

Plastic Waste Management in Sri Lanka

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Abstract— Plastic could be an extremely helpful material and its application area unit expected to extend as additional new merchandise and plastics area units developed to satisfy demands. Plastic waste will be managing by victimization these ways cut back, reuse, usage, and recovery. However, there's still a lot to be done. Since the invention of the Northern Pacific Garbage Patch, analysis has explored the gyres as areas of plastic waste accumulation, also as beaches and stream estuaries. On land, there square measure few figures on the amount of plastic waste and there's a necessity for a lot of data on sources and potential pathways into the setting. There has been increasing concern regarding the presence of small plastics, that square measure typically outlined as plastic fragments but 5mm in size. These square measure made either from the weathering of larger plastics or deposited directly as pre-consumer plastic or from use in abrasives, like those employed in some cosmetics. Small plastics square measure notably troublesome to watch and that they may additionally have a lot of important impacts than larger plastics. The impacts of plastic waste on our health and also the setting square measure scarcely changing into apparent. Most of our information is around plastic waste within the marine setting, though there's an analysis that indicates that plastic waste in lowland and badly managed utilization systems can be affecting, principally from the chemicals contained in plastic. In the marine setting, the foremost well-documented impacts square measure the web and body process by life. Different lesser-identified effects square measure the alteration of habitats and also the transport of alien species. Maybe one in every of the foremost troublesome impacts to completely perceive, however additionally probably one in every of the foremost regarding, is that the impact of chemicals related to plastic waste. There square measure many chemicals inside plastic material itself that are adscititious to provide it sure properties like Bisphenol A, phthalates and flame retardants. These all have identified negative effects on human and animal health, principally touching the system. There are deadly monomers that are connected to cancer and generative issues. The particular roll of plastic waste in inflicting these health impacts is unsure. This is often partly as a result of it's unclear level of exposure which caused by plastic waste, and part as a result of the mechanisms by that the chemicals from plastic could affect humans and animals aren't established. The foremost seemingly pathway is the thru-body process when those chemicals might bioaccumulate up the organic phenomenon, which means that those at the highest can be exposed to bigger levels of chemicals. Plastic waste additionally has the power to draw in contaminants, like persistent organic pollutants (POPs). this is often notably therefore within the marine setting since several of those contaminants square measure hydrophobic, which suggests they are doing not combine or bind with water. Again, the role of plastic waste within the impact of those deadly chemicals is unclear. That's why research is ongoing everywhere. if it is managed plastic waste. This research helps to reduce plastic waste and suggests the substitute for the plastic also clearly mentioned how to reduce plastic waste providing a sustainable framework both for manufacturers and consumers.

