

# Plastic waste Management : A Step Towards A Smart City

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**Abstract:** -- A Smart city is that city where in by the use of technology we create focus on sustainable economic development and giving high quality of life to its citizens. A 'smart city' is developed upon numerous distinct elements and plastic waste management is one of these vital aspects. Packaging wrappers of chocolates, chips, hand bags, cold drink bottles and all other forms of plastic create significant environmental and economic problem. It consumes massive energy and other natural resources, depleting the environment in various ways. To overcome environmental problems effective plastic waste management system required. The effectiveness of plastic waste management system depends upon the active participation of all the stakeholders and citizens. Plastic waste management is of grave importance to an urbanized region which faces the constant pressure of increasing population density, rising infrastructural demands and expanding inflow of immigrants. Hence, the need for creating a stronger civic sense among the citizens is of pivotal importance for the success and fruitful implementation of plastic waste management system. The paper discusses aspect and prospects of plastic waste management system and their limitations in order to dispose of or at least reduce the accumulation of plastic waste.

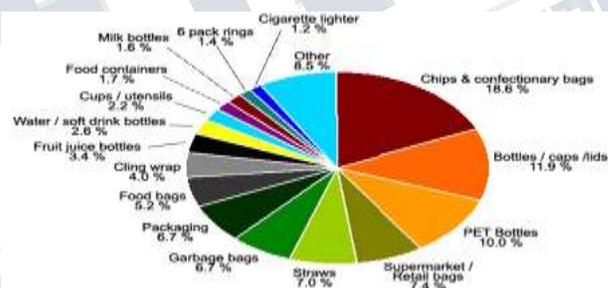
**Keywords:** Plastic, Plastic Waste management, Recycling, Reuse.

## I. INTRODUCTION

There has been a significant increase in Plastic waste generation in India in the last few decades, largely due to rapid population growth and economic development and changes in life style. Plastics waste is a significant portion of the total municipal solid waste (MSW). It is estimated that approximately Ten thousand tons per day (TPD) of plastics waste is generated i.e. 9% of 1.20 lacs TPD of MSW in the country. This creates a lot of environment pollution, which in turn affects ecosystem and human health. Plastics are low molecular weight organic materials, that are non degradable in the natural environment.

Types of Plastics: The plastics waste constitutes two major category of plastics; (i) Thermoplastics and (ii) Thermoset plastics.

Thermoplastics, constitutes 80% and thermoset constitutes approximately 20% of total post-consumer plastics waste generated in India. The Thermoplastics are recyclable plastics which include; Polyethylene Terephthalate (PET), Low Density Poly Ethylene (LDPE), Poly Vinyl Chloride (PVC), High Density Poly Ethylene (HDPE), Polypropylene (PP), Polystyrene (PS) etc. However, thermoset plastics contains alkyd, epoxy, ester, melamine formaldehyde, phenolic formaldehyde, silicon, urea formaldehyde, polyurethane, metalised and multilayer plastics etc. The environmental hazards due to mismanagement of plastics waste includes spoiling of the beauty of the city, pollution by emitting gases, problems in landfill operations etc.



**Fig.1 Sources of Plastic waste**

## II. METHODOLOGY

Today most of our scientific research is focused on the reuse and disposal of this plastic waste.

Few of the methods are:

- 1) Use of plastic powder, fibers, coirs along with sand, fly ash to improve the quality of concrete in civil work [1,2,3,4].
- 2) Fiber reinforced plastic composites [5,6].
- 3) Use of plastic waste for construction of bituminous roads and flexible pavements. [7]
- 4) Land fill [8]
- 5) Incineration
- 6) Reuse by remolding
- 7) Recycling

Extensive laboratory work is in progress for all above mentioned methods of plastic waste disposal. Few of the

conclusions on above methods of plastic waste disposal are as follows.

- Up to 1% addition of plastic waste improved the splitting tensile strength of concrete but has reduced its compressive strength by 20% in 28 days. At the same time addition of E-plastic aggregate up to 15% by weight with fly ash was used effectively in concrete.

- Fiber reinforced plastic (FRP) comprises of polymeric resin and reinforcement usually in fiber form with other additives like filler, catalyst, etc. Here the fibers are continuous and long enough and can be arranged to produce higher strength properties in one direction. These FRP are useful in geothermal engineering, sports, automobiles, highway infrastructure, construction industries, cooling towers. It is the most emerging technology with low processing cost and number of applications due to its properties like dimensional stability, flexibility, high strength, light weight and corrosive resistance. These composite materials basically consists of three systems namely matrix, fiber and additive.

- Plastic waste for construction of bituminous roads and flexible pavements strengthen the road with increased marshall stability value, better resistance towards rain water and water stagnation so no stripping and no potholes, increase binding and better bonding of the mix thus reduction in pores in aggregate and hence less rutting a raveling. The load withstanding property increases. It helps to satisfy today's need of increased road transport.

