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REVIEW ARTICLE **OPEN ACCESS**

A Review On Recycling Of Plastics

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ABSTRACT
Plastic is one of the most used materials in the modern age. From toys to computers, from bottles to tanks, from pens to furniture, from clothes to vehicles, the list of products and processes where plastic is used is countless and still growing every day. It is also increasingly found in the environment due to inappropriate disposal and low to non-existent biodegradability. Plastic waste can be found in oceans, rivers, landfills, and roadsides etc., which causes pollution and contamination and poses risks to human health and the environment. This review discussed about the history, types, harmful effect, methods, process, techniques, application, current trends and challenges of recycling of plastic.
Key words*: Recycling, plastics, types, methods, techniques, application.*

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INTRODUCTION

Plastics have elaborated in every occurrence of our life. They are organic polymers. However, they are not decomposable, they exist in the environment and releases toxic fumes during combustion or pollute water and soil this confirms the need of recycling [2]. Plastic consumption is growing and with it the amount of plastic ending up as waste. Managing plastic waste is a world-wide problem with increasing amounts of waste in emerging countries as well as commercial nations [3].
Polymeric materials can be classified as thermosets and thermoplastics. Thermoset polymers denote to the irreversible polymerization and this type of polymer is cured by chemical reaction or heat and Becomes infusible and insoluble material. Thermoplastics are made up of linear molecular chains and this polymer softens on heating and hardens when cooled [5].
Plastic waste can be originate in oceans, rivers, landfills, and roadsides etc., which causes pollution and contamination and poses risks to human health and the environment.

OBJECTIVES OF CURRENT STUDY

Following are the different objectives of Current study--

- ✓ To study different types of Plastics.
- ✓ To observe the harmful effects of Plastics.
- ✓ To study the Plastic waste management.
- ✓ To study different techniques for recycling of plastics.

WHAT ARE PLASTICS?

Plastics are made up of long chain molecules called polymers. Various types of polymers can be made from hydrocarbons resulting from coal, natural gas, oil and organic oils which are transformed into materials with required properties. Plastics that can be gladly recycled are Thermoplastics which means they will soften when heated. Thermosetting Plastics harden when heated, are often used in electrical applications and are not suitable for recycling. Thermoplastics are light, durable, mouldable, hygienic and economic, making them suitable for an extensive variety of applications counting food and product packaging, car manufacturing, agriculture and housing products. Thermoplastics can be continually reformed into new products and are the focus of this technical brief.

HISTORY OF PLASTICS

Plastic was made for the first time by Alexander Parkes, who established it in international exhibition at 1862 in London. It was named as Parkesine, it is derived from cellulose, and thus the first plastic was plant origin. Celluloids were originally used for the Ballard balls and photographic films, by 1897 formaldehyde resins were used, in 1899, Arthur Smith patented for his use of phenol-formaldehyde resins as the substitute for ebonite and in 1907, Leo Hendrik Baekeland made an upgraded phenol-formaldehyde and named as Bakelite.

TYPES OF PLASTICS

The six most common types of plastic can simply be recycled.

The plastics industry has freely devised a coding system which makes recycling plastics easier. Table 1 shows these 6 types of plastics with their identification code, general properties and common uses.

