

Disposable PLASTICS, “A Boon or a Curse?”

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Abstract- In today's world we are living in an age where disposables have become a way of life. In this “use and throw” society, plastics have become a part of our day to-day lifestyle, and affect everyone. Plastics have several drawbacks, and also contain toxins that can trigger the development of cancerous diseases. The hospital today is on the brink of a progressing ecological catastrophe. Excessive use of chemicals of various kinds, burning of PVC plastic, use of bio-chemicals and disinfectants, irresponsible playing around with waste treatment technologies, have all led to the breakdown of ecological, thermal and oxygen balance. Proper Plastic Waste Management not only reduces quantum & volume of Waste generated but also changes the quality of waste. Generation of plastics waste which constitutes a major part of municipal solid waste creates a lot of environmental pollution, which in turn affects ecosystem and human health. This article focused much on hospital and municipal plastic waste, an eco-friendly concept to protect the environment.

Index Terms- Hospital plastic equipment used Environmental problems, Remedial measure, and PVC (Poly Vinyl Chloride) syringe

I. INTRODUCTION

Generation of plastic waste is an ongoing process arising from use of plastic products. Every year, around 500 billion plastic bags are used worldwide. So that over one million bags are being used every minute and they're damaging our environment. India's plastics consumption is one of the highest in the world. The plastic consumption in India, as per estimate in 2008 by CPCB was 8 MT/annum, out of which about 5.7 MT of i.e. 15,722 tons of plastic waste is generated plastics are converted into waste annually per day. Therefore the per capita generation of plastic waste has been estimated as 5.7 Kg/annum. It has been reported that 60% of total plastic waste generated is recycled and 40% is littered and remains uncollected. Therefore, approximately, 6289 tons per day (TPD) i.e. 40% of plastics are neither collected, nor recycled and find their way into drains. Use of plastic in hospitals and is constantly increasing by an astounding proportion of approximate initially 6% per annum and presently it is growing at the rate of 15 % per annum. Large amount of plastic wastes are generated in health care facilities and municipal solid waste in the form of packaging materials, disposable syringes, catheters, OT gowns and kits and day to day activities of the patients. Cafeterias, in campuses also serve beverages and food in plastic containers. Plastics owe their name to their most important property, the ability to be shaped to almost any form to produce articles of practical value. Plastics can be stiff and hard or flexible and soft. Because of their light weight, low cost, and desirable properties, their use has rapidly increased and they have replaced other materials such as rubber,

metal and glass. They are used in millions of items, including cars, bullet proof vests, toys, hospital equipments and containers. Health care areas have also had an over-whelming onslaught of plastic disposable goods. Plastics constitute a major chunk of waste generated in the health care facilities, both large and small. This causes immense problems in managing hospital waste. We shall deal with some of the issues related to plastic use in hospitals and highlight the problems and dangers in health care facilities. Plastic waste can be easily managed at the point of generation. If this is not done, then the magnitude of cost in treating plastic waste multiplies several times because management and treatment of plastic waste is expensive and difficult, but not impossible. In USA a study on “Finding Prescription for Medical Waste 1990” narrates that plastics comprise 25% of total waste generated in hospital. As compared with Municipal Solid Waste (MSW), hospital waste contains a larger percentage of plastic. In the Indian scenario the plastic content in Hospital Waste is four times higher than that in Municipal Solid Waste. There are around 3.30 lakhs tones of bio-medical waste annually in India. It has been seen that the economic status of the patient and the hospitals is directly proportionate to the generation of disposable plastic waste. Hence the volume of plastic waste in sophisticated, multi-specialty private hospitals like Apollo, Escorts is considerably higher as compared to that in district government hospitals. However, there is a marked shift towards the use of plastic, “use and throw” disposables. In India the market for medical disposables has grown from 2350 million USD in 1979 to 4000 million in 1986. (Alok R. Ray & Dr Bhommick, AIIMS, New Delhi). Plastic usage in Indian Healthcare industry is growing approximate by 15% per annum. Various market segments like medical and dental surgical equipments, implants and medical plastics disposable industry is on an expansion mode.

