Current Plastic Wastage and Introducing New Innovations to Minimize Plastic Wastage in Sri Lanka

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Abstract: Plastics have been used widely in day to day life and as a raw material for many industries due to its unique properties. Plastic bottles, sachets, food packaging, and other items become prevalent all over the country, and due to its long-lasting properties, plastic pollution has become a major burning problem in the world. Currently, Sri Lanka follows several common ways of getting rid of plastics by dumping them in the incinerators or as landfill. This study mainly focused on the methods of plastic waste management, the current situation of Sri Lanka, available options, and proposals to reduce the plastic wastage in Sri Lanka.

Index Terms: Innovation, plastic wastage, Pollution, Sri Lanka.

1. INTRODUCTION

Plastics is a synthetic organic material derived from petrochemicals that have a very high molecular weight. The name "plastics" is used because of its property of plasticity, ability to deform without breaking. Therefore this polymeric material has the capability of being molded or shaped by the application of heat and pressure. Plastics consist of other unique properties such as low cost, low density, transparency, packaging, electrical, and heat insulation. Due to having properties like Electrical conductivity, and toughness plastics are used for the manufacturing of household and electronic goods and other items of daily or specific use. Due to these properties, plastic production by humans is very high. The packaging is one of the essential applications of plastic impact; about 40% of plastic materials worldwide are used in packaging applications.

Plastics have made a significant contribution in all most every field of human activities today- agriculture, medical, transportation, piping, Even though the plastics are incredibly versatile and beneficial, it leads to huge plastic pollution in the environment. Plastic pollution can afflict land, waterways, and oceans. The risk of microscopic particles of plastics transferring toxins into the food chains is highly considerable. Plastic manufacturing processes include nonrenewable resources, such as oil, and it releases greenhouse gasses into the atmosphere contributing to climate change.

Also, the use of chemical additives in plastics can be hazardous to human health. However, it is not the material to be blame but the misuse of the material as consumers. People follow several common ways of getting rid of plastic by dumping them in landfills, by burning them in incinerators, or by littering them. Among the existing

solutions, recycling is one of the most convenient and proper ways [1].

WHAT IS 3R

The 3R for waste management stands for Reduce, Reuse, Recycle. It calls for an increase the amount of recyclable materials, further reusing of raw materials and manufacturing waste, an overall reduction in resources and energy use. This can be applied for the entire lifecycle of products and services from the design and extraction of raw materials to transport, manufacture, use, reuse, and disposer.

Reduce

Reduce means cut down the waste or reduce the amount of usage. In the present, the highest plastic pollution is mainly due to the single-use products. As examples, PET water bottles, cappuccino cups, sachet packets, lunch sheets, food wrappings, soft drink bottles, and straws. Using a minimum amount of plastic bottles and multipurpose items, avoid using disposable cutleries, prevent over packing, buying durable products can be done in order to reduce plastic waste.

Reuse

Reuse means putting an item in to use again or for another purpose. This also means passing on things to another instead of throwing them away. Broken pieces can be used for another use or to make another product instead of putting it into a bin. As examples using old plastic containers like flower pots, donation old toys to the needy, reusing reusable lunch bags instead of disposable ones.

Recycle

It is the process of recovering waste plastic and reprocessing the material into useful products, sometimes completely different from their original state. Recycling plastics will reduce waste while reducing the pilling up of virgin material on earth. Moreover, it will reduce the energy and water consumption and emission of toxic gasses and chemicals in the production process of virgin materials.

Plastic recycling can be done mainly in two ways. The first one is mechanical recycling; in here, the waste plastic is washed, reshaped, shredded, and granulated under controlled conditions, then melted and make into different products. In chemical recycling, the polymer is broken down into smaller molecules that can be easily separated from impurities. This process has restrictions on some materials, and sometimes they cannot handle untreated, and it is necessary to remove fractions containing heavy metals, filers, and halogen compounds. This is suitable for polymers like PU, PET, Nylon (polymers formed by condensation). There are other methods of recycling as thermal conversion technologies, which consist of pyrolysis, hydrogenation, and gasification. There are two types of plastics, thermoplastics, and thermosets. Out of these two types, only thermoplastics can be recycled. Most plastic recycling enterprises are small scale operations, and most commonly used plastics are PP,

HDPE, LDPE, and PET. These plastics are easier with recycling than PS, PVC, Acrylics, and Polycarbonates.