Key words: Bio degradable Plastic, Plastic waste, Pollution, Recycle,

1 INTRODUCTION

Plastics square measure made of natural materials like polysaccharide, coal, natural gas, salt and petroleum and even supposing these plastics square measure products of naturally created things, they are doing ruinous devastations once they got disposed to the character creating vast troubles worldwide. Even though every country contributes to the pollution of the setting in cathartic plastics, Sri Lanka has taken a better place in the pollution of plastics. Thus it highlighted the devastation of plastic pollution on this small island situated within the middle of the ocean. These ruin situations during this little island impact of plastic pollution on the island's natural setting, inhabitants, ocean life and therefore the damage caused to food sources. Once it involves plastic pollution around the globe, Sri Lanka still is within the high 10 of plastic polluters around the globe impacting the lifetime of birds, alternative life and additionally human lives. Its serious consequences on our food systems, ecology, and health. If you visit the nearest beach provide all the proof you may like. You'll even go a step any and appearance at these problems across the island relating to inadequate and ineffective waste management (the devastating waste yard collapse at Meethotamulla may be a recent example). Still as criminal selling and therefore the public's propensity towards plastic consumption (from plastic baggage, bottles, caps, containers, wrapping and more), which give any proof of the intense nature of this drawback. per Sri Lanka's Central setting Agency, the island annually imports two hundred, metric heaps of raw plastic materials - around the seventieth is for daily use whereas solely half-hour is for exports [1]. Alarmingly, the CEA expects future growth within the demand for plastics in Sri Lanka supported key indicators. In Western Province generates around 3500 metric tons (MT) of solid waste every day of that solely 2400 MT is collected [1]. Of this, close to fifteen percent has become compost, ten percent recycled and seventy-five percent thrown into open dumps". The rubbish issues square measure any combined by natural disasters like floods and landslides. If you have been chase the circular nature of droughts, floods, and landslides in Sri Lanka over the past 5 to 6 years, then you may recognize the island has been experiencing what sounds like an associate degree annual cycle of environmental devastation with terribly major flow-on effects.[1] Especially once it comes with Sri Lankan industries, they manufacture varied forms of waste and plastic waste that's typically disposed of directly while not being processed in industries in Ceylon. Thus this has noncontiguous the setting like the marine scheme. The explanations why individuals dispose of plastic waste directly square measure as a result of the method to handle plastic waste is troublesome and take heaps of your time. The employment of plastics is additionally troublesome to scale back as a result of there's no material that will replace plastics in terms of characteristics and functions. Most industries use plastic as stuff for each packaging and extra materials in process merchandise. To modify issues mentioned higher than, a method is required to forestall the increasing quantity of plastic waste. The contribution of industries in process waste is going to be useful in maintaining environmental stability and environmental health in Sri Lanka. If the associate degree business implements an honest plastic waste management system, the business has enforced a property system to scale back plastic waste piles. Managing plastic waste isn't simple and dear. Solely a little quantity of plastic waste treatment is effective that is why contributions from industries across Sri Lanka square measure required to assist managing plastic waste still as doable. The target of this study is to research the matter of plastic waste in Sri Lanka as well as providing an answer to counteract it whereas delivery the simplest solutions in minimizing the plastics in industrial areas and grocery store chains [1]. Fig.1, Fig.2 and Fig.3 represent plastic waste, impacts & management practices apply in the society.



Fig. 1. plastic waste



Fig. 2. Plastic waste impacts



Fig. 3. Plastic waste management

Considering the plastics, they are regarded as synthetic or semi-centric polymerization products formed from organic condensation or the addition of polymers. Plastic has a lower degree of crystallinity than fiber. Plastics can be softened or printed at high temperatures using various processes such as injection molding or extrusion. Plastics are waterproof, lightweight, easy to form, and flexible. They can be used as packaging for a variety of objects such as products, storage areas, additional materials for automotive. There are various types of plastic used in packaging as shown in Fig.4.

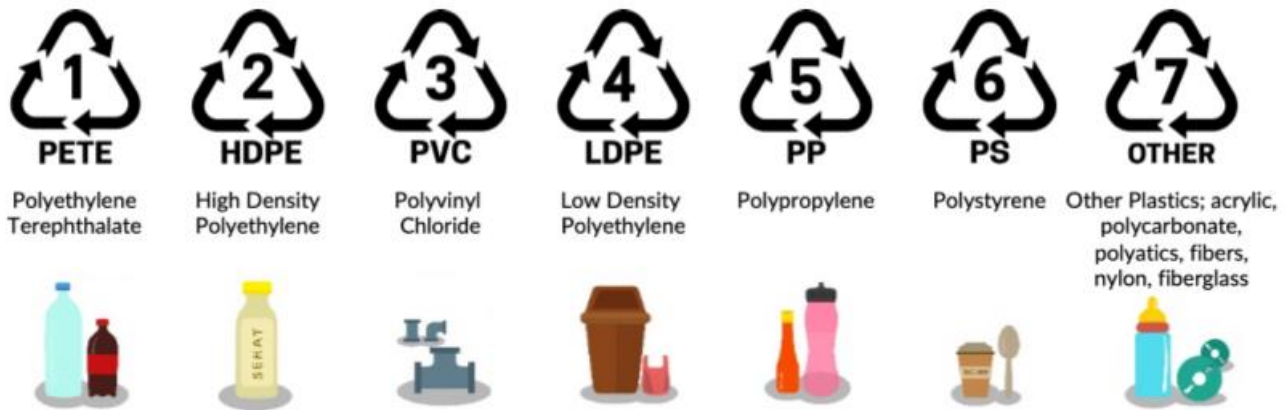


Fig.4.Types of plastics [2]

