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Plastic Waste Management Technologies

Serkan Rezaee[1]

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Abstract:

Plastics use is considered as the crucial part of our daily life and used in large quantity of applications across the world. It is mostly used in the cities and villages of India, for the purpose of drinking water bottle, purchasing vegetable, plastics objects in kitchen, plastic furniture in home, plastic drum in packing, storing of various chemicals for manufacturing use and its tools are used for domestic purpose and in a number of more because of their natural properties such as neutrality and less bulk densities and make them appropriate material for moving and shifting, which causes less contamination. It will be a part of waste garbage, after the usage of plastic, due to which it creates pollution due to the occurrence of deadly chemical substances and it will contribute in spreading illnesses. By plastic waste management policy, packaging revolt has not been backed but in a lot of countries in India, left littered part of plastic waste creates horrifying optical difficulties and added civic health issues. In most developing countries, increasing ecological attentiveness and decrease in accessible landfill capability have encouraged plastic recycling programmes. Now a days, plastic waste is recycled only 5% to 25% and it contain limited methodologies for utilization of plastic waste again. This review paper, discusses about the existing methodologies of plastic waste management schemes.

Keywords: *Plastic waste management, Landfill, Recycle, Packaging Revolt*

Authors:

1. *Cukurova University, Turkey.*

Introduction

In our everyday life, plastic items plays a significant contribution for coating and wiring, greenhouse, films, and covers, packaging, containers and bags. In medicinal goods, plastics like blister packing of tablets and capsules, disposable syringes, joint replacement prostheses, catheters, heart valves, inter venous (IV) fluid bottles, blood bags, etc., that have expressively aided in being supportive to the life of the humans. It contains the lightweight (energy saving), exhibit unique, versatile properties and low cost. One of the most significant application of plastics is packaging in which 40% plastic supplies are used for packing. Thermoplastic are used of the over-all plastic usage of coarsely 80% and used for packaging that is application of plastics but non-plastic applications such as plastic coating and fiber.

Packaging has been conceivable because of the listed features of plastic goods:

- Harmless and clean – neutral and chemical resilience
- Less weight and non-brittleness
- Outstanding barricade qualities - augmenting shelf-life
- Greater impact resistance
- Sterilizable and resistance to microbial and other bacterial development
- Transparency as well as impenetrability
- Lower fuel consumption and product loss during shipping

Health, safety and environmental problems are created by the use of plastics. As the plastics and non-biodegradable, so this property cause waste management problem and choke the drain urban cities.

Active group consciousness movement is very significant, it is because solid waste management contain the solution that stays in separation of wet and dry solid waste at the origin. To increase the concept of resource management by occurring plastics can be reprocessed to produce objects. With the recycle of plastics, many useful products have been developed and in small, micro and informal sectors, huge amount of persons is hired in such type of actions. The undesirable and rejected plastic left-over does not stay in road side not it is carried to landfill that is providing through the recycling. By conventional process, many kinds of plastic left-over like multilayer laminates, EPS etc. are not effortlessly reprocess-able.

The over-all ecological influence of a product or activity on the earth is analyzed by Life Cycle Impact Analysis (LCIA) that is a significant and contemporary technical equipment. Life Cycle Analysis (LCA) proved that plastics have much less adverse impacts on the environment pollution as compared to their alternative that is conducted by credible academic institutions and independent professional organizations of reputation.

Plastic is manufactured from fossil oil which is refined to portions comprising a combination of hydrocarbon chains and successively splintered into restating molecular entities, ‘monomers’. The monomers are combined into polymers forming the base material, e.g. granulate or powder, that can be made to diverse forms and goods by numerous mechanical methods, as for example, extruding and molding.

Plastic can be separated into two chief assemblages that is grounded on their thermal processing conduct: thermoplastics, which is responsible for by far the biggest quantity of plastic formed (around 80%), and thermosets.

Type of plastics with their chief implementations are listed below:

Thermoplastics:

Thermoplastics have an arrangement with long chains of polymers and increase temperature and pressure in which doing the mechanically work. It can be stable at high temperature array that make them eye-catching for usage and also for reprocessing.