The main method use to recycle plastic in Sri Lanka is mechanical recycling. First, the materials are collected through collecting centers, and then they are sorted according to the type of plastic. It is essential to remove labels and other foreign materials from the bottles and other plastics; otherwise, it will affect the quality and the properties of the end product. Then the plastics are washed well to remove any impurities and residuals in several bath tanks. Then the plastics are crushed into smaller pieces, which can be fed into an extruder. A mechanical shredder can be used for the crushing process.

If recycled plastics are used for the production of new items instead of using virgin polymers will directly reduce the oil usage and emissions of greenhouse gasses. It has been estimated that PET bottle recycling gives a net benefit in greenhouse gas emissions of 1.5 tons of carbon dioxide per ton of recycled PET as well as the reduction in landfill and net energy consumption. A recent life cycle analysis (LCA) specifically for PET bottle manufacture calculated that the use of 100% recycle PET instead of 100% virgin PET would reduce the full life cycle emissions from 446 to 327 g carbon dioxide per bottle, resulting in a 27% relative reduction in emissions [2].

2. PRESENT STATUS OF SRI LANKA

According to the annual central bank reports, it has been estimated that Sri Lanka earns Rs 2.8 billion foreign exchange via imports and exports of plastics. Currently, 232 companies in Sri Lanka engaged in plastic processing for both local and international markets.

Sri Lanka imports around 160,000 MT of plastic raw materials in primary forms and another 100,000 MT of finished and intermediate products every year. In the meantime exports around 280,000 MT while the capacity of our local processing industry presently being nearly 120,000 MT per annum with an annual average growth rate of around 10% [3].

However, when it comes to waste collection, there is no proper collected and maintained a total number of waste records up to now. But according to the assumptions on the number of waste collecting tractors and their capacities, it is found to be 73.044 MT of plastic wastage within Colombo district in 2005 [4]. Furthermore, the Colombo municipal council collects 700 tons of garbage on average per day, and 6% of this is polythene and plastic waste [2]. So it can be assumed that the total amount of plastics and polythene collected ***will be more than 1000 MT***. But this assumed information is relevant to different years, and the present amount can be much higher than that according to the world surveys; by every ten years, the plastic consumption increase by three times [2]. And now Sri Lanka has been named as one of the top 5 plastic polluters in the world. The most common method of solid waste disposal is open dumping. Since plastics are non-degradable, it will cause

mountains of waste as Meethotamulla, Karadiyana, and Bluemendhal areas, which cause degradation of wetlands, coastline, rivers, and other streams which become dumping sites for plastic and other mixed waste. The rest of the plastic will be burned on a domestic basis, or waste will be disposed to oceans through a stream and other waterways.

Sri Lanka generates about 400MT of plastic and polythene per day. This includes 15 million lunch sheets and 20 million shopping bags. Though they are around 170 plastics/polythene collectors and recyclers registered under the central environment authority, plastic and polythene recycling are not taking place at a satisfactory level. In Sri Lanka, a survey was done according to the ocean conservancy guideline, has quantified the quantity of marine litter collected within the coastal zone of Sri Lanka as 103.38 kg per km in 2017 [5]. The local authority should solve waste reduction with their efforts. If the authority faces the severe waste problem and wishes to solve it, the head of the authority should define their policies and the plans. At the same time, the capable human resources must be in charge of the waste management for proper implementation of the waste reduction policies and plans.

Even if the local authority is necessary to outsource some works of waste management to private companies, the authority should be responsible for all of the waste management. Therefore it is required to develop the capability of each operator (companies), so the authority should not depend on only a bidding system to select operators. The local authority and intermediate treatment operators must consider from the recycling manufacturer's point of view bout hoe to take measures such as separation, compression, and packaging. Then the authority must search traders who will take separated waste stably and continuously. The local authority should research waste composition analysis and understand each waste characteristics, and then seek how to recycle it [6].

3. AVAILABLE OPTIONS TAKEN TO REDUCE THE PLASTIC WASTE IN SRI LANKA.

- Implementation of rules of regulations
  - Sri Lanka banned the import, sale, and use of polythene bags less than 20 microns and Styrofoam containers in 2017, however, the implementation and monitoring of this regulation has not been adequate and objections are occurred by the industrial sector requesting for a more phased and practical solution to be adopted within a given time period [7]. In Sri Lanka the government imposed a deposit refund policy and a tax on plastic which proved to be untenable and detrimental to economic development.
- Establishment of plastic collecting centers with the collaboration of plastic recyclers in every organization.

- Currently, about 152 waste plastic collecting and recycling centers have been registered in the central environmental authority.