The main types of plastics can be categorized as follows,

- 1) Polyethylene Terephthalate (PET) is a type of plastic that is lightweight and durable. This type of plastic mostly used as bottled water, soda bottles, juice, cooking oil, and food packaging. This bottle is single-use and it should not be contained hot water [2].
- 2) High-Density Polyethylene (HDPE) is a strong and rigid type of plastic. Usually used as shampoo bottles, liquid soap bottles, and shopping bags. This type of plastic is not reusable [2].
- 3) Polyvinyl Chloride (PVC) is a type of hard plastic and used as an electrical cable, glass cleaning bottles, and water pipe. PVC is not recommended to be used as a food or beverage packaging because the substances contained in PVC can disrupt the digestive system [2].

4) Low-Density Polyethylene (LDPE) is a type of plastic that is easily formed at high temperature, hard and strong. This type of plastic mostly used as bags, bottles, storage boxes, and toys. This type of plastic is very safe to use for food or beverage packaging. However, LDPE is difficult to destroy but can be recycled into household furniture and trash cans [2].

5) Polypropylene (PP) is a type of plastic that is easily formed in high temperature, flexible, hard, and resistant to fat. Because of the nature of this plastic, it is used as food containers, plant pots, drug bottle caps, and straws.

6) Polystyrene (PS) is a type of plastic that is easily formed in high temperatures and is very stiff at room temperature. Polystyrene can be found in plastic tools, CS boxes, and plastic cups. This plastic is the primary Material for Styrofoam. This type of plastic is unfavorable to use because it can be used once, cannot decompose by the soil, and can release toxic gas when burned [2].

7) Other types of plastic produced with label seven are made from a mixture of two or more types of plastic which indicate that the resin is unknown. This type of plastic is used in the food or beverage industry [2].

Plastic waste generation areas

Plastic is distributed from the industry to consumers through wholesalers and retailers. But some industries produce plastic itself to be used as packaging for their products (plastic cups/polythene bags/shampoo, gel & sachet packets/biscuits, chocolate wrappings, etc.). Then the product will be distributed to consumers. After consumers use the product, the packaging of the product will become a waste. Besides, the industry will also produce industrial waste and makes additional plastic waste. The raw material for making plastic is petroleum and other components. The raw material is collected by suppliers. Then the supplier processes the raw materials until they are ready to be used. The supplier then provides to not only the plastics industry but also other industries that use plastic as raw materials for their products such as the household products industry, and the plastic pipe industry. The plastic industry then distributes its products to various parties such as supermarkets, consumers and other industries that use plastic as packaging. But some industries process their plastic to be used as packaging for their products. The product then will be distributed to sellers and consumers. After consumers use the product, the product will be disposed of. The waste will be collected by plastic waste collectors and given to the plastics recycling industry or collected in the Waste Disposal Site [2]. Then, the plastic can be processed and recycled.

- Plastic Processing Technologies available in Sri Lanka:[3]
 - Pipe and Profile extrusion
 - Cast Film Extrusion
 - Blown Film Extrusion
 - Injection Molding
 - Extrusion blow molding
 - Rotational Molding
 - EPS Molding
- Other Sub – Process used in Sri Lanka[3]
 - Laminating
 - Printing

Weaving

Thermoforming

- Major allied Industries are as follows:[3]

Water Supply and sanitation

Telecommunication

Construction

Packaging

Automobile

Medical

Impact of plastic pollution

1. It upsets the organic phenomenon

Because it comes in sizes massive and little, polluting plastics even affect the world's tiniest organisms like being. once these organisms become poisoned thanks to plastic consumption, this causes issues for the larger animals that rely on them for food. this will cause an entire slew of issues, every step any on the organic phenomenon. Plus, it means plastic are gift within the fish that several individuals eat every day [4].