Strange! All these peoples are drinking bottled water to protect their bodies and their health, and then they're throwing their bottles out of the car window. It's like they haven't completed the loop in their rationale here. Plastic packing is slowly becoming the norm in India too and we happy to carry away water, juice, biscuits, chips, muruku, pulses, pickles, curd and ready-to-eat dishes, in plastic containers. It is not too late for us in India to go back to our old ways of carrying our own cloth bags for shopping, taking stainless steel tiffin and bottles carriers for take-out food, and safe water respectively. We need to encourage and demand more eco-friendly packaging; glass bottles instead of plastic, less packing instead of more, and reusable instead of throwaway.

II. OBJECTIVES OF SUSTAINABLE PLASTIC WASTE POLICIES

The objective of a policy in addressing an issue is very important, since targeting the right objective is crucial in alleviating the problem. A policy objective should not only aim to address immediate concerns, but also provide a long-term solution to the problems. This would help to analyze whether the objectives of the existing policies on plastic waste management in India contribute to sustainable waste management. The following reflects the main principles for sustainable waste management.

1. Prevention of plastic waste generation at source as the first priority.
2. Reuse and recycling should be practiced to the extent possible.
3. Treatment of plastic waste prior to disposal.
4. Disposal is the least preferred option.

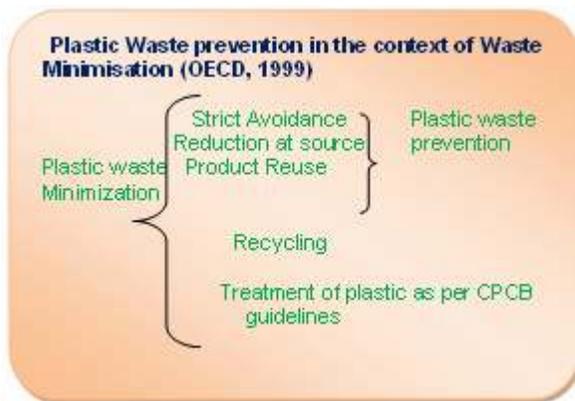


Fig 1: “Linkage between waste prevention and waste minimization”

III. PLASTIC IN THE HOSPITAL AND ENVIRONMENT

The use of plastics in hospitals began in 1960s when enamel urine bottles and disposable plastics replaced bedpans. The concept of disposable hospital equipments started in health care facilities because of its cheaper cost and easy availability. It thus found its way into the day to day use of health care facilities. Plastic originates as a by-product of the petroleum industry. When this plastic is used in manufacture of equipments, it generates poisonous gases specially dioxins and furans. Similarly, when plastic waste is burnt it again produces dioxins, furans, sulphur dioxide, carbon dioxide etc. These poisonous gases not only affect green house but also increased impotency in our country in last one decade due to Hormonal in-balance. Dioxin, Furan, Sulphur dioxide, Carbon dioxide, etc. gasses also increased congenital abnormality in new born like cleft pallets, harelip etc. Plastics, though convenient and cheap, it causes damage to the environment and health when disposed off and increase the volume of waste making it difficult to collect, transport and treat. This indirect increase in cost is not considered when disposables are used. Hospital waste generation can be controlled if plastic usage is reduced. Hospital Waste

Management plan in the area of plastic usage is influenced by the following factors:

1. Waste production is related to the choice of material used especially reusable traditional hospital equipment v/s disposable plastic hospital equipment.
2. Proper segregation of waste at source will reduce waste treatment costs.
3. Waste may also be reduced through decreased plastic packaging material in hospital supplies.
4. PVC plastic items may be substituted with reusable crockery and cutlery as far as possible.

