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Plastic Waste and Plastic Footprint

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Abstract – Although plastics provide many conveniences to our daily lives, they never really disappear. As a result of the widespread and increasing use of plastic materials, plastic waste and environmental damage have increased. Plastic pollution has occurred as a result of both the widespread use of plastic and poor waste management. Today, with the development of the concept of footprint, the definition of plastic footprint has also been made. Environmental problems caused by plastic production, use and consumption need to be solved urgently. If our world continues to be polluted with plastic waste, it is estimated that there will be more plastic waste in the seas than fish in 2050. The millions of tons of plastic litter that end up in the oceans each year is one of the most visible and alarming signs of these problems. For this reason, plastics should be considered as a kind of pollutant in terms of their production and the leakage of plastic products and wastes into the environment should be prevented. Within the scope of this study, plastic pollution caused by plastic waste and how it can be prevented are mentioned, and the concept of plastic footprint is also mentioned. This study has been carried out by making use of the scientific research and studies that have been done in this field and the literature data in this field.

Keywords – Plastic Waste, Plastic Footprint, Plastic Pollution, Environment, Waste Management

I. Introduction

Plastic containers are easier and cheaper to produce and transport than containers such as soil, wood, metal. Due to these features, it has been widely used in almost every field of social life, from medicine to education, from industry to household appliances, since the 20th century. The use of plastic is not only limited to utensils, but also used in other works such as packaging, transportation and bags. Today, the use of plastic has entered all areas of social life so much that it is almost impossible to imagine a plastic-free world. But despite the practical and positive aspects of plastic use, there are also negative and environmentally harmful aspects.

Plastic is a general term that describes many synthetic or semi-synthetic materials used in a wide and growing number of applications.

Plastics are organic, just like wood, paper or wool. Raw materials such as cellulose, coal, natural gas, salt and of course crude oil used in plastic production are natural products. The term "plastic" is of Greek origin and is derived from the words "plastikos" and "plastos". It is a reference to the ability of the material to be poured, pressed or shaped into film, fiber, plate, tube, bottle, box and many more thanks to its malleability or kneadability during.

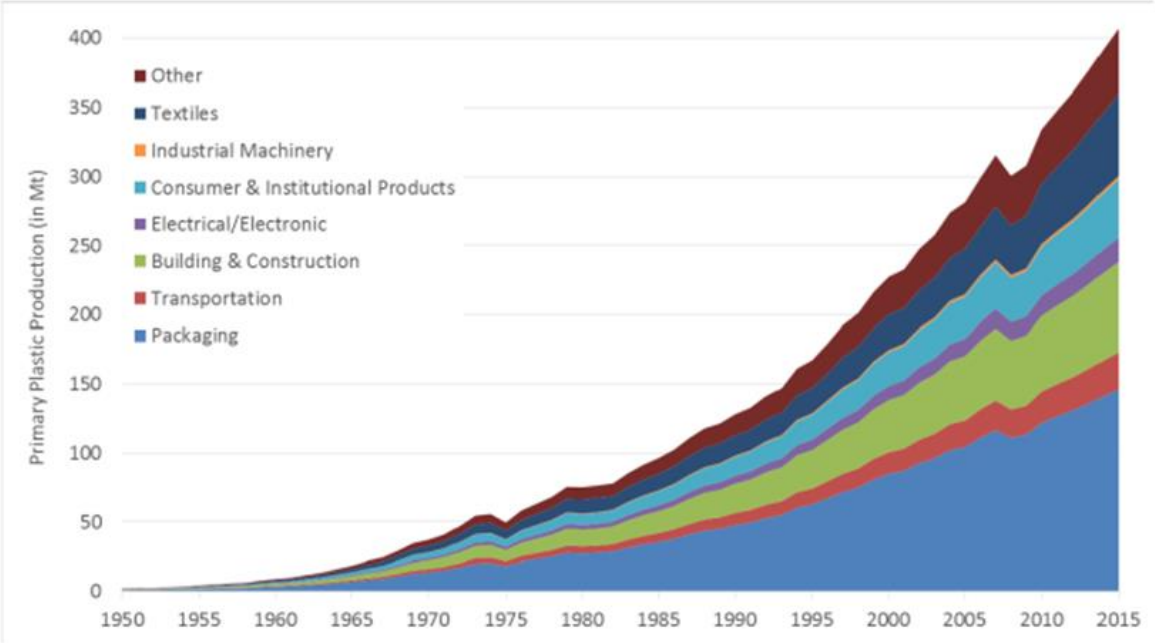

Figure 1. Global plastic production over the years [1]

There are two common categories of plastic materials; thermoplastics and thermosets. New products can be obtained by heating thermoplastics. Later, when these finished products are reheated, the plastic will soften and melt again. Thermoset plastics can also be shaped after melting. However, once they have taken a shape in liquid form, they remain solid and cannot be remelted like thermoplastics [2].