2. Groundwater Pollution

The world's water is in nice danger as a result of leaky plastics and waste [4]. If you've ever seen a site, imagine what happens when it rains – then imagine that being in your drink. Groundwater and reservoirs are at risk of leaky environmental toxins. Most of the litter and pollution touching the world's oceans conjointly derives from plastics. This has had terrible consequences on several marine species, which may result in consequences for those who eat fish and marine life for nutrients – as well as individuals[4].

3. Land Pollution

When plastic is the drop in landfills, it interacts with water and type unsafe chemicals. once these chemicals course underground, they degrade the water quality. The wind carries and deposits plastic from one place to a different, increasing the land litter. It can even grind to a halt on poles, traffic lights, trees, fences, tower, etc. and animals which will are available the neck of the woods and would possibly suffocate them to death [4]

4. pollution

Burning of plastic within the outside ends up in environmental pollution thanks to the discharge of toxic chemicals. The impure air once indrawn by humans and animals affect their health and might cause metabolic process issues [4].

5. It Kills Animals

Despite infinite TV ads over the years showing ducks or dolphins treed in six-ring plastic will holders, this stuff is still used and discarded as a group daily. whether or not as a result of the mass of plastic has displaced animals or the connected toxins have poisoned them, plastic pollution will a great deal of injury to the world's ecosystems [4].

6. It's toxic

Man unnaturally makes plastic by employing a variety of hepatotoxic chemicals. Therefore, the employment of and exposure to plastics has been coupled to a variety of health considerations touching individuals round

the world. The processes of creating, storing, doing away with, and simply being around plastics will be very harmful to living things [4]

7. It's pricy

It prices ample bucks annually to scrub affected areas when exposure, to not mention the loss of life to plants, animals, and people. As land becomes additional valuable, simply finding an area to place garbage is turning into a tangle in several components of the planet. Plus, excess pollution ends up in ablated business in affected areas, considerably impacting those economies [4].

Why we should manage plastic waste

1. Technological factors

The development of plastic processing machinery is growing over time. As time goes on, technology will become more sophisticated to the point where it can process plastic waste optimally. Few industries in Indonesia apply plastic waste management systems because the technology needed is expensive. The use of technology will be an important factor in determining the application of a plastic waste management system [2].

2. Environmental factors

The application of plastic waste management processes has an impact on the environment. One of the impacts is the smoke from burned plastic waste. The management of waste is intended to reduce the impacts on the environment. Therefore, environmental factors become one of the considerations in determining the application of a plastic waste management system [2].

3. Regulatory factors

Regulations stipulated by the government such as legislation related to policies in managing waste will be a limitation in implementing a plastic waste management system. Regulations regarding the obligation to apply the plastic waste recycling process can support industries in implementing sustainable plastic waste management systems. The regulation related to the scope of waste management, community participation, and other regulations as stated in UU RI No. 18 About Waste Management needs to be considered before implementing a plastic waste management system [5].

4. Economic factors

The price of waste processing machines will be one of the industry's concerns in terms of the economy. But on the other hand, the application of plastic waste recycling processes can improve the industry's economy indirectly. Not only for the industry but can the application of plastic waste management also improves the economy for scavengers and recyclers. The industry can get additional income through sales of processed plastic waste products. Likewise, scavengers and recyclers can increase their income by participating in the implementation of a sustainable waste management system. Therefore, this can be a consideration for the industry in implementing a plastic waste management system [2].

5. Social factors

Community participation influences the process of plastic waste management in Indonesia. Public awareness in collecting plastic waste will be a success factor for the application of plastic waste management. For this reason, it is necessary to pay attention to the behavior of the community towards plastic waste to find out what process

is feasible to be applied in carrying out the processing of plastic waste on an ongoing basis considering the industry that implements the system requires contributions from various parties including the community [2].