Table 1: Types of plastics and common uses

Types of plastics	General properties	Common uses
1)High density polyethylene	✓ Barrier to water ✓ Chemical resistance ✓ Hard to semi-flexible ✓ Strong ✓ Soft waxy surface ✓ Low cost ✓ Permeable to gas ✓ Natural milky white colour	✓ Jerry cans ✓ "Crinkly" shopping bags ✓ Film ✓ Milk packaging ✓ Toys ✓ Buckets ✓ Rigid pipes ✓ Crates ✓ Bottle caps
2)Low density polyethylene	✓ Tough ✓ Flexible ✓ Waxy surface ✓ Soft - scratches easily ✓ Good transparency ✓ Low melting point ✓ Stable electrical properties ✓ Moisture barrier	✓ Agricultural films ✓ Refuse sacks ✓ Packaging films ✓ Foams ✓ Bubble wrap ✓ Flexible bottles ✓ Wire and cable applications
3)Polystyrene (PS)	✓ Clear to opaque ✓ Glassy surface ✓ Rigid ✓ Hard ✓ Brittle ✓ High clarity ✓ Affected by fats and solvents	✓ Packaging pellets ✓ Yoghurt containers ✓ Fast food trays ✓ disposable cutlery ✓ Coat hangers
4)Polyethylene terephthalate (PET/PETE)	✓ Clear ✓ Hard ✓ Tough ✓ Barrier to gas and water ✓ Resistance to heat Resistance to grease/oil	✓ Mineral water bottles ✓ 2 liter soda bottles ✓ Cooking oil bottles ✓ Powder detergent ✓ jars ✓ Fibre for clothing ✓ Fibre for carpets ✓ Strapping ✓ Peanut butter jars
5)Polyvinyl chloride (PVC)	✓ Transparent ✓ Hard, rigid (flexible when ✓ plasticised) ✓ Good chemical resistance ✓ Long term stability ✓ Electrical insulation ✓ Lowgas permeability	✓ Pipes and fittings ✓ Carpet backing ✓ Window frames ✓ Water, shampoo and ✓ vegetable oil bottles ✓ Credit cards ✓ Wire and cable sheathing ✓ Floor coverings ✓ Shoe soles and uppers
6)Polypropylene (PP)	✓ Excellent chemical resistance ✓ High melting point ✓ Hard,but flexible ✓ Waxy surface	✓ Yoghurt containers ✓ Potato crisp bags ✓ Drinking straws ✓ Medicine bottles

	✓ Translucent Strong	✓ crates, ✓ plant pots ✓ Car battery cases ✓ Heavy gauge woven bags
7)Other plastics		Mostly not available in sufficient quantities for recycling

WHY RECYCLE PLASTICS

Recycling plastics has numerous benefits; it pays to energy savings and the decrease of greenhouse gas emissions. It also protects non-renewable sources like oil and gas. In adding to that, recycling provides livelihood for millions of people and families in developing countries, either in the form of formal occupation or informal economic activities. [3].

In industry there is an increasing move near reuse and recycling of plastics for economic, as well as environmental reasons, with many commendable examples of companies developing technologies and plans for recycling of plastics. Not only is plastic made from a non-renewable resource, but it is commonly non-biodegradable. This means that plastic litter is often the most offensive kind of litter and will be visible for weeks or months, and waste will sit in landfill sites for years without degrading [4].

ROLE OF MICROBES IN RECYCLING OF PLASTICS

Microbes degrade synthetic polymers and natural polymers by the process called as biodegradation. Polymers like polyethylene are used as substrate for microorganisms' growth when they are being degraded. Degradation of polymers can be observed by cracking, erosion, discoloration, and phase separation. As early in 1998, reported that bacterium Alcaligenes faecalis produces polycaprolactone depolymerase. He also isolated several polycaprolactone (PCL) degrading bacteria from soil. polycaprolactone is a biodegradable polymer, which can undergo degradation by aerobic and anaerobic microorganisms. Polycaprolactone can be degraded with Aspergillus and Penicillium. Strain ST-01 of Aspergillus, isolated from soil is reported to degrade PCL at incubation of 50°C for 6 days. In the case of Penicillium, strain 26-1 was studied and the results showed that PCL was degraded in 12 days by this strain. Fast enzymatic degradation of PCL by *Penicillium funiculosum* and *Aspergillus flavus* is also reported in amorphous region. Enzymes degrading PCL are lipase and esterases.

HARMFUL EFFECT OF PLASTICS

Polyvinyl chloride (PVC) is the most harmful plastic, where dioxins are released during it manufacture. Dioxins causing cancer and affect the immune system and indications to developmental reproductive disease. Burning of PVC releases chlorinated compounds includes Polychlorinated biphenyls (PCBs), PCB accumulates in fishes and other organisms and undergo bioaccumulation which result in high value in top- level carnivore such as humans, PCB also absorbable via skin and inhaled or ingested causing neurotoxicity, liver damage, tumors, immunosuppression and behavioral changes, and reproductive disorders, abnormal sperms. The disposal of plastics products also contributes expressively to their environmental impact. Most plastics are not biodegradable and can persevere in the environment for many years. Plastics can cause blockage of drainage and sewage systems causing in water logging, flooding and spread of water borne diseases. With more and more plastics products, mainly packaging, being disposed of soon after their purchase, the landfill space required by plastics waste is a growing concern.

Old plastics production involves the transformation of petroleum or natural gas into their constituent monomers. This process is highly energy-intensive, and was projected to account for 400 million tonnes of greenhouse gas emissions in 2012. The fossil fuel feedstock used in plastics production also accounts for 4 - 8% of global oil and gas production and this share could increase further in the future. The hydrocarbon molecules that are bound into the structure of plastics are initially inert, but release carbon dioxide as well as other greenhouse gases when incinerated [2].