- Researching to test whether we can use waste plastic with tar for construction purposes (E.g., road, roofing sheets, and tiles).
- Use paper cartoons instead of plastic cans and bottles.
- Steps taken by supermarket chains to reduce plastic wastage.
  - Producing small biodegradable mesh bags to store vegetables, grains, and other groceries, which can be used several times by john keels.
  - Introducing large reusable green bags to store the bought items when leaving the supermarket and reducing 4 rupees from the bill every time someone brings it back.
- Manufacture of polyester fibers from PET bottle recycling by eco spindles
  - Example- MAS holdings collaborated with Sri Lankan navy, Eco spindle, Sri Lankan cricket team and successfully up cycled waste plastic recovered from the beaches of Sri Lanka to produce the official Jerseys to worn by Sri Lankan's National cricket team during ICC cricket world cup 2019
- The national post-consumer plastic waste management project of Central environmental authority, Sri Lanka encourages plastic waste recycling to prevent the material from piling up along the roadsides and causing environmental pollution.
- Use of biodegradable plastics

  Biodegradable plastic is a form of plastics derived from renewable biomass sources, such as vegetable fats and oils, cornstarch pea starch, or microbiota. They are more sustainable because they can be broken down in the environment faster than fossil fuel plastics

Example

- production polydime- biodegradable and compostable lunch sheets
- Polyethylene with Oxo-biodegradable (OBD) additives, which causes plastics to degrade.

PROPOSALS FOR MINIMIZING PLASTIC WASTE IN SRI LANKA.

- As we know, there is a massive amount of plastic waste collected in public places in Sri Lanka.as examples, around railways stations, shopping malls, and parks. We are proposing a SMART plastic collecting Bin which can act as a Wi-Fi zone.

  When we dump some plastic waste, the BIN will recognize it and act as a free Wi-Fi hotspot to a

specific limit (depend on the weight of the waste).

- As we know, the highest plastic pollution is due to single-use products. PET water and soft drink bottles play a significant role in it. Furthermore, we know that when we take a soft drink in a glass bottle, we have to pay a separate price for the bottle to bring it home. If the supermarkets can implement a different version of a vending machine to collect the water bottles inside the supermarket, which will reduce a little amount from the bill or that can be collected as points in loyalty cards, people will motivate and attempt to follow that, which will minimize the plastic pollution. This also helps to collect plastics for the recycling process.
- Encourage people to use reusable stainless steel or glass straw instead of plastic straws or encourage people to use edible straws. (as examples starch-straws made of noodles) even in restaurants
- In Sir Lanka dump one million sachet packets – such as sauce, jam, shampoo, dump 20 million polythene bags, and 15 million lunch sheets landfill per day. To reduce this, we can encourage industries to produce detergents and shampoo in solid form instead of making bottles or sachet packets.
- Implementation of strict rules and regulations for plastic disposal. As an example of banning plastic waste imports from reducing pollution from the recycling process.
- Charging a price for polythene bags at every shop (even a small amount will encourage people to bring a bag from home.
- Encourage people and plastic sellers to implement home appliances recycling systems.
    - As some retailers take old television or a new one, encourage them to take back old plastic products when buying new products. (Examples – plastic chairs, tables, ceiling fans)
- Establish rules and regulations to produce white color products instead of colored ones (examples as polyethylene bags and bottles. This will increase the ability to produce a vast range of products without spending more money in order to get a uniform color.
- Conducting aware programs to local people about plastic consumption and health issues (health issues due to the use of PET water bottles, juice bottles repeatedly, using nonfood grade packaging to store food items.
- Improve and develop the use and production of biodegradable plastic.
- Plastic is made from hydrocarbons, and is more energy dense than coal. And it creates a lot of heat when its burn so there is a possibility to generate electricity by incineration with the plastic waste in Sri Lanka. But this process emit harmful gasses to the atmosphere like hydrochloric acid, sulfur dioxide, carbon dioxides, dioxins and furans. Therefore those fireplaces would need to include technology that would control temperature and emission, and properly dispose of the residual toxic materials.

4. CONCLUSION

Waste separation from the household level, proper storage, more efficient waste collection systems, and sustainable recovery and disposal are the critical processes to be considered. Considering the nature of the collected waste, waste reduction, reuse, recycling, and composting would be more suitable, and adequate concentration should be given to monitoring the above processes. Public education and properly planned waste management programs also needed to be introduced, and the authorities should provide for the introduction of complementary programs and policy development In order to establish a sustainable society and handing over the rich environment to the next generation.

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