In 1974, annual global plastic consumption per capita was 2 kilograms, today it has increased to 43 kilograms, and despite all laws, the number is still expected to increase. If plastic consumption increases at its current rate, it is predicted that by 2050, 12 billion tons of plastic will be stored in landfills, according to National Geographic [3].

In the last 50 years, the role and importance of plastic in our economy has increased continuously. Global plastic production has increased twenty-fold since the 1960s, reaching 322 million tonnes in 2015. It is expected to double again in the next 20 years. Approximately 25.8 million tons of plastic waste is produced in Europe every year. Less than 30% of such waste is collected for recycling. A significant part of this amount leaves the EU for treatment in third countries where different environmental standards may apply [4].

In 2015, global plastic production reached 407 million tons (Mtpa) per year (Figure 1) (Figure 1). In this case, more plastic was produced than paper (400 Mt/year) and aluminum (57 Mt/year). If plastic production continues at this rate, it is expected to reach 1 600 Mtpa in 2050. [5].

II. Plastic Pollution

Plastic pollution is the accumulation of plastic objects and particles (for example, plastic bottles, bags, and microbeads) in an ecosystem that adversely affects the environment. Plastics defined as pollutants are classified as macro, meso or micro waste according to their size [6].

The widespread use of plastic combined with poor waste management has resulted in widespread and persistent plastic pollution. It is thought that approximately 6,300 million tons of plastic waste was produced between 1950 and 2015. Only 9% of this plastic waste is recycled. 12% was incinerated, about 80% of the remainder being deposited in landfills or in the natural environment. Plastic pollution is present in all major ocean basins of the world, including remote islands, the poles and the deep sea. An additional 5 to 13 million tons of plastic pollution are added to these ocean basins each year [5].