PLASTICS WASTE MANAGEMENT

When material enters the waste stream, recycling is the process of using recovered material to manufacture new product. For organic materials like plastics, the concept of recovery can also be lengthy to include energy recovery, where the calorific value of the material is used by controlled combustion as fuel, although this results in a lesser overall environmental performance than material recovery as it does not reduce the demand for new material. This thinking is the basis of the 4R's strategy in waste management parlance—in the order of decreasing environmental desirability—reduce, reuse, recycle and recover, with landfill as the least desirable management strategy [6].

RECYCLING OF PLASTICS

Recycling plastics saves landfill space, energy, water, resources, and reduces pollution. Additionally, it is derived from oil which is a limited natural resource and reducing. This can be segmented in to primary, secondary, tertiary and quaternary recycling.

1) Primary recycling:

Includes using equally uniform and contaminated plastics it also can be added with virgin resin at different ratios. Change in the structure of polymer such as reduction in average molecular weight, increase in average molecular weight, formation of unsaturation or cyclization.

2) Secondary recycling:

This contains Mechanical recycling, chemical modification and co-extrusion and co-injection moulding.

3) Tertiary recycling:

These changeswaste plastics into high-value petrochemical or fuel feed stocks. This includes chemical recycling and thermolysis.

4) Quaternary recycling:

It is beneficial recovery of energy within plastics by using plastics as the source of energy to produce steam then the electricity. However, incineration releases small amount of toxic residue than thermal decomposition and incineration was in highly oxidizing environment while gasification requires reducing environment. However, Gasification releases carbon monoxide with hydrogen [2].

SYSTEM FOR RECYCLING OF PLASTICS

Plastic materials can be recycled in a variety of ways and the ease of recycling varies between polymer type, package design and product type. For example, rigid containers consisting of a single polymer are simpler and more economic to recycle than multi-layer and multi-component packages. Thermoplastics, including PET, PE and PP all have high latent to be mechanically recycled. Thermosetting polymers such as unsaturated polyester or epoxy resin cannot be mechanically recycled, excluding to be potentially re-used as filler materials once they have been size-reduced or pulverized to fine particles or powders. This is because thermoset plastics are permanently cross-linked in manufacture, and therefore cannot be re-melted and re-formed.

The capability to substitute recycled plastic for virgin polymer generally depends on the purity of the re-covered plastic feed and the property requirements of the plastic product to be made. This has led to current recycling schemes for post-consumer waste that concentrated on the most easily separated packages, such as PET soft-drink and water bottles and HDPE milk bottles, which can be positively identified and sorted out of a co-mingled waste stream. Equally, there is limited recycling of multi-layer/multi-component articles because these result in contamination between polymer types. Post-consumer recycling therefore comprises of several key steps: collection, sorting, cleaning, size reduction and separation, and/or compatibilization to reduce contamination by incompatible polymers. [6].

COLLECTION AND SEPARATION

A) Collection:

Thinking about setting up a small-scale recycling enterprise, it is sensible to first carry out a survey to ascertain the types of plastics available for collection, the type of plastics used by manufacturers and the economic viability of collection.

The method of collection can vary. The following gives some ideas;

1) House to house collection of plastics and other materials (e.g. paper).
2) House to house collection of plastics only (but all types of polymer).
3) House to house collection of certain objects only.
4) Collection at a central point e.g. market or church.
5) Collection from street boys in return for payment.
6) Regular collection from shops, hotels, factories, etc.
7) Purchase from scavengers on the municipal dump.
8) Scavenging or collecting oneself.

The method will depend upon the scale of the operation, the capital available for set-up, transport availability, etc. [4].

B) Separation:

The success of plastics recycling is depending on proper separation from non-plastics and the subsequent separation of individual resin. No simple solution exists for mechanical separation of plastic wastes after disposal, e.g., analogous to magnetic separation of ferrous metals. While some organizations such as the N ew York City Metropolitan Transit Authority enjoy a high recycling rate with collection followed by separ ation, this is highly labor intensive and may not be feasible to replicate in a more driven operation. Manua l sort rates are typically 1200+ bottles per hour, while automatic sort rates can be up to 40,000 bottles pe r hour [1].