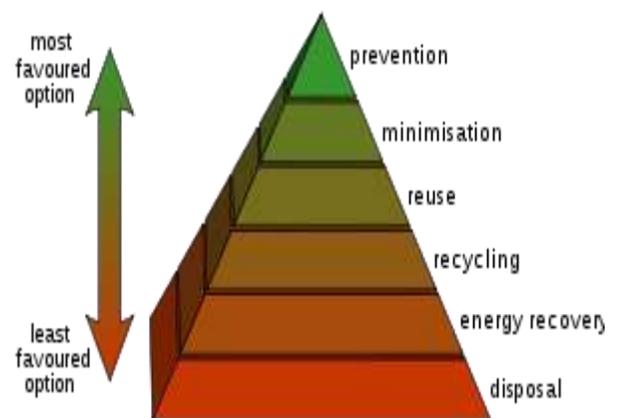
- A landfill is a disposed area where garbage is piled up and eventually covered with dirt and topsoil. Fraction of E-waste is most often dumped into landfills. But this can very often lead to ground water contamination.

- Incineration: E- waste and other plastic waste burnt incinerators under controlled conditions to separate the toxic gases like dioxins. Looking only at CO<sub>2</sub> emissions, incineration of plastics produces a much greater amount of CO<sub>2</sub> than landfill. However, in the special case when incineration is performed with high-efficiency energy recovery, it provides power normally generated by plants burning fossil fuels, and can produce less CO<sub>2</sub> than would otherwise have been released into the atmosphere, making the overall process CO<sub>2</sub>-negative. Incineration may also be implemented without energy and materials recovery. Recently work is in progress to carbonize this waste in absence of air to produce fuel and lubricant of low grade qualities. Many researcher claims to produce diesel from these waste.

- Recycling and reuse of plastics is gaining importance as a sustainable method for plastic waste disposal. Unfortunately, plastic is much more difficult to recycle than materials like glass, aluminum or paper. A common problem with recycling plastics is that plastics are often made up of more than one kind of polymer or there may be some sort of fiber added to the plastic (a composite).

Plastic polymers require greater processing to be recycled as each type melts at different temperatures and has different properties, so careful separation is necessary. Moreover, most plastics are not highly compatible with one another. Apart from familiar applications like recycling bottles and industrial packaging film, there are also new developments e.g. the Recovynyl initiative of the PVC industry (covering pipes, window frames, roofing membranes and flooring).

8) Polyethylene terephthalate (PET) and high density polyethylene (HDPE) bottles have proven to have high recyclability and are taken by most curbside and drop-off recycling programs. The growth of bottle recycling has been facilitated by the development of processing technologies that increase product purities and reduce operational costs. Recycled PET and HDPE have many uses and well-established markets. In contrast, recycling of polyvinyl chloride (PVC) bottles and other materials is limited. A major problem in the recycling of PVC is the high chlorine content in raw PVC (around 56 percent of the polymer's weight) and the high levels of hazardous additives added to the polymer to achieve the desired material quality. As a result, PVC requires separation from other plastics before mechanical recycling [9]



**Fig.2. Pyramid of plastic waste**

### III. CONCLUSION

Disposal of plastic waste is a serious concern in India and such no technology has been validated, however, several experiments have been conducted on reuse of plastic waste in road construction, co-processing of plastic waste in cement kilns. Currently, Worldwide accepted technology used for the plastic disposal is incineration, however, due to poor maintenance of incinerators, it releases several harmful gases including dioxins and furans in case of chlorinated and brominated plastic waste therefore, raising several environmental issues.

Fig. 2. shows the least favored option and most favored option for plastic waste. Plastic is now an integral part of the everyday activity of human life and one cannot rule out the advantages of plastic but the disadvantages can be reduced to some extent if certain tips to deal with plastic waste are followed and these are:

1. Plastic Recycling: Separating the plastic products from the garbage and at home and handling over this plastic for recycling can reduce the impact of environmental pollution due to plastic waste. Plastic recycling industry is now a billion dollar industry in developed economies. Recycled plastic is usually used for laying down roads in place of bitumen, bottles, benches etc. Buying recycled plastic also helps with plastic management.

2. Using incinerators: Plastic waste is being burned in incinerator centers located outside the city limits in developed economies and this practice is now being followed by developing economies as well. This technique eliminates huge volumes of plastic material but there are some concerns related with air pollution due to such burning but efforts are being made to improve technology to reduce such air pollution in future.

3. Prohibition on manufacturing/selling of certain plastic material/bags: Some governments in the developed and developing countries has prohibited the manufacture and selling of plastic bags or material that contains more than the standard prescribed microns of plastic. By this way, the excessive dependence on plastic has been controlled to some extent.

4. Using paper bags and other cloth materials as shopping bags for a customer can be useful. It is suggested to use paper bags and bags made with cloth material such as jute, cotton etc while going for shopping or for purchasing grocery

items. In this way, we as individuals can rely less on the plastic bags while going on a shopping spree.

5. Implementing the best civic practices: As the citizens of a community or country the best tip for proper disposal of plastic is follow the below mentioned practices:

a. Using garbage bins/dust bins at public places for disposing of the plastic water bottles, food containers and other plastic material.

b. Avoid throwing plastic garbage in open spaces, public places, water channels, rivers, sea beaches and other fragile natural resources or environment.

c. Follow the government regulations relating to plastic management and help the government agencies in dealing with plastic waste.

d. Create awareness among the people about safe practices of plastic waste management and run a campaign if possible with the help of other agencies who are involved in plastic waste management programs.

Thus the use of plastics can be controlled and we can also give a lending heart for an effective plastic waste disposal system, which can lead the city to become a smart city.

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