An Overview of Microplastic Contamination and Research Gaps in Sri Lanka

T.U.H. Liyanage*, I. Thushari, R.T.K. Ariyawansha

Sustainable Environment Research Group, School of Technology, Faculty of Engineering and Technology, Sri Lanka Technological Campus (SLTC Research University), Padukka 10500, Sri Lanka

* teshanu@sltc.ac.lk

Abstract - Microplastics (MPs) have gained the attention of scientists, researchers, policymakers, and the general public as one of the controversial environmental issues of the decade. Recent researches suggest that MPs have already infiltrated both the terrestrial and aquatic ecosystems in many countries including living organisms. This study reviews the current research focuses, findings, and gaps in the content of Sri Lanka. Most of the available research is focused on coastal environments where a higher level of MPs contamination was reported. Furthermore, they have claimed fishing industry, tourism and urbanization are key contributors to MPs pollution in coastal waterways. A handful of researchers have found MPs in food products that were collected from retail shops raising concerns about the food security of the nation. Therefore, it is vital to understand the MPs situation in terms of infiltration of water and food supply, air, ecology, MPs associated contaminants, and the potential health risk to humans, to identify the key MPs producers/polluters/sources and the severity to mitigate the MPs pollution by introducing or changing the existing plastic waste management laws and policies.

Keywords: microplastic pollution, policies, review

I. Introduction

Microplastics (MPs) are ubiquitous and slowly-degrading contaminants in waters, soils, and air measured at 5 mm or less in size. The situation and the fate of MPs are hot topics in the scientific community. The present global plastic production is about 320 million metric tons while single-used plastic accounts for half of the total production. It is estimated that about 58% of plastic waste enters the natural environment and eventually becomes MPs. It is estimated that about 938 metric tons of plastic waste are being produced daily in Sri Lanka while about 300.3 metric tons of plastic waste are being collected, the rest is not even collected properly [1]. Personal care products, cosmetics, and fabrics are some of the main sources of primary MPs that are being released unintentionally into the environment. Furthermore, incidents such as the X-Press Pearl container vessel disaster have released unprecedented amounts of MPs into the ocean around Sri Lanka. This study reviews the MPs situation in Sri Lanka and provides comprehensive undemanding current research trends and gaps that need to be addressed by future researchers.

II. Materials and Methods

A literature review was conducted using the two keywords "Microplastics" and "Sri Lanka" while limiting the period to 2015 onwards in google scholar. Ongoing research and preliminary studies were found using Sri Lankan University databases, and Research gate while government, and recognized NGO websites were used to gather reports.

III. Results and Discussion

Sri Lanka, being a developing country consumes relatively small amounts of plastics estimated at 6 Kg/year (per capita) compared to Europe and the USA stand at per capita consumption of 50 and 68 Kg/year, respectively [2]. In nature, due to different reasons these plastics brakes down into much smaller MPs. The degree of MPs pollution and its fate needs to be understood. This study has found a handful of peer reviews articles investigating MPs pollution in Sri Lanka most of which are very recent publications. Furthermore, several preliminary publications were also available in the form of conference and symposium publications. Researchers have identified different sources of MPs and key factors in plastic pollution leading to the occurrence of MPs such as urbanization, unsustainable tourism, and recreational activities, fishing activities, development projects, and waste mismanagement. The majority of the research carried out in Sri Lanka was focused on marine and coastal environments as mentioned in Table 1 where most of them were carried out on the western and southern coasts of Sri Lanka since much of the urban population and coastal economic activities such as tourism, fisheries, and several industries are located. But it is important to focus on other coastal areas and waterways such as rivers, "Oya", estuaries, etc. as some researchers have suggested that rivers and other waterways bring MPs from inland to the ocean [3]. The river Mahaweli is the longest in Sri Lanka associated with several major cities such as Kandy, which meet the sea on the northeast coast of Sri Lanka making it an ideal MPs transporter. But there is very little information available on MPs status in such environments in Sri Lanka. Few researchers have reported that the Sri Lankan food supply has been compromised by MPs, but the understanding is currently limited. Furthermore, the infiltration of MPs into living bodies is need to be investigated further.