METHODS OF RECYCLING

The principle for setting up the analysis is that the ideal end-of-life situation for bio-based plastic is to collect it as plastic waste and send it for recycling. Later, for those bio-based plastics thatright to be biodegradable, the potentials for collection together with organic waste for composting ordigestion purposes are not included. From the viewpoint of keeping material cycling in the economy, mixing these two types of plastics is less desirable.

a)In the first place, we have considered the recycling of PET and HDPE (high-density polyethylene) bottles. These two plastics display, for the moment, the best point of view in terms of the production of high-quality recycles: selective collection is in place in many countries, efficient mechanical recycling processes have been developed, and there are examples of the high-grade application of recycles.

b) Next, we develop on the recycling of mixed household packaging waste, given the increased overall focus on plastics recycling as explained above.

c) In a next step, the impact of small amounts of bio-based plastics made from new building blocks was assessed. As we touched that this group of plastics is too heterogeneous in nature, we have chosen a case-by-case approach by considering later the impact of three examples of such plastics, PLA, PHA and PEF, in order to develop a more general viewpoint on the risks. As preparation for these exercises, we first considered the impact of polyvinyl chloride (PVC) in PET recycling and gathering the available information on the case of PVC in PET recycling was considered instructive as a preparation for assessing the impact of the selected bio-based plastics. Assumed the very small amounts of these plastics appearing on the market, setting up separate collection is not viable and hence they will act as contaminants whose impact on recycling processes and products has to be analysed.

d) The analysis starts by considering the physical, chemical and other, more practical, properties of such contamination. Then, these are compared with the properties of PET and HDPE bottles or household packaging waste constituting the main flows. Finally, this results in the identification of the possible pathways that particular bio-based plastics can follow and the possible impact that may arise from their presence in certain amounts[8].

PROCESS OF RECYCLING

After the plastic has been collected, it will have to be cleaned and sorted. The techniques used will depend on the scale of the operation and the type of waste collected, but at the simplest level will involve hand washing and sorting of the plastic into the required groups. More classy mechanical washers and solar drying can be used for larger operations. Sorting of plastics can be by polymer type, by product (bottles, plastic sheeting, etc.), by colour, etc. [4].

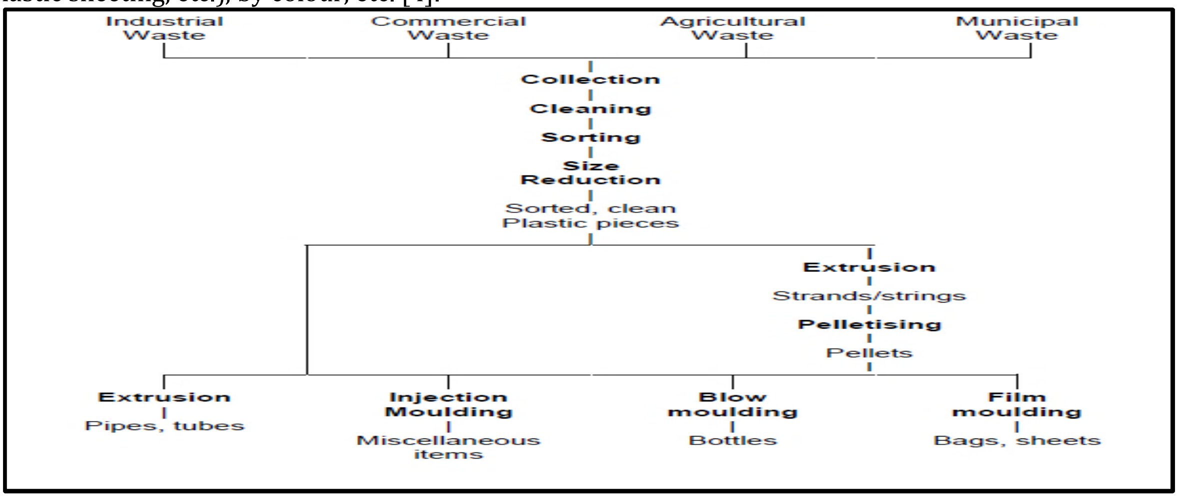

Figure 1: Flow chart of a typical waste plastic

The extreme common method of recycling is called mechanical recycling. In the first case collected plastics are ground down to a suitable size to be reprocessed. This has long been practiced by the plastics industry in production facilities. This in-house recycling called primary recycling makes significant economic senses as manufacturers not only use up their own waste but production yields are also improved. For a re-processor to reclaim used material from other sources requires greater effort. Material may come in a variety of forms bales, mouldings, large plastic lumps. It may also require all or some of the following: size reduction, cleaning, sorting, and regranulation to a suitable feed stock size. Recycling activities of this type are termed secondary recycling. A further difficulty is that the history of the material may not be known and therefore the properties of the resultant recycle produced may be considerably different to the properties of the virgin material even if the original grade is known. For high quality products, high quality plastic materials are required. It is therefore difficult for recycled materials to compete in such markets where there properties can be variable. For example properties could vary depending on:

a) How many times has it been re-processed previously?
b) How much thermal degradation has it been exposed to.
c) Whether it is a single polymer or mixed.
d) If it is contaminated with other materials i.e. dirt, oil, wood,
e) Metals.
f) What it was used for previously.
g) Whether it has been damaged by its service life (prolonged light
h) Exposure, water exposure, steam, high temperatures etc.).

Within a closed loop cycle, these answers are usually known which is why primary recycling is so common place. With this knowledge comes confidence in the quality of the materials being used. Creating closed loop infra-structures and recyclate materials calibration schemes therefore have and are major drivers in improving confidence in using recyclate in the automotive sector, packaging and waste electrical and electronic equipment sectors. These industrial sectors have been heavily established to drive improvements in recyclability, forcing manufacturers to act [7].

TECHNIQUES FOR RECYCLING OF PLASTICS

1) Size reduction techniques:-. Size reduction is required for several reasons; to reduce larger plastic waste to a size convenient for small machines, to make the material denser for storage and transportation, or to produce a product which is suitable for further processing. There are several techniques commonly used for size reduction of plastics;

a) Cutting is usually carried out for initial size reduction of large objects. It can be carried out with scissors, shears, saw, etc.

b) Shredding is suitable for smaller pieces. A typical shredder has series of rotating blades driven by an electric motor, some form of grid for size grading and a collection bin. Materials are fed into the shredder via a hopper which is cited above the blade rotor. The product of shredding is a pile of coarse irregularly shaped plastic flakes which can then be further processed.

c) Agglomeration is the process of pre-plasticising soft plastic by heating, rapid cooling to solidify the material and finally cutting into small pieces. This is usually carried out in a single machine. The product is coarse, irregular grain, often called crumbs

2) Further processing techniques:-

d) **Extrusion and pelletizing:-**The process of extrusion is employed to homogenise the domestic polymer and produce a material that it afterward easy to work. The reclaimed polymer pieces are fed into the extruder, are heated to induce plastic behaviour and then forced through a die to form a plastic spaghetti which can then be cooled in a water bath before being pelletized. The palletisation process is used to reduce the 'spaghetti' to pellets which can then be used for the manufacture of new products.

3) Manufacturing techniques:-

e) **Extrusion**: **-** The extrusion process used for manufacturing new products is similar to that outlined above for the process preceding palletisation, except that the product is usually in the form of a continuous 'tube' of plastic such as piping or hose. The main components of the extrusion machine. The reclaimed plastic is forced along the heated tube by an Archimedes screw and the plastic polymer is shaped around a die. The die is designed to give the required dimensions to the product and can be interchanged.

f) **Injection moulding: -** The first stage of this manufacturing process is identical to that of extrusion, but then the plastic polymer emerges through a nozzle into a split mould. The quantity of polymer actuality forced out is carefully controlled, usually by moving the screw forward in the heated barrel. A sequence of moulds would be used to allow continual production while cooling takes place. . This type of production technique is used to produce moulded products such as plates, bowls, buckets, etc. [4].

g) **Blow moulding: -**Again the spiral screw forces the plasticised polymer through a die. A short piece of tube, or 'prison' is then enclosed between a split die -which is the final shape of the product - and compressed air is used to develop the prison until it fills the mould and achieves its required shape. This manufacturing technique is used for manufacturing closed vessels such as bottles and other containers [5].

h) **Film blowing:-**Film blowing is a process used to manufacture such items as garbage bags. It is a technically more complex process than the others described in this brief and requires high quality raw material input. The process involves blowing compressed air into a thin tube of polymer to expand it to the point where it becomes a thin film tube. One end can then be sealed and the bag or sack is formed. Sheet plastic can also be manufactured using a variation of the process described [4].