Alternatives for Waste Management

- Refuse :avoid purchase plastics
- Reduce: Buy only what you need because a better way to reduce waste is by not creating it
- Reuse: If you have to acquire goods, try getting used ones or obtaining substitutes.
- Recycle: When discarding your waste, find ways to recycle it instead of letting it go to landfill

Recycling plastic waste

Specific applications of plastic waste management that can be applied by industries are:

1. Processing plastic waste into asphalt mixture

Plastic waste can be treated as a basic material used for an asphalt mixture. Additional plastic materials will strengthen the stickiness of the asphalt. Steps that can be taken are; Plastic waste cleaning process, Shredding, transforming the waste-based its size, Waste plastics mixed with the hot aggregate, and Aggregating plastics-bitumen mix.

2. Processing plastic waste into pellets (plastic seeds)

Plastic waste can be recycled and used as an ingredient for plastic bags [6]. Waste that can be used in this process is thermoplastic. Plastic waste treatment is carried out through the following steps. First, Enumeration to transform the plastic into flakes so that it can be carried out by using a shredding machine, then wash the plastic to remove dirt and bacteria that can interfere with the production process. The next phase is trying to minimize the water that can interfere in the production process. Finally, making pellets is done by melting the plastic chopped using an extruder, then formed into a long cylindrical rod and cooled until becomes solid. To get pellets in satisfying size, the cylinder rod should be cut.

3. Processing plastic waste into fuel oil

Plastic waste can be recycled and processed into fuel oil through a pyrolysis process [2]. The catalysts are derived from Residual Fluid Catalytic Cracking (RFCC) waste in the depolymerization process. The most oil that can be acquired is from the type of PS plastic which is then followed by PP, LDPE, HDPE, and PVC plastics.

4. Recycling PET bottle waste as fiber in recycled aggregate concrete

The use of Recycled PET (RPET) on recycled plastic fiber for reinforcing Recycled Aggregate Concrete (RAC) will significantly increase strength [2]. The steps taken include are; collecting PET plastic waste, washing the plastic, cutting PET plastic waste, rinsing and drying of PET plastic waste, and mixing the fiber with concrete

5. LDPE processing becomes a mixture of wood

This processing is carried out by mixing LDPE plastic melt with sawdust with a ratio between the polystyrene weight and sawdust of 1: 1.5 [2]. Then, the product is cooled to a temperature between 170 and 180 °C. This mixing produces a durable strength and can be used for furniture, carpentry, and building. The implementation of the system is expected to be able to reduce plastic waste piles in Indonesia and help various parties in improving their economy.

Applications of plastic waste management which will be applied in different areas-

1. 3D-Printing Recycled Plastic
2. Perishable Water Bottles
3. Versatile Packaging Uses Crab Shells and Trees rather than Plastic [7].
4. Mushroom Packaging

The future of packaging is also rotten in spite of a viable plastic different is made or not - through the foundation of the latter isn't essentially negative. Fungi packaging might bridge a revolution in perishable packaging. The visible portion of plant life, or a mushroom, represents solely a tiny low fraction of the complete organism. To a lower place, every spongy entity is an intensive network of thread-like roots higher referred to as plant structure - and manifestly, these fibrous members might supply the ultimate answer to different plastic packaging. Scientists have nearly formed plant life packaging and the square measure already exploitation it to form structures, sort of a 40-foot tower created from living mushroom bricks. The bricks square measure simply factory-made by merely filling molds with organic matter infused with spores. In an exceedingly matter of 5 days, the mushrooms rework the organic matter into a brick-like substance an inexpensive and extremely effective method [7].