So Plastics form a major constituent of Hospital Waste. On one end of the spectrum plastic attracts the attention of the planner of plastic waste management in hospitals and municipal streams, on the other end it attracts the rag pickers who often get injuries from sharps while rag picking from solid waste.

A. Pollution Concerns

The basic reasons that make plastics a source of pollution are the following.

1. Plastics are non-biodegradable.
2. Plastics prevent or reduce the seepage of water into the soil.
3. These clog/block the domestic pipelines and sewage lines.
4. Direct burning of plastics lead to the emission of toxic fumes and gases, which in turn affects human life.
5. Emission of CO₂ during burning of waste plastics adds the causes which raise Earth's temperature.
6. Incorporation and dumping of synthetic colouring dyes (azo dyes) to manufacture plastics pose a threatening health hazard to workers and consumers,
7. Continuous accumulation and dumping of plastics, in due course of time reduces cultivable land. Accumulated plastics invite additional wastes and these dumps are aesthetically disturbing and potential health hazards.

B. Hospital Acquired Infection

Plastic equipment used for patient care is discarded after single use. Thus we believe that inter patient transmission of infection via equipment is restricted. Hospital workload gets reduced with use of disposable plastic equipment. If, despite the usage of disposable plastic equipment the rate of hospital acquired Infection remains unchanged it is easy to shift the blame on the quality of disposable plastic equipment procured by the patient. It is commonly believed that “use and throw” equipment reduces chances of Hospital acquired Infection because it is used only once. WHO survey conducted in 1988 across 14 countries showed that the prevalence rate of Hospital acquired Infection of different hospitals varied from 3-21%with a mean of 8.4% and this prevalence rate is increasing exhorvirant. The result of the survey reported that the Hospital acquired Infection is a considerable problem, even in hospitals with means and interest in control of Hospital Acquired Infection. This is largely due to poor hospital waste management and reuse of disposable which may be accidental or intentional as in the case of drug abusers. However, in effect, the rates of Hospital acquired Infection have

increased because these plastic disposables increase the quantum and volume of Hospital Waste, which cannot be properly managed. It is this unmanaged hospital waste which is also largely responsible for the increase in the rate of hospital Acquired Infection.

Most of the time disposable equipment is discarded without disfiguring and thus gets recycled by rag pickers and hospital staff. Often, newspapers & television report the recycling rackets flourishing in the country. The disposables are recycled and repacked under standard company brand s. Also, spurious IV fluids are packed in these pouches and sold in the market to unsuspecting buyers. This is big business in India with annual turn over's of several crores of rupees. In addition to the problem of recycling of hospital disposables, sharp injuries sustained by rag pickers also lead to spread of infections like Hep. B, Hep. C and AIDS etc. In view of these facts and the alarming fallout from plastic disposables, the use of plastics should be minimized forthwith, before the problem gets out of hand.



Figure 2: "Dangerous disposal"

*Needles, syringes and medicine vials dumped along the Kurichi Tank in the Coimbatore. Source: The Hindu, Wednesday, Feb 21, 2007

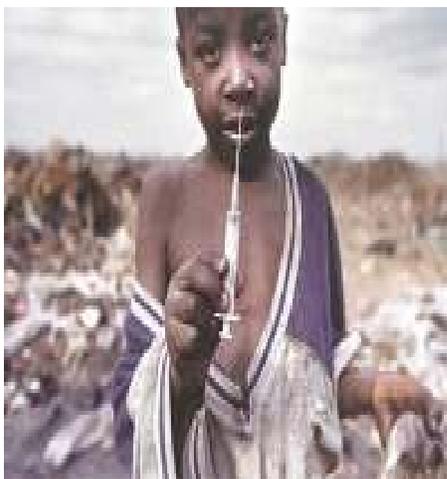


Figure 3: "A rag-picker in danger"

*Many times improperly disposed of used needles, and medical wastes in dumpsters, trash or along the road