Most of the developed countries still working on MPs and there are no specific rules or regulations for MPs in the food

Table 1. Summary of recent studies on MPs in Sri Lanka (PP- Polypropylene, PE- Polyethylene, PES- Polyester, ABS -Acrylonitrile Butadiene Styrene, PVC- Polyvinyl chloride, LDPE- Low-density PE, HDPE - High-density PE

Research Area	Location	Key Findings
Coastal environment	The southern coast, Sri Lanka. Surface water	0.23 to 0.33 MPs/m^3 (Average) HDPE, PP, PS [4]
Coastal environment	The southern coast, Sri Lanka Beach and beach sediment	60% of the sand samples and 70% of the water samples. PP (highest), PE, PE+PP, and PS [5].
Food	Puttalam, Hambantota, and Elephant Pass salterns. Commercial salt	MPs were presented in all types of salts LDPE, HDPE, PVC, etc. [6].
Coastal and lagoon Environment	Marine Protected Areas of Southern, Sri Lanka. Bundala and Hikkaduwa	Coastal sediments 111 MPs/m^2 and waters 0.515 MPs/m^3.PE, PP, and PS (in some locations) [3].
Coastal environment Food	Fish (Sardinella gibbose) West coast, Sri Lanka (Negombo)	The highest MPs 7.2 MPs/m^3 (Pitipana). MPs were found in fish guts. PVC, ABS, PES, PE, and PP [7].
Food	Dried fish (*Spratelloides delicatulus*)	0.27 ± 0.04 per g of fish [8].

according to European, United States, Australia, and New Zealand regulators, but there are some specific regulations to control MPs pollution such as primary MPs from cosmetics and personal care products. Sri Lanka also has taken initiatives to address MPs pollution directly and indirectly through NAPPWM 2021-2030. Even though there were initiatives such as the "Pilisaru" National Solid Waste Management Project, this is the 1st such initiative aimed to reduce plastic pollution through the 3Rs principle. Reduction of single-use plastics by 80% and reduction of marine plastic pollution by land base activities are some of the goals of this initiative that address the marine plastic issue. The 5th goal aims to reduce marine plastics pollution and has pointed out knowledge gaps such as the issue of the product containing primary MPs, bioaccumulation, and human-health impacts of MPs that are needed to be investigated [1]. An overview of MPs contamination and research gaps in Sri Lanka is given in Fig.1.

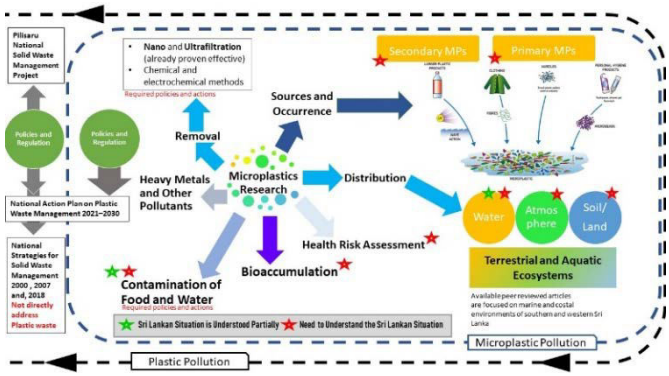

Fig. 1. An overview of MPs contamination and research gaps in Sri Lanka

IV. Conclusion

Several recent studies have found a higher level of MPs in different places in Sri Lanka, most of which are mainly concentrated in southern to western coastal environments. There is a lack of studies that investigate the situation of MPs in different aspects such as the occurrence and distribution of MPs in major rivers, estuaries, etc, afflation of heavy metals and other pollutants, the occurrence of airborne MPs, and, human health risk assessments.

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