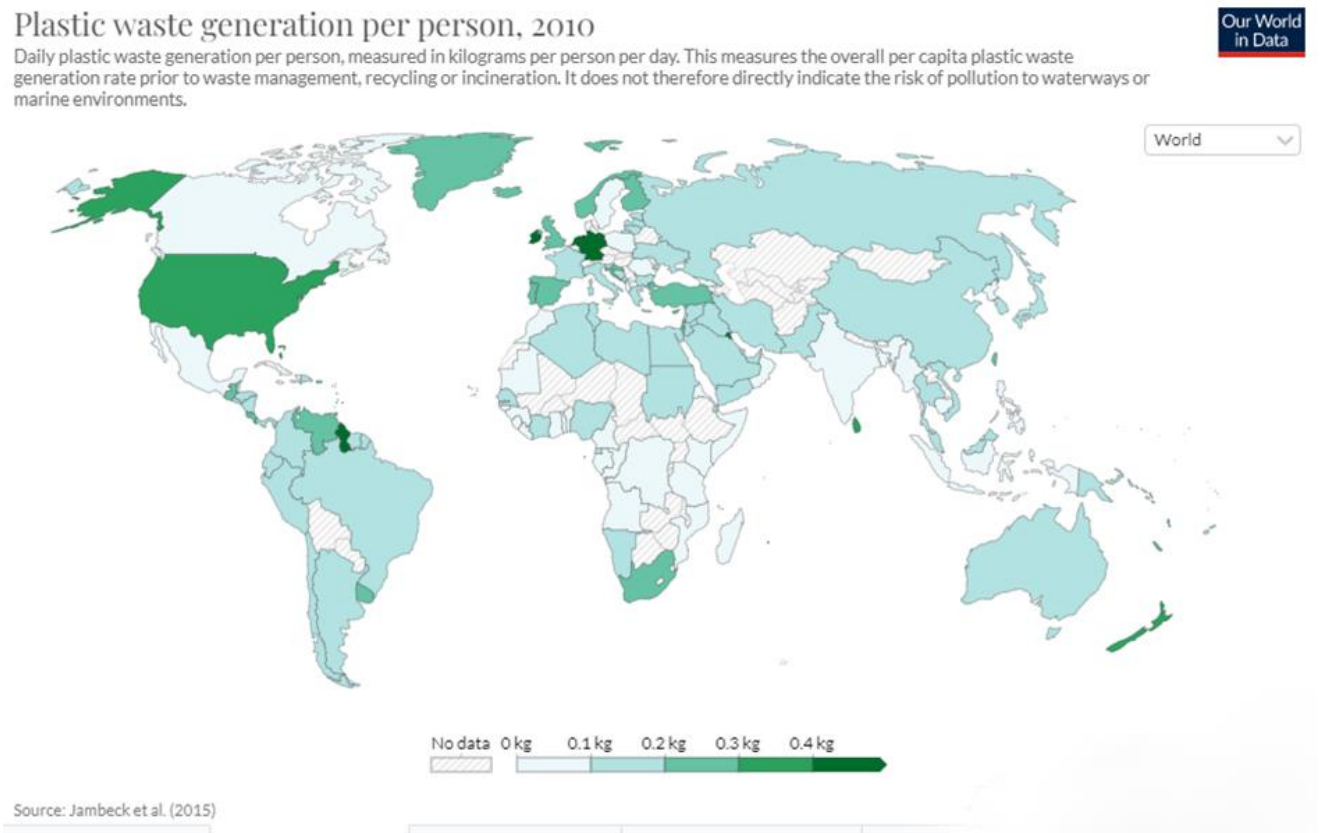

Figure 2. Amount of plastic waste produced per capita [7]

Figure 2 shows the amount of plastic waste produced per capita [7]. Plastic waste production per capita for Turkey in 2010 was determined as 0.21 kg (Figure 2) [8].

Plastic pollution also poses a risk to human health. The presence and subsequent public consumption of plastic in seafood, including fish and shellfish, has raised concerns about chemical bioaccumulation in the food chain. Plastics also enter the food chain directly. Studies have found microplastic contamination in tap water and bottled water and plastic contamination in sea salts in many countries [5],

Figure 3 presents plastic waste emitted to the ocean per capita [7].

The probability of mismanaged plastic waste being emitted to ocean is given in Figure 4 [7].

Plastic waste inputs from land into the ocean. Mismanaged plastic waste to ocean per capita (kg per year) detected as 0.17 kg for 2019 (Figure 4) [9].

Today, approximately 11% of the waste thrown into nature by the total population of 192 countries is plastics [8]. According to a report prepared by WWF (World Wildlife Fund) on plastic waste, 95% of the waste in the Mediterranean is plastic waste [10].

III. Causes of plastic pollution

The causes of plastic pollution can be stated as follows:

a) The use of plastic in all areas of life today.

b) Use of plastic bags and containers in daily shopping; With the increase in shopping activities, plastic pollution is also increasing due to the plastic used. It is stated that more than 400 billion plastic bags are used in the USA alone every year.

c) Transporting randomly discarded plastic bags and containers to the seas and oceans.

d) Plastics accumulated in the garbage, after a while, enter the soil and then mix with the groundwater, causing the pollution of the groundwater.

e) Microplastics leaking from the sinks to the waste water facility: Plastic particles smaller than 1-5 mm,

called particulates, are called microplastics. One of the most important sources of microplastics is plastic fibers and particles that mix with water from clothes and detergents during laundry [11].