5. Inexperienced light-weight matches
6. Siloxane square block trays
7. Reusable food wraps
8. A glass bottle with chrome steel flow lid
7. Eco-friendly beauty bars
10. Steel containers for storeroom staples
11. Steel scissors
12. Reusable grocery luggage
13. A reusable bottle that is temperature-controlled
14. Glass bottles
15. Disposable picket cutlery
16. A steel compost bin
17. Reusable metal straws

Fig. 6 represent some of different applications of plastic waste management



Fig. 6. Applications [6]

How to minimize plastic usage in supermarket chains in Sri Lanka

Usage of plastics in supermarkets can be reduced with recycling and through lots of remedies, therefore the following methods can be followed to minimize the usage,

- Stop victimization plastic straws, even in restaurants. If a straw could be a should purchase a reusable chrome steel or glass straw
- Use a reusable manufacture bag. one bag will take one,1000 years to degrade. Purchase or create your reusable manufacture bag and take care to scrub them often!
- Give up gum. Gum is created of artificial rubber, aka plastic.
- Buy boxes rather than bottles. Often, a product like detergent is available in cardboard that is a lot of simply recycled than plastic.
- Purchase food, like cereal, and rice from bulk bins and fill a reusable bag or instrumentation. You save cash and unneeded packaging.
- Reuse containers for storing leftovers or looking in bulk.
- Use a reusable bottle or mug for your beverages, even once ordering from a to-go look.
- Bring your instrumentation for take-out or your eating place doggy-bag since several restaurants use foam.
- Use matches rather than disposable plastic lighters or invests during a refillable metal lighter.
Avoid shopping for frozen foods as a result of their packaging is usually plastic.
- seem to be cardboard are coated during a skinny layer of plastic. and you will be uptake fewer processed foods!
- Don't use plastic ware reception and take care to request restaurants don't pack them in your take-out box.
- Ask your native merchant to require your plastic containers (tomatoes, etc.) back. If you back up a farmers market they'll refill it for you.
- Make recently squeezed juice or eat fruit rather than shopping for juice in plastic bottles. It's healthier and higher for the surroundings.
- Make your cleanup product which will be less noxious and eliminate the necessity for multiple plastic bottles of cleaner.
- Pack your lunch in reusable containers and luggage. Also, want recent fruits and veggies and bulk things rather than the product that is available in single-serving cups.

CONCLUSION

In Sri Lanka when considering the plastic generation it has become a really big issue since it's hard when it comes with the minimization because of the huge disposal and it is generated in thousands of areas impacting the live styles of the humans and the environment is badly affected with the disposal making it a big catastrophe in the country and especially when it comes with the minimization of plastics central environmental authority has implemented the 4R methods to decrease the waste generation. as well as in the supermarket chain it is being implemented to use biodegradable bags and recyclable wrappings and bags. therefore as a Sri Lankan citizen it is then responsible for all of us to be aware of the impact and the issued occurred due to the plastic waste to minimize it efficiently.

REFERENCES

- [1] Waste trading, <https://waste-trading.com/index.php/12-english/sections/188-sri-lanka>, 31.12.2019 .
- [2] Y.A. Hidayat, S. Kiranamahsa, M.A. Zamal , A study of plastic waste management effectiveness in Indonesia industries, AIMS Energy, Volume 7, Issue 3, 350–370, 2019.
- [3] Export Development board Sri lanka, Available from: <http://www.srilankabusiness.com/plastic>, 2019.
- [4] Conserve energy future, Available from: <https://www.conserve-energy-future.com/causes-effects-solutions-of-plastic-pollution.php>, 31.12.2019.
- [5] Zulkifi, Waste management regulation in Indonesia. Available from: <https://bangazul.com/regulasi-pengelolaan-sampah-di-indonesia>, (2013).
- [6] A.Z. Abidin, Plastic pellet making (Afval recycling). Industrial Training Centre. Ministry of Industry of Indonesia, 2017.
- [7] 25 cheap and easy replacements for plastic in your home and kitchen,' <https://www.businessinsider.com/household-plastic-alternatives-eco-friendly-2018-8>