.01	4-16

Table 2: Characteristic of Municipal Solid Waste (MSW) Especially Plastic Material

Source: CPHEEO Manual on MSW Management

Since urban population is increasing at alarming rate. Likewise waste quantities are also increasing from 46 million tons in 2007 to 65 million tons in 2010. Table represents MSW especially plastic materials during the last three decades. There is rapidly increase in paper, plastics, metals, glass due to change in life style of urban areas. According to latest CPCB (central pollution control board) report, metropolitan Delhi city generate about 5.6 million tons of plastic waste annually. According to CPCB report, Plastic pouches containing tobacco products, gutkha and other products should be avoided in the country otherwise we all sitting on plastic time bomb which can explode any time. Plastic cups which we use for morning coffee, are using styrene puffed with CFCs or pentane since the release of CFCs destroy stratospheric ozone.

There is another aspect of study of various plastic material and average annual growth rate in which graph clearly indicates that PET is increasing at a alarming rate as compared to other plastic materials like PS, PVC, PE, PP, PET (PS=Polystyrene, PVC=Polyvinylchloride, PE=Polyethylene, PP=Polypropylene, PET=Polyethylene terephthalate). Among all the plastics, PET is accelerating at a rapid rate globally shown in graph below. It is reported that in 2001, the uncollected plastics waste may be 80,000 tons which remained as a litter on the Indian roads, posing risk to human life waste management process. To save our environment, littering of plastic bags, packaging films, thermocol, spoon, plastic cups should be properly collected and recycled. Plastic waste and MSW be treated separated. Recycling process must be confined in particular areas.

- Global growth rate (2007-2010)

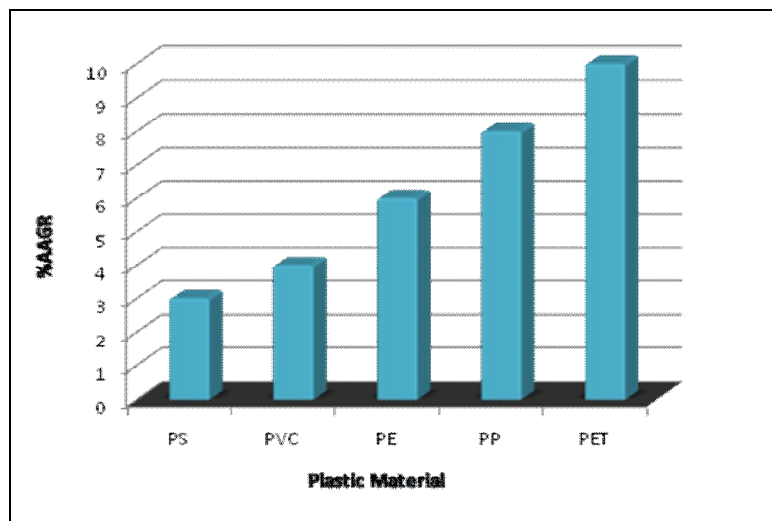


Figure 1: Graph between %AAGR (Average Annual Growth Rate) and Various Plastics Material

Source: CPCB Report

4. Plastic waste management

4.1. Sources of Waste Plastics

The prominent sources of plastic waste are

- Municipal sources-Plastic waste from residential and household markets and hospitals, streets, parks, waste dumps.
- Industrial sources- Food ,chemical or other packaging industries
- Other sources-Agriculture, automobile or construction waste

4.2. Collection

The method of collection can be done in the following chain of people

- Rag pickers
- Kabadiwala/Reddiwala
- Dealers

The plastic waste recovery and recycling is generally carried by informal sectors. There is chain of persons who are involved in trade of plastics waste recovery.

- **Rag Pickers**

They are the backbone of plastic waste collection and recycling in India. In overcrowded cities like in Mumbai, there are 2 lac rag pickers who collect everything which has value in market. The study reveals that these rag pickers playing an important role in the management of plastics in all the urban areas. These rag pickers collect about 700-900 tons of waste in metropolitan cities like Delhi and sell the collected waste to Kabariwala.

- **Kabariwala/Reddiwala**

They move in city, street to street, house to house and collect the waste. Since his materials have not been mixed with the wastes but the quality of waste collected by them, of the higher quality that collected by ragpickers. Reddiwala collect only clean scrap like metal plastic, paper, and glass. The Reddiwala remain stationary in one place at his shop and carry out business. The reddiwala buy the materials from the rag pickers or Kabariwala and sell to next person in chain of scrap dealers.

- **Scrap Dealers**

Scrap dealers will buy specific item and sort out the waste, bundles it and sell to bulk buyers. The bulk buyers sent the waste materials to the recycling unit of the city. It is evident that packaging materials are the major components in the scrap. The quality of the scrap depends on the type of materials processed the color and general purity. It is known that colorless plastics are preferred than colored plastics as they can fetch more money.