- This type of plastic turn out to be soft
- When it is heated, they can be molded or designed with pressure
- When it is chilled, they harden and recollect the shape or mould

Some mutual thermoplastics with their practices and assets are listed below:

Table 1: Types of Thermoplastic and their Properties

Plastic type	Abbreviation	Thermosetting	Properties
Polyethylene terephthalate	PET	Bakelite	• Hard and pure, good strength and toughness, heat and chemical resistance • Used in packing soft-drink and mineral water bottles, fibers for clothing, films, food vessels, conveyance, construction and machine manufacturing (for it being resistant to fire), etc.
High density polyethylene	HDPE	Alkyd	• Good procedure capability • Exceptional equilibrium of firmness and impact power, • Outstanding chemical resistance, crystalline, melting point (130-1350C), • Brilliant steam barricade qualities • Used for making blow molded products (various types of containers, water bottles), pipes, injection molded stuffs (storage bins, caps, buckets, mugs), films (carrier bags), etc.
Polyvinyl chloride	PVC	Polyester	• Adaptability and saving energy, • Adaptableness to varying time and atmosphere, • Resilience and resistance to fire • It is used in businesses such as construction and building, packing, medicinal, farming, transportation. • Also used for creating wires and cables, furniture, footwear, house-hold machines, sheets and films, bottles, etc.

Low density polyethylene	LDPE	Urea - Formaldehyde	• Versatility and saving of energy • Flexibility to varying time and situation • Resilience and resistance to fire • It is used in productions like as building and construction, packaging, medical, agriculture, transport. • Also used for making wires and cables, furniture, footwear, domestic appliances, films and sheets, bottles, etc.
Polypropylene	PP	Epoxy	• Low density and outstanding chemical resistance, • Ecological stress resistance and high melting point • Good processing capability, dielectric properties and less cost, sneak resistance • Used for manufacturing bottles, medical containers, pipes, sheets, straws, films, furniture, house wares, luggage, toys, hair dryer, fan, etc.
Polystyrene	PS	Polyurethane	• Glassy surface, clear to opaque, firm, solid and high clarity • Exaggerated by fats and solvents • Used for making electrical and communication equipment's such as sockets, plugs, switch plates, circuit boards, coil forms, housing and spacers • Also used for making vessels, toys, wall tiles, baskets, cutlery, dishes, cups, tumblers, dairy containers, etc.
Polyvinyl Acetate	PVA	Melamine	• It is amorphous polymer, not a crystalline one. • It is good adhesion to most surfaces. • Used in engineering sector.

Source: (Siddiqui and Pandey, 2013; Gawande *et al.*, 2012)

Some common technologies for Plastic Waste Management that is as follows:

Recycling: It is conceded out in such a way that reduces the pollution level through the procedure and results in increasing the effectiveness of the procedure and preserve the energy. This type of reprocessing have been separated into four kinds:

Primary: It is included in plant process of recycling of waste scrap into a material with landscapes alike to the actual product.

Secondary: In this recycling, the process of waste plastics into goods with the features divergent to the original plastics stuffs.

Tertiary: In this recycling, plastics scrap is produce the basic chemicals and fuels that is as chunk of municipal waste stream or as a separated left over.

Quaternary: By burning or incineration, retrieves the energy satisfied of the scrap plastics and it is not used in India.

Landfilling: This process is purely temporary and to manage the plastic remain and buried the remains materials in specific area. It give result that harm to environment and create risk of adulteration of soils and underground water by collapse of water. This may result in:

- Disturbing water recharge
- Dropping soil microbial activity
- Blocking the drainage
- Water line blockging

Such blocking may result in making of gases like methane that marks the Green House effect.

Incineration: It can be used with retrieval of a few of energy portion in plastic and diverge energy that is dependent on whether which is used for electricity generation, power and heat. It is carried out about 700°C and incineration of polymers like PE, PP, PS that produces gases like CO, CO_2 etc. and these gases cause global warming, air pollution, monsoon failure etc. but in case of PVC mixed with waste that produces of HCl, Cl_2 and dioxin, poisonous gas.