IV. ROLE OF RAG-PICKERS IN PLASTIC WASTE

At the site of most hospital dumpsters, child rag pickers are paid Rs 12-15/day by the contractor who reclaims the hospital waste. This waste is segregated into various categories like pouches, IV bottles, drips sets, glass, syringes etc. and sold at much higher price to the recycling Mafia. Sometimes the rag picker himself sells these directly to the contractor at low rates of Rs. 4 –10/kg of mixed plastics. This in turn is sold at much higher rates as seen in the fact sheet (1) "Recycled" in this case merely means "collected", not reprocessed or converted as the some useful products. On the other hand, researchers throughout the world are working towards inventing new products from living resources that are biodegradable. There are several such types and grades of biodegradable plastics coming up in the market. But the cost of these products is exorbitant. Emerging social concerns and growing environmental awareness throughout the world have triggered the search for new materials and processes that enhance the environmental quality of products. Companies throughout the world have or are initiating the design and engineering of new products with holistic environmental evaluations beginning with the acquisition of raw materials, continuing through product use/ reuse, and ending with disposal.

Fact Sheet 1

Item	How it is disposed	Rag pickers price	Buying price	Selling Price
Syringes	Dumpsters	Rs. 4-10/kg	Rs.15-16/kg	Rs.22/kg
IVbottle	Dumpsters	Rs. 4-10/kg	Rs.15-16/kg	Rs.22/kg
IV tubes	Dumpsters	Rs. 4-10/kg	Rs.15-16/kg	Rs.22/kg

V. USE OF PLASTIC IN HEALTH CARE INDUSTRIES

The rapid increase in population and urbanization the hospital bed patient is also increased in India has led to an increase in plastic usage and its waste generation. Every year a huge quantity of plastics in India finds its way from hospital and municipal waste to the landfill sites of major cities, where in the remote areas from health care centers they can be usually found scattered among the vegetation. They seem to be harmless but in reality they are silent killers.

(PVC) Poly Vinyl Chloride is a thermoplastic, 40% of which is composed of additives which confer the property of flexibility and transparency to the plastic. A commonly used additive in PVC is DHEP (Diethyl Hexyl Phthalate), along with lead and cadmium. A study has revealed that storage of cyclosporine in dextrose solution in PVC bags has been shown to cause leaching of significant amounts DHEP. Lead is neurotoxin, Cadmium is nephrotoxic and DHEP is carcinogenic. **At the time of graduation every doctor takes the pledge "DOES NO HARM". However, despite the pledge the doctors do more**

harm than good to the patient by supporting the usage of PVC. Plastic is light in weight, balloons up from hospital waste and floats carrying with it hospital infections to surrounding colonies. Thus the health of people living near health care facilities is always at stake. This plastic chokes the sewer lines causing increased rates of infection. Plastics and needles are also consumed by stray cattle grazing on hospital dumpsters. Many of them die due to intestinal obstruction and internal hemorrhage. The BMW rules of India, 1998 have ignored the issue of plastics altogether. No policies have been laid down to regulate the use of plastics in different types of medical equipments. We have still not formulated a policy, which lays down standards for the quality of plastic permissible in the manufacturing of hospital equipment. Over 1.5 million pounds of plastic bottles were recycled in 2000, representing a four-fold increase in the amount of plastics recycled in the previous decade. Nonetheless, the capacity to recycle bottles appreciably exceeds their supply by about 40 per cent, so local governments and environmental groups need to encourage greater participation in this practice among consumers. Profitable operations are currently in place for recycling PET from bottle sources and converting it into products such as fibers. PS is another potentially recyclable polymer. The initiative to popularize a simple technology using waste plastics to lay roads has received a shot in the arm with the Central Pollution Control Board (CPCB) approving it for wider application. In Tamil Nadu, the District Rural Development Agency (DRDA) had laid 1,200km of plastic roads bin 28 districts.