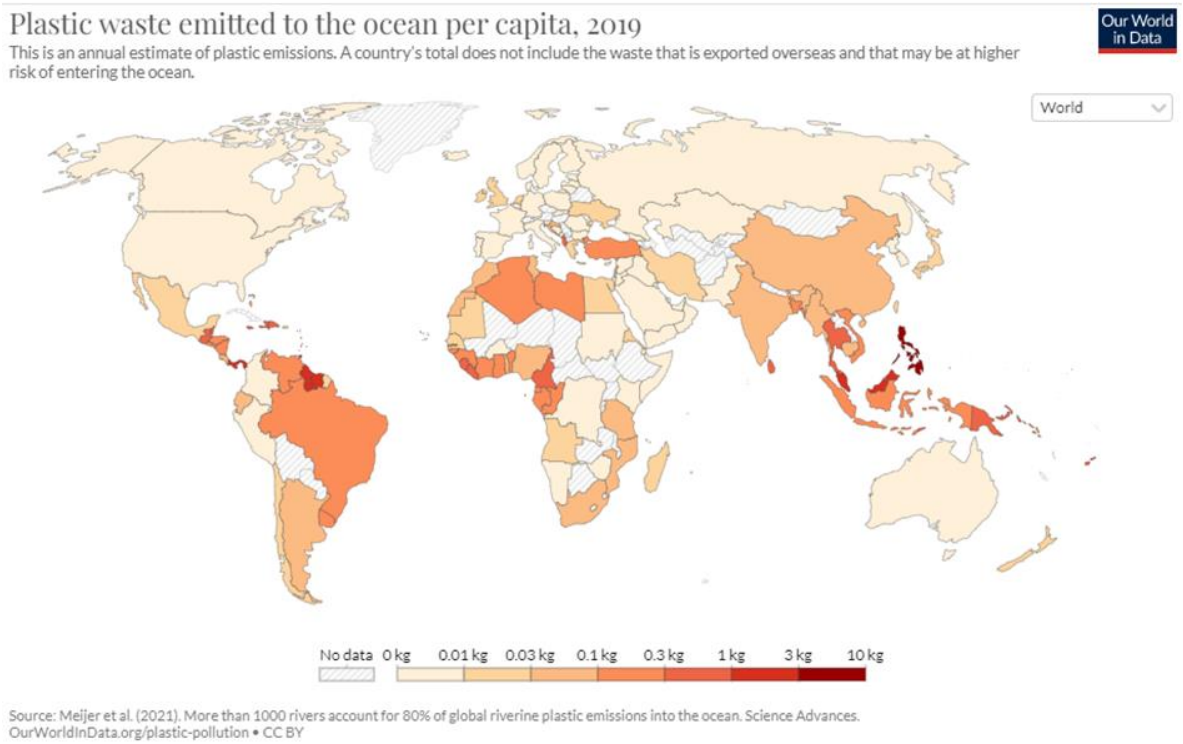

Figure 3. Plastic waste emitted to the ocean per capital, 2019 [7]

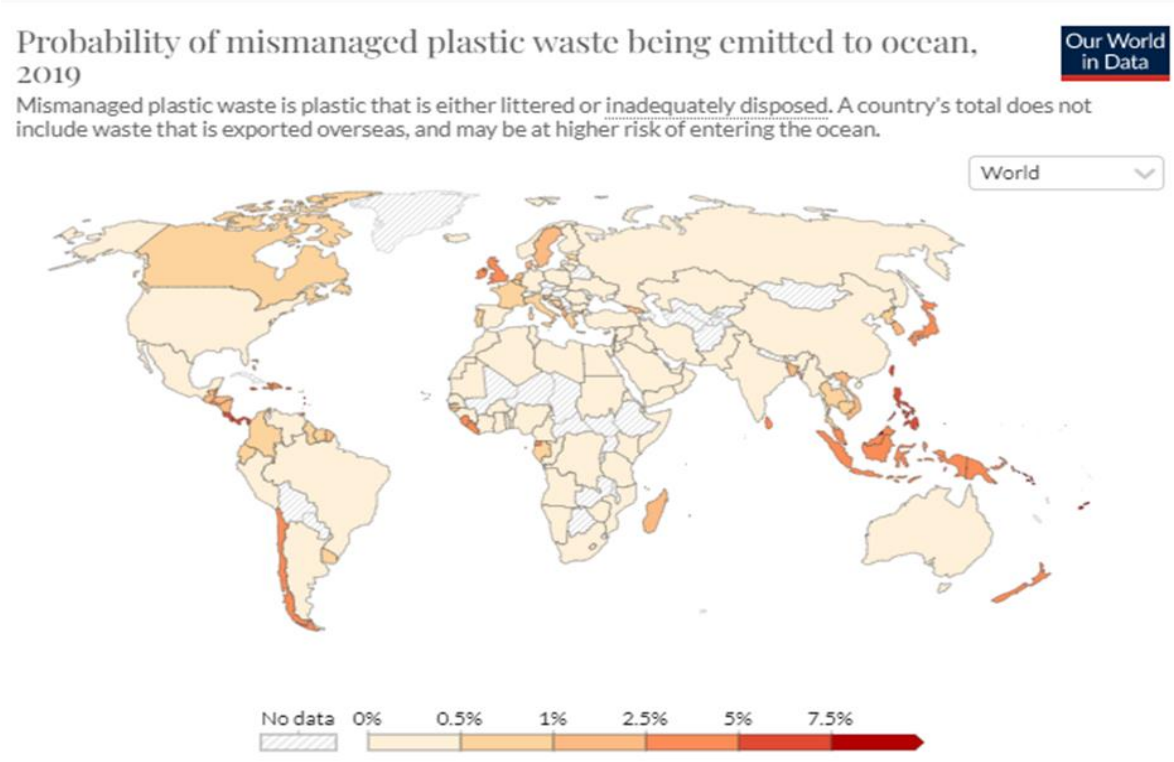

Figure 4. Probability of mismanaged plastic waste being emitted to ocean [7]