Table 1: Plastic processing techniques

Process	Complexity of parts	Forming action	Mould	Plastic types	Tolerance to contaminants
Blow moulding	Complex	Inflation	Closed	Single	Very low
Multi-layer blow moulding	Complex	Inflation	Closed	Single layers	Very low
Extrusion	Fairly simple profiles	Extrusion	None	Single	Low
Film blowing	Simple	Inflation	None	Single	Low
Injection moulding	Complex	Injection	Closed	Single	Low
Co-injection moulding	Complex	Injection	Closed	Single layers	Low
Intrusion moulding	Simple	None	Open	Mixed	High
Sinter moulding	Simple	Compression	Open	Mixed	Very high
Transfer moulding	Simple	Compression	Open	Mixed	High

APPLICATION OF RECYCLED PLASTICS

Numerous waste materials are generated from manufacturing processes or municipal solid wastes every year. Due to the fact that solid waste management represents a big problem to the world, the waste utilization has become an attractive alternative to disposal. In 2012, according to the European Association of Plastics Recycling and Recovery (EPRO), 5.4 m tonnes were recycled, 34.7%, of all the plastic packaging waste.

Table 2: Applicatons of recycled of plastics

Plastic	Product Identification Code (SPI)	Applications
PET	PETE	Drink bottles, detergent bottles, clear film for packaging, carpet fibers
PVC	V	Packaging for food, textile, medical materials, drink bottles
HDPE	HDPE	Detergent bottles, mobile components, agricultural pipes, compost bins, pallets, toys
PP	PP	Compost bins, kerbside recycling crates
PS	PS	Disposable cutlery
LDPE	LDPE	Bottle, plastic tubes, food packaging
Others *	OTHER	Containers

a) Recycled Polymers for Food Industry:-

The large problem with these recycled polymers refers to the possibility of contamination of virgin material and from contamination during the previous use of packaging and during production processes. The contamination of these materials may be of a chemical or microbiological nature. Also, the Food and Drug Administration (FDA) has announced that their concerns with the use of recycled plastic materials in food-contact are related to:

i) Contaminants found in the post-consumer material which may appear in the final food-contactproduct made from the recycled material;

ii) Recycled post-consumer material not suitable for food-contact use may be incorporated intofood-contact packaging;

iii) The adjuvants from the recycled plastic may not respect the regulations for food-contact use.

b) Recycled Polymers for Indoor Applications:-

Due to the growth of the number of home electrical appliances from the last years, numerous environmental risks were associated with these appliances. So, to avoid these risks many countries have introduced recycling systems. For example, the European Union has established three directives on electrical and electronic equipment: 2002/95/EC on restrictions on the use of certain hazardous substances in electrical and electronic equipment; 2002/96/EC on waste electrical and electronic equipment and 2005/32/EC on the eco-design of energy-using products.

In current years, it was observed that electronic waste encompasses a broad and growing range of electronic devices ranging from large household appliances like air conditioners, refrigerators, and consumer electronics for computers and cellular phones. Also, it was reported that the recycling yield has increased since system implementation. The recycling yield rate, the weight of recycled materials divided by the total weight of collected appliances, has gradually increased to more than 70%. For indoor applications, the only used plastics are those in which recycling is from high-grade plastic. For example, polypropylene and polystyrene are recycled and they are used in the back-cabinets of TVs, flow fans, balancers of washing machines, base frames, dewatering tanks and protection nets of air conditioners[5].

ECOLOGICAL CASE FOR RECYCLING

Life-cycle analysis can be a useful tool for evaluating the potential benefits of recycling programmes. If recycled plastics are used to produce goods that would otherwise have been made from new (virgin) polymer, this will directly reduce oil usage and emissions of greenhouse gases associated with the production of the virgin polymer. However, if plastics are recycled into products that were previously made from other materials such as wood or concrete, then savings in requirements for polymer production will not be realized. There may be other environmental costs or benefits of any such alternative material usage, but these are distractions to our discussion of the benefits of recycling and would need to be considered on a case-by-case basis. Here, we will primarily consider recycling of plastics into products that would otherwise have been produced from virgin polymer. Feedstock (chemical) recycling technologies satisfy the general principle of material recovery, but are more costly than mechanical recycling, and less energetically favourable as the polymer has to be depolymerised and then re-polymerized.