The crusade against “stopping use of PVC” is going on for more than 5-10 years and has gained international momentum. Plastics used in hospital equipment are patented, licensed and widely used in many developed countries like Canada, U.S.A. and U.K. However, international trend in use of plastic disposables in hospitals is shifting downwards due to hazards of plastics. Pollution level in the capital city of India, Delhi is already 410 SPM (suspended particulate matter) which is five times more than the pollution standard laid by WHO. It is to be noted that even 210 SPM level is considered critical. Hence we must minimize use of PVC plastics whose burning releases toxic gases and particulates into the atmosphere. If at all necessary we must use biodegradable polymer materials.

A. Health Hazard

Thermal decomposition of plastics is a source of dioxins. They are significantly toxic and termed as environmental “repeat offenders”. They belong to the special group of dangerous chemicals known as persistent organic pollutants (POPs). Once dioxins have entered the body, they are there to stay due to their uncanny ability to dissolve in fats and due to their rock-solid chemical stability. Their half-life in the tissue of an organism is, on an average, seven years – half of DDT that had been banned for welfare. The best way to get rid of toxic effects of dioxins is to incinerate the plastic waste at temperatures as high as 850oC to 1000oC. Brief exposure to dioxins which 90% through fatty food results in skin lesion and impairment of liver functions and longer exposure may disturb the immune system, nervous system, endocrine system, and reproductive system. Several studies conducted so far indicate that incidences of some form of cancer may have been caused by dioxins. Based on human

epidemiological data, dioxin was categorized by International Agency for Research on Cancer (IARC) as a known human carcinogen. Unless an alternative cost effective solution to replace the non-biodegradable plastic is made available to society, it is impossible to completely stop production or prevent people from using plastics, as well as, to prevent their hazardous effects

VI. RESPONSIBILITY OF MUNICIPAL AUTHORITIES TOWARDS PLASTIC WASTE MANAGEMENT

The municipal authority shall be responsible for setting up, operationalisation and co-ordination of the waste management system and for performing the associated functions. Which are as follows?

- To ensure safe collection, storage, segregation, transportation, processing and disposal of plastic waste.
- To ensure that no damage is caused to the environment during this process.
- To ensure that open burning of plastic waste is not permitted.
- To ensure that the setting up of collection centres for plastic waste involving manufacturers and its channelization to recyclers.
- To determine the minimum price for carry bags depending upon their quality and size which covers their material and waste management costs in order to encourage their re-use so as to minimize plastic waste generation.

A. Responsibility of Manufactures and Recyclers

- Recycling of plastic shall be carried out in accordance with the Indian standard: 14534:1998 titled as guidelines for recycling of plastics, as amended from time to time.
- Each recycled carry bags shall bear a label or a mark” recycled” as shown below.

Fig 4: “Different Label or a mark”



PET- Polyethylene Terephthalate,
HDPE- High density polyethylene, V-Vinyl (PVC),
LDPE- Low density polythethylene, PP- polypropylene, PS- polystyrene and other means all other resins and multi-materials like ABS (Acrylonitrile butadiene),
PPO - (Polyphenylene oxide),
PC - (Polycarbonate),
PBT - (Polybutylene terephalate)

B. Civic Responsibility towards Environment Protection

Biodegradability and recyclability have become important considerations in the design of new products. Many green

organizations have been presenting governments to ban the use of non-biodegradable plastics. In some states viz. HP, Rajasthan etc., it has already been banned. It required people co-operation to support the law so total plastic in the municipal waste and hospital waste is finished. We must remember that there are limits to growth. It is for us to accept these facts and to think wisely to find an alternative to replace non degradable plastics, control the use of these materials in packaging and find more ways of utilizing the discarded plastics to save the future generation from being massacred through our thoughtless and negligent use and disposal of plastic. A small step to “stop use of PVC plastics”, can lead to changes that will make the world environment a clean, green and safe place to live in.