4.3. Processing of Reclaimed Plastic

The sorting of plastic scrap is done on the basis of transparency, colour, density and opacity. Sorting of plastic can be polymer type (thermoplastic etc.) or byproduct (plastic bottle etc.). The sorted waste is sent to granulators which help in reducing size to granules form. Then it is further proceed for processing. There are several techniques commonly used for size reduction of plastic like cutting, Shredding (done by rotating blades driven by electric motor), Agglomeration (heating of pre-plasticizing soft plastic followed by cooling). The next step of processing is extrusion which is employed to homogenize the reclaimed polymer and produce a material that is subsequently easy to work. The plastic polymer can be undergo injection moulding which is used to produce moulded products such as plates, bowls, plastic etc. It can be undergo film blowing process which is used to manufacture garbage bags. It is also possible to manufacture closed vessels such as bottles and other containers by blow moulding process.

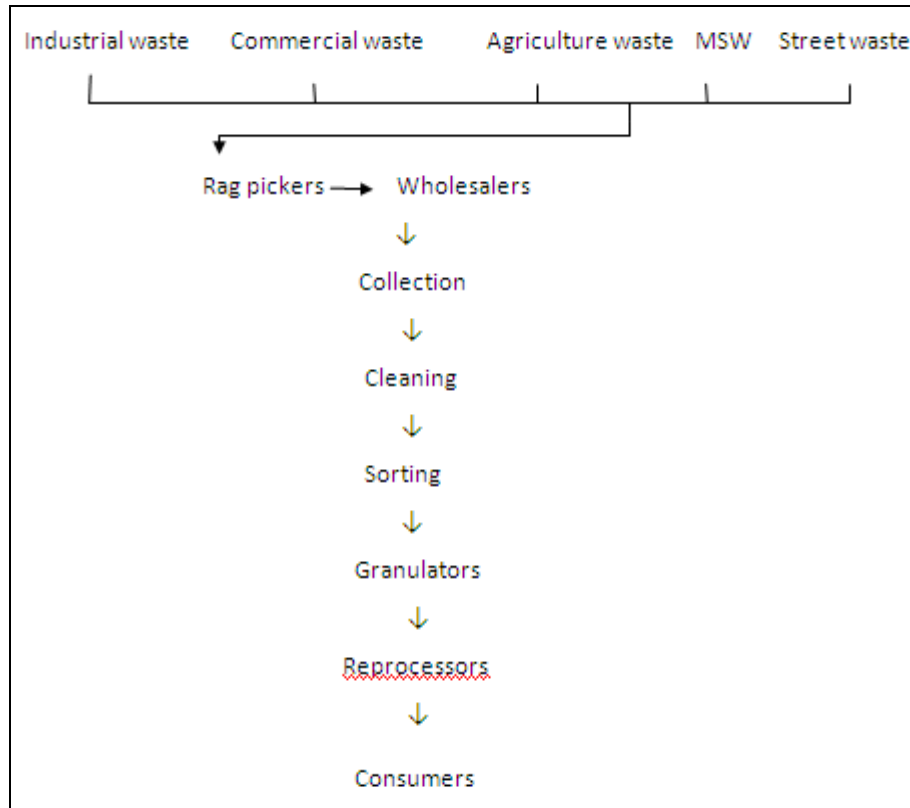


Figure 2: Flow Chart of a Typical Waste Plastic Reprocessing

5. Energy Recovery with Incineration Techniques

Plastic waste industry also supports the idea of converting into energy. This also solves the problem of waste management. Big cities like Chennai or Mumbai set up the plant for energy recovery. In Chennai, 14.85 MW waste into energy is going to set up where 6000 tons /day of MSW would be converted into electricity. In developed countries like Sweden, 95% of heat generated from incineration is used for district central heating covering roughly 10% of total power requirement. Indian waste composition is very different from the western countries. In India, waste into electricity follows following limitation:

- Calorific value of Indian waste is around 800 to 1000KJ/Kg which is very low. This need additional fuel for combustion which thereby extra cost to operational cost. This is because Rag pickers retrieve most of the combustible materials from the dustbins and dump yards.
- Incineration changes the form of the waste, reduces its volume and weight, but does not destroy many of its hazardous components.
- Incineration techniques causes' air pollution and causes release of toxic gases like SO_x , NH_3 , dioxins or furan, generation of fly ash.

In fact, two new forms of waste are produced: gaseous emission and solid residue. Gases exit from smokestacks of the incinerators and solid residue include ash from combustion chamber (bottom ash) and fly ash that rises up the smokestacks.

6. Conclusion

No doubt, there has been tremendous increase in quantity of plastic waste generation for the last few years. MSW management is major environmental issues in India. Problem lie with municipalities in collection, storage, transport and disposal. Municipalities failed to tackle the situation due to scarcity of funds to handle the waste. The informal sector neglected picking of carry bags and PET as they found them as economical. To view this, Indian government has drafted a rule called Recycled Plastic manufacture and usage rule to curb the littering problem minimize health risk.

“Awareness among the public, particularly school children is necessary to make our cities clean and green. So, unless the students understand the importance of clean city, they would be more conscious about waste generation and disposal”.

Biodegradable Plastic is alternative promising technology on which research is going on. Starch can be added with plastic so as degrade the plastic completely. Another way to handle the waste management is use of genetically engineered bacteria could also produce biodegradable plastic which is very costly but not recommended.

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