PUBLIC SUPPORT FOR RECYCLING

There is amassed public awareness on the need for sustainable production and consumption. These has encouraged local authorities to organize collection of recyclables, encouraged some manufacturers to develop products with recycled content, and other businesses to supply this public demand. Marketing Studies of consumer preferences indicate that there is a significant, but not overwhelming proportion of people who value environmental values in their purchasing patterns. For such customers, confirmation of recycled content and suitability for recycling of the packaging can be a positive attribute, while exaggerated claims for recyclability can reduce consumer confidence.

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 GreenePunt (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.

ECONOMIC ISSUES RELATING TO RECYCLING

The primary methods of waste disposal have been by landfill or incineration. Costs of landfill vary considerably among regions according to the underlying geology and land-use patterns and can influence the viability of recycling as an alternative disposal route. In Japan, for example, the excavation that is necessary for landfill is expensive because of the hard. Nature of the underlying volcanic bedrock; while in the Netherlands it is costly because of permeability from the sea. High disposal costs are an economic incentive towards either recycling or energy recovery.

Collection of used plastics from households is more economical in suburbs where the population density is sufficiently high to achieve economies of scale. The most efficient collection scheme can vary with locality, type of dwellings (houses or large multi-apartment buildings) and the type of sorting facilities available. In rural areas 'bring schemes' where the public deliver their own waste for recycling.

CURRENT TRENDS IN PLASTIC RECYCLING

In Western Europe, plastic waste generation is growing at approximately 3 per cent per annum, approximately in line with long-term economic growth, whereas the amount of mechanical recycling increased strongly at a rate of approximately 7 per cent per annum. In2003, however, this still amounted to only 14.8 percent of the waste plastic generated (from all sources).Together with feedstock recycling (1.7 per cent) and energy recovery (22.5 per cent), this amounted to a total recovery rate of approximately 39 per cent from the 21.1 million tonnes of plastic waste generated in2003 .This trend for both rates of mechanical recycling and energy recovery to increase is continuing, although so is the trend for increasing waste generation.

CHALLENGE AND IMPROVEMENTS

Actual recycling of mixed plastics waste is the next major challenge for the plastics recycling sector. The advantage is the ability to recycle a larger proportion of the plastic waste stream by expanding postconsumer collection of plastic packaging to cover a wider variety of materials and Pack types. Product design for recycling has strong potential to assist in such recycling efforts. A study carried out in the UK found that the amount of packaging in a regular shopping basket that, even if collected, cannot be effectively recycled, ranged from 21 to 40%. Hence, wider application of policies to promote the use of environmental design principles by industry could have a large impact on recycling performance, increasing the proportion of packaging that can economically be collected and diverted from landfill. The same logic applies to durable consumer goods designing for disassembly, recycling and specifications for use of recycled resins are key actions to increase recycling [6].

CONCLUSION

In Conclusion, recycling is one method for end of life waste management of plastic product. It makes collective sense economically as well as environmentally and current trends demonstrate a significant increase in the rate of recovery and recycling of plastic wastes. These trends are likely to continue, but some important challenges still exist from both technological factors and from economic or social behaviour issues relating to the collection of recyclable wastes and substitution for virgin material.

This study expresses that the recycling process is the best technique to treat waste polymer products in comparison with the old-style methods which lead to negative influences on the environment via the formation of dust, fumes and toxic gases.

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REFERENCES

1. Alter, Harvey.,(1993). The Origins of Municipal Solid Waste II. Policy Options for Plastics Waste Management. Wa ste Management & Research 11: 319-332.
2. Siva Kumaran, Sivaramanan., "Plastics and strategies for recycling, waste management and pollution control".**10**:13140.
3. Lardinois, I., and van de Klundert, A.(1995), Plastic Waste - Options for small - scale resource recovery , **90**-70857-34-0.
4. Vogler, Jon., (1984). Small-scale recycling of plastics. Intermediate Technology Publications. A book aimed at small-scale plastics recycling in developing countries.
5. Madalina, Elena Grigore., (2017). "Methods of Recycling, Properties and Applications of Recycled Thermoplastic Polymers" in the year of Recycling, **2**: 24.
6. J Hopewell., R,Dvorakand., Edward,K., (2009) . Plastics recycling: challenges and opportunities". Phil. Trans. R. Soc. B. **364**: 2115–2126.
7. Vannessa, Goodship., (2007). "Plastic recycling" Science Progress **90** :(4), 245–268.
8. Luc Alaerts , Michael Augustinus and Karel Van Acker., (2018). "Impact of Bio-Based Plastics on Current Recycling of Plastics" Sustainability, **10**: 1487.

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