VII. RECYCLING OF PLASTIC AND HOSPITAL WASTE- COST BENEFIT ANALYSIS

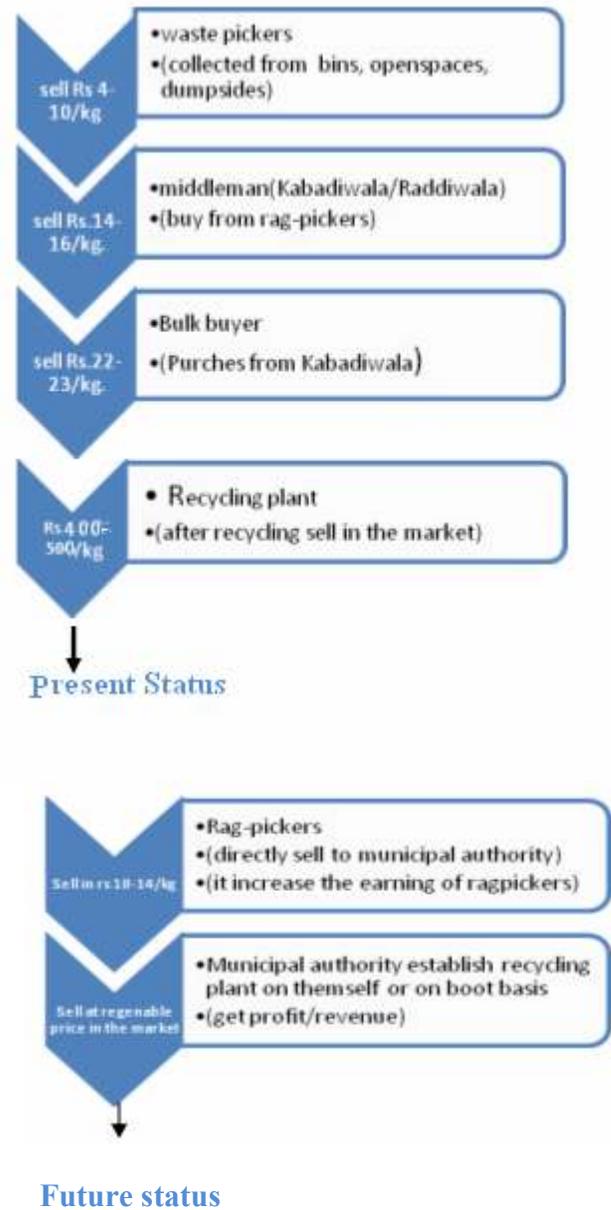
As the plastic waste reaches the top of the pyramid, it has acquired a fairly high value after passing through the various actors in the informal sector. The plastic acquires a fairly high value before it is fed into the recycling chain. The above fact sheet (1) provides only an approximate idea of the money involved in the trade. Although the statistics are not very recent, they are valid even today with minor differences. The value of the plastic waste within the trade increases by a minimum of 350%.The starting point for the cost benefit analysis of government policies is the assumed objective policy should result in an improvement in the overall welfare or well-being of society.69% of total plastic used in health care industries in packing material which is in huge quantity i.e. bring recycled, projection and presumption have future recovery rate for packing plastic material.

To Summaries benefit of recycling and comparison of cost and benefit we have to make analysis for each material uses three sets of assumption:

- An initial rate of recycling based on benefit estimates that include savings in landfill costs (social cost estimate rather than a market rate) but ignore external costs associated with emissions, leachate and the direct consumer benefits.
- A low benefit estimate that uses the low assumptions.
- A high benefit estimate that uses the high assumptions.

To assess this cost benefit analysis measures total costs and benefits wherever they fall in Society and compares one with another improving policies for which the total benefits exceed the total costs.