Co-processing of Plastic waste in Cement Kiln: Municipal Solid Waste (MSW) contains the part in which plastic waste produced from diverse towns and cities. Removal of plastic left-over is affecting a number of problem like as leaking influence on land and ground water, clogging of drains, making land unproductive, undiscriminating burning instigating ecological threats etc. It is generated approximately 15,342 tonnes per day (TPD) in country. It is most operative approaches of reprocessing of plastics waste for retrieval of energy that is used as an alternate fuel in cement kilns. With the aim of plastic into new energy sources that is separated from reprocessing of plastic for creating fresh goods and saving of energy. Plastic is made up from crude oil that is the same raw material from which fuel is made. It contain the goal that waste plastic back to crude oil which is reused for powering engines that is made by scientists. The high temperature used in the cement kilns stretches a scope to some kind of plastic waste adulterated with deadly chemicals like as pesticides and some other dangerous stuffs deprived of generating any increase in amounts of emissions in the air or water.

Co-processing of plastic waste as an Alternative Fuel and Raw Material (AFR): Co-processing is referred to as the application of left-over stuffs in manufacturing procedure like as production of lime or steel and power stations or any other large combustion plants and cement. By waste recovery industry and material from waste, co-processing displays standby of primary fuel and raw material. In this, plastic waste are used for co-processing that are mentioned to as alternate fuels and raw materials (AFR). It advises the benefits for cement industry and also for the Municipal Authorities accountable for management of discarded products. Fossil fuel and raw material consumption are saved by cement producers and contributing the more eco-efficient production.

Pyrolysis Technology: By the time the waste plastic stuff putrefy into gases and oils, when plastic materials are heated in the absence of oxygen. Plastic polymers are broken into smaller molecules during pyrolysis. At high temperature (greater than 600°C), produces the small gases molecules but at low temperature (less than 400°C), produces more viscid fluids during pyrolysis. This procedure is feasible way for reprocessing of discarded plastics and transform into gases and fuels and also resolve the ecological issue as maximum plastic material comprises toxic and halogen flame retardants. For pyrolysis, fluidized reactor is an enhanced device which include benefits of obtaining more oil

products, improved temperature regulating mechanism. Pyrolysis or thermal cracking is an appropriate method and is used in the processing of petrochemicals. Pyrolysis helps in alteration of post-consumer discarded plastic for the manufacture of valued hydrocarbons and also exclusive methodology for catalytic reprocessing of plastic left-over.

Advantages of Pyrolysis procedure

- It diminishes CO_2 releases
- It lessens landfilling
- It aids in quicker commercialization of goods
- It assists in goods that could be used to produce electricity and heat

Review of Literature

Salem, Lettieri and Baeyens (2009), for plastic waste management recycling, treatment and recovery, have various technologies which assisted greatly to eco-image of waste management. Certain benefit of current situation is re-using and declining single-life polymeric stuffs. Plastic solid waste (PSW) is a derivative of oil and has recoverable energy that can be compared to the other energy sources. One or two stage combustion techniques occur direct incineration that lessen the capacity of PSW and also its dependency on fossil fuels that lead to an improved preservation of natural resources and incorporated waste supervision arrangements. Incineration is most significant to take into account the recycling and energy restoration procedures in plastic producing and transforming services.

Gawande (2012), in this review paper, find out the operative methods to reuse hard plastic left-over particle. Usage of reprocessed discarded plastic in path asphalt characterizes a treasured channel for such stuffs. The usage of discarded plastics in construction of roads and laminated roofing also assist in consuming huge amount of discarded plastics.

Sasane *et al.* (2015), dictated that upsurge of discarded plastic in bitumen, escalates the qualities of aggregate and bitumen. Their shows good result when use of waste plastic in flexible pavements and compared with conventional flexible roadways. It is an eco-friendly technique which has more value in minimizing the disposal of plastic waste.