IV. What can be done to prevent plastic pollution?

Changes in product design, such as the use of alternative materials instead of plastic, can reduce the production, use and disposal of plastic in the first place. Changes in design practices, such as reducing product weight, can also help prevent the generation of plastic waste. Switching to biobased or biodegradable plastics can more directly reduce the negative environmental impacts of plastics by reducing their environmental footprint.

A high rate of waste collection and recycling will be achieved with better waste management systems. Thus, it will be possible to control it without causing environmental and public health problems.

It will be possible to eliminate plastic pollution in the natural environment with cleaning and improvement activities (activities such as beach cleaning and plastic collection technology from the oceans).

Numerous life cycle assessments (LCAs) have been conducted on the relative environmental impacts of various options for end-of-life plastic management. These studies conclude that plastic recycling has a significantly smaller greenhouse gas footprint than plastic incineration or storage [*5*].

To prevent plastic pollution, the use of plastic should be reduced. In addition, importance should be given to recycling. Of the 9.6 million tons of plastic produced annually in Turkey, only 500 thousand tons are recovered. As other measures; Reducing the use of disposable, non-recyclable products, Supporting the paid use applications for plastic bags (As of January 1, 2019, nylon bags used in shopping in our country have been paid), Turning to long-lasting and reusable products such as glass and metal in daily life, Recycling of suitable plastics Precautions can be listed, such as the use of plastics that need to be disposed of, and the recycling of plastics that need to be disposed of [*12*].

V. Footprint concept and plastic footprint

The pressure of people on nature and the productive natural space capacity they use are symbolized by the concept of "footprint". Factors such as the dietary habits of the person or communities, transportation and accommodation preferences, and the amount of waste put pressure on the natural balance and caused us to face the danger of depletion of resources [*13*].

The plastic footprint is the total amount of plastic used by a single person. This includes everything from plastic bottles to keyboards, shampoo to microbeads and nylon clothing. The difference between plastic footprint and carbon footprint is that carbon footprint is the amount of greenhouse gas that our lifestyle emits into the atmosphere; plastic footprint is the amount of plastic our lifestyle demands [3].

VI. What can be done to reduce our plastic footprint?

• Stainless steel forks, spoons and knives can be used instead of plastic.

• The use of plastic straws can be abandoned.

• Mesh or cotton shopping bags can be taken with us when going shopping.

• Instead of plastic or plastic film-coated cardboard cups in our office, we can take our own cups and consume our tea and coffee.

• Instead of drinking water from a plastic bottle; A water bowl or flask can be obtained.

• Biodegradable toothbrush can be preferred.

• The packaging of dishwashing and laundry detergents and liquid soaps can be reused. For this, we can buy large-size spare bottles of detergent and cleaning materials and fill them in our small bottles.

• Using ear cleaning sticks as much as we need.

• After using plastic packaging, we can look at how we can reuse it at home before sending it for recycling. Their useful life can be extended.

• By not seeing the plastics we use as just waste, knowing that plastics are one of the most important raw materials of recycling in the circular economy, they can be thrown into the recycling bins [14].

VII. Conclusions

Plastic waste, which takes a very long time to disappear in nature, has caused very serious environmental problems by threatening the living life in the seas and oceans. In fact, according to experts, if our world continues to be polluted with plastic waste in this way, it is estimated that there will be more plastic waste in the seas than fish in 2050. People need to act responsibly and consciously when using, consuming and disposing of plastics. When using and discarding plastic, companies must also release it into the environment in a way that does not harm the environment. To reduce the use of plastic and the amount of plastic waste; The harms of plastic use in schools and the ways and methods of reducing its use should be included in the curriculum and explained to students, and awareness of responsibility in people should be developed at an early age. The use of plastic bags in markets and grocery stores should be limited, and the use of plastic bags should be banned if necessary. The use of harmful plastic in cleaning products and personal care products should be limited and banned if necessary. For this, state and local governments should make strict inspections during the production of plastic products and derivatives. Otherwise, the environmental damage of plastic waste, which is increasing day by day due to its use, cannot be prevented and it will be inevitable for people to encounter great environmental damage and dangerous diseases caused by plastic pollution.

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