Fig.5 “Present and future status hierarchy”



A. Basic Relationships

Profit (π) = Revenue (R) - Cost (C)
 Revenue(R) = Selling price (SP) x Quantity (Q)
 Cost (C) = [Variable cost (VC) x Quantity (Q)] + Fixed Cost (FC)]

Remember,

Quantity produced = quantity sold
 By substitutions,
 $\pi = (SP \times Q) - [(VC \times Q) + (FC)]$

$$\pi = SP*Q - VC*Q - FC$$

$$\pi = (SP-VC)*Q - FC$$

B. Eco- efficiency

Eco- efficiency is recognized as “one of the primary way in which business can contribute to the concept of sustainable development.”

$$Eco\ efficiency = \frac{Product\ of\ service\ value}{Environmental\ influence}$$

$$Return\ on\ Environment = \frac{Life\ cycle\ cost/selling\ price}{Life\ cycle\ environmental\ impact}$$

So Eco-efficiency = Benefit-Cost/eco cost

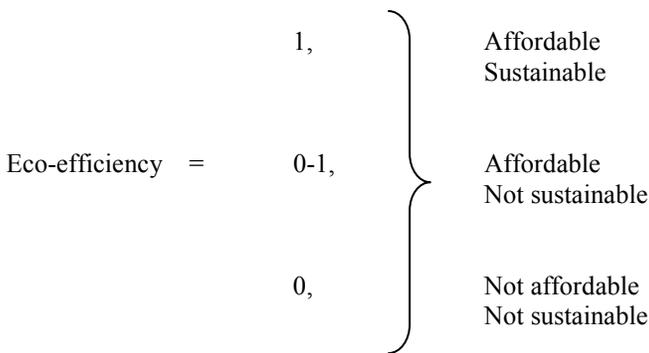


Fig. 6 “Hidden Profit”



C. Analysis of PVC and Rubber syringe in hospital waste:

PVC Syringe	Rubber Syringe
Cost:-	Cost:-
PVC syringe around Rs.10/each	Glass Syringe around Rs.15/each
Use and throw	Boiled and reuse
Loss/(No Benefits):-	Benefits/(No loss):-
Harmful for health and Environment	Sustainable development
Not economic	Economic

VIII. CONCLUSION

“There are two things certain in life when you are using plastic, one is Boone and the other is curse”, accurately sums up the plastic waste scenario in urban India. Plastic waste is a pressing issue in the country today. The environmental issues regarding plastic waste arise predominantly due to the throwaway culture that Plastics propagate, and also the lack of an efficient waste management system. A large number of Indians have turned away from traditional modes of consumption, and are moving towards more wasteful patterns of resource use. The increasing purchasing power and consumerism of the burgeoning Indian middle class is moving India into the vicious use-and-throw cycle. It is likely that better segregation of waste would have a quick and dramatic impact on lowering the total hazardous waste. In particular, there would be a huge benefit arising from better procedures for dealing with plastic waste, when this plastic is burn it produces gas like dioxins and furan which are very federal cases which change human life causing impotency, nephrotoxic, neurotoxin, By preventing this we are saving lots of life and environment greenhouse cases reduces. Crusade against use of plastics in health care facilities and human life to save the earth from future pollution. We had taken the earth from our ancestors as a green peace without pollution and think for us what we are giving back to our children’s. However finding solutions to these problems and to translate the goals into reality calls for an active involvement from the stakeholders, particularly the Government along with a clear policy agenda, and also by the people will only help to ensure sustainable use of plastics in the country. Following steps are helpful for sustainable development.

- Remedied to minimize pollution.
- Installation of RDF plants to prepare pellets for cement industries as a fuel. Temperature of plant is 8500 C and high of stake is 30 m, so no pollution is generated.
- Use of biopolymers for bio plastic.
- Poly hydroxyl butyrate.
- Proper plastic waste management.
- Preparation of eco-bricks at landfill site which are widely used for construction of boundary wall.
- Prefer rubber catheter tubes and glass syringe as for as possible for personal use in good sterilization procedure.

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