Sharma (2015), day by day, increasing the generation of waste plastics and have polymers like as polyethylene, polypropylene, polystyrene that is display adhesion quality in their melted form. One of the best method is use of discarded plastics for pavement, for stress-free removal of discarded plastics. It has increase the technologies for prevention of harmful from waste plastic products.

Joshi and Ahmed (2016), stated that Muncipal Solid Waste Management system are fail from many reason like as absence of consciousness, incorrect mechanical information, insufficient finance, non-answerability, application of legislation and policies. In this review paper, improved capability, enhanced processes and teaching can diminish the topics like as appropriate location assortment, suitable economic sustenance, and inappropriate human resource supervision. The progress and espousal of suitable skills and absence of qualified manpower will need at convincing time set up for solution of the problems. It is not only central government bodies but also state government have taken numerous activities for firming the Municipal Solid Waste Management in country.

Singh and Sharma (2016), concluded that reduce the pollution and waste is viable through the industries due to which produces the harmful effects. In this, lessen packaging stuffs for products and make products that last lengthier and easier reprocess, reuse and reparation.

Conclusion

In present day, Plastic Waste Management has presumed great significance. In India, plastic waste management contains the numerous systems that are applied to moderate the effects of plastic discard. Reprocessing is the most useful technique to manage the plastic solid waste. It increases the degree of retrieval and reprocessing of plastic discards in current trend and rising sense environmentally as well as economically. These fashions are estimated to endure but certain important tests still occur from both technical features and from financial or societal behavior matters involving to the gathering of recyclable discards, and replacement for exploited stuff. In this review paper, discuss about the technology for improving the environmental performance of polymer industry of recycling of waste plastics. .

References:

Al-Salem, S.m., *et al. "Recycling and Recovery Routes of Plastic Solid Waste (PSW): A Review."* Waste Management, vol. 29, no. 10, 2009, pp. 2625–2643.

Awasthi, Arun Kumar, *et al.* "Plastic Solid Waste Utilization Technologies: A Review." *IOP Conference Series: Materials Science and Engineering*, vol. 263, 2017, p. 022024.

B., Sasane Neha, *et al.* "*Application of Waste Plastic as an Effective Construction Material in Flexible Pavement.*" Application of Waste Plastic as an Effective Construction Material in Flexible Pavement , vol. 2, no. 03, June 2015, pp. 1943–1948.

Banerjee, Tirthankar, *et al.* "*Plastics waste Management in India: An Integrated Solid waste Management approach*." Plastics waste Management in India: An Integrated Solid waste Management approach, vol. 2, 27 Mar. 2017, pp. 1–32.

Christensen, Thomas H. *Solid Waste Technology & Management*. Wiley, 2011.

GAWANDE, AMIT, *et al.* "*Utilization of Waste Plastic in Asphalting of Roads*." Utilization of Waste Plastic in Asphalting of Roads, 2(2), 2012, pp. 147–157.

Joshi, Rajkumar, and Sirajuddin Ahmed. "*Status and Challenges of Municipal Solid Waste Management in India: A Review."* Cogent Environmental Science, vol. 2, no. 1, 2016.

Rao, M. Narayana, *et al.*, Solid and Hazardous Waste Management: Science and Engineering. Butterworth-Heinemann, 2017.

SHARMA, H. K. "*Utilization of Waste Plastic in Construction of Pavement*." Utilization of Waste Plastic in Construction of Pavement, 2015.

Siddiqui, Javeriya, and Govind Pandey. "*A Review of Plastic Waste Management Strategies*." A Review of Plastic Waste Management Strategies, 2(12), Dec. 2013, pp. 84–88.

Singh, P., and V.p. Sharma. "*Integrated Plastic Waste Management: Environmental and Improved Health Approaches.*" Procedia Environmental Sciences, vol. 35, 2016, pp. 692–700.

Unde, Sandeep R, and S. C. Potnis. "*Effective Utilization of Plastic Waste in Flexible Pavement and Analysis by Experiments."* Effective Utilization of Plastic Waste in Flexible Pavement and Analysis By Experiments, 4(6), June 2015, pp. 882–891.