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MICROPLASTICS AND THE IMPORTANCE OF REDUCING THEM FOR THE BENEFIT OF HEALTH

José Melero

Sustainable Development and Environment
Research Group - Tecnológico Nacional de
México

Karla Aldana-Mejía

Estudiantes Ingeniería Química, Tecnológico
Nacional de México campus ITMexicali,
Mexico

Grecia López-Cuevas

Estudiantes Ingeniería Química, Tecnológico
Nacional de México campus ITMexicali,
Mexico

Sindy Pastor-Telles

Estudiantes Ingeniería Química, Tecnológico
Nacional de México campus ITMexicali,
Mexico

Argelia Melero-Hernández

Sustainable Development and Environment
Research Group - Tecnológico Nacional de
México

Dora Hernández-Martínez

Sustainable Development and Environment
Research Group - Tecnológico Nacional de
México
Campus: ITMexicali, Mexico

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Abstract: The objective of this documentary research is to carry out an analysis of the negative impact on health caused by daily use plastics that are not legislated. Currently, government regulations are prohibiting single-use plastic bags but do not pay attention to other types of plastics that have direct contact with humans, such as baby bottles, personal thermoses, bottled water that sells for millions, glasses, etc... The use of this type of products causes the direct ingestion of the microplastics that are released from them. In studies carried out on blood samples, plastic particles were found in 77% of them and of these, half corresponded to PET and 25% to styrene polymers. It is estimated that bottled water and food products extracted from the sea near the coast are the most contaminated. The danger of microplastics lies in their weight and size, which are tiny because they can adhere to red blood cells, limiting oxygen transport. They can be in the placentas of pregnant women and in babies' bottles. To prevent and counteract the use of any type of plastics, the government must legislate its use in a comprehensive manner and civil society must raise awareness through campaigns on social networks, talks, forums, among others, to be more proactive and be aware of their negative impact.

Keywords: bottled water; ingestion of microplastics; blood samples; environmental regulations.

INTRODUCTION

Much of the plastic that is discarded in the environment ends up in the seas and oceans. Water, the sun, the wind and microorganisms over time (a long time) degrade the plastic dumped into the ocean until it becomes tiny particles less than 0.5 centimeters (5 mm) long known as microplastics, but It is important to note that these plastics do not "disappear", they only become smaller and smaller pieces

(Aldana, 2022). These particles are ingested by plankton, bivalve mollusks, fish and even whales, who confuse them with food, its presence being found in up to 800 species of fish, crustaceans and mollusks (FAO, 2016). Molina et al (2021) mention that the pollution generated on the coasts is evidently anthropogenic and is caused by the poor final disposal of liquid and solid waste (the population throws their waste into the sea), this includes the hundreds of masks or face coverings used to protect against COVID-19. Given this situation of plastic pollution, due to its severity, the UN mentions it as a "planetary crisis", since there is practically no place that is saved from this pollution (AWI, 2022).

PLASTIC

Plastics come from the family of organic polymers that are formed by the polymerization of monomers extracted from petroleum (Cole et al., 2011). The main characteristic of plastics is their malleability and durability properties, which leads humans to consume said material excessively. Starting in the 1950s, its production increased on a large scale, introducing new forms of use. Figure 1 shows the evolution of the production of this material, which in 2015 was 381 million tons.

TYPES OF PLASTICS

It is estimated that the most used plastic is polypropylene, which is usually used in packaging such as bottle caps, milk formula caps, pallets, among others. This can take between 100 to 300 years to degrade organically (figure 2).

Other types of plastics

Polyester (PES) is a type of plastic resin that is always obtained from carbon. It is a thermoplastic and is mainly used in the textile industry (Servei estació, 2023; Arletex, 2023).

Polyethylene Terephthalate (PET). It is

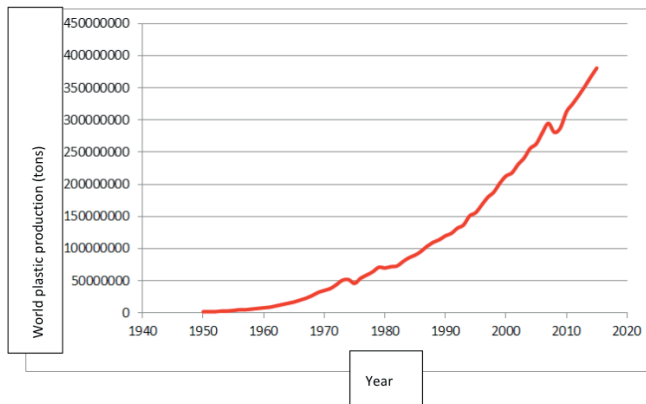


Figure 1. Evolution in global annual production of plastics. Source: <https://lalineadelmedio.com/planeta-plastico/>



Figure 2. Pallet or pallet made with Polypropylene.

Type of polymer	Acronym	Density g/cm ³	Application
Polyethylene Terephthalate	PET	0,96 - 1,45	Bottles, filling fibers, food packages
Polyester	PES/PEST	1,24 - 2,3	Textile
Polypropylene	PP	0,83 - 0,92	Packaging foams, bottle caps, laboratory equipment, straw
Polyethylene	PE	0,89 - 0,98	Plastic bags, bottles
Polyurethane	PU/PUR	1,2	Sponges

Table 1: Comparison of the main plastics



Figure 3. Microplastics found in the ocean with a diameter less than 5 mm.

a plastic with high hardness, rigidity and resistance, it is used in the food industry for the manufacture of single-use bottles and food containers. PET is one of the most recycled plastics for the production of new packaging. Its degradation time is approximately 1,000 years, it is the easiest plastic to manufacture. There are two types of polyethylene, low density (PET 1) and high density (HDPE 2). Low-density ones are used in the production mainly of single-use bags, high-density ones are used for more resistant objects such as detergent containers (Acoplásticas, 2023; Ecoembes, 2023).

Polyamide (Nylon) is a highly resistant and lightweight synthetic polymer used for the manufacture of threads for textile use or for fishing (Aceromafe, 2023).

All of these plastics and others of lesser use, unlike other materials such as paper or cardboard, do not degrade, so they end up at the bottom of the oceans, mainly in coastal areas. Table 1 shows different plastics and their use. It is observed that the density varies according to the type and use given to it in daily life.

PARTICLES SMALLER THAN 5 MM

Currently, there is still debate about what the size of the small pieces of plastic that contaminate our environment, called microplastics must be. What we must be very clear about is that these small pieces are found in all ecosystems on the planet and it is precisely their smallness that makes them dangerous and they manage to go unnoticed. This silent and almost imperceptible enemy to the human eye does not begin its life cycle that way; It gradually comes off the plastics mentioned in the previous points and is a process that lasts many years (Rodríguez and Montilla, 2021; eScholarium, 2023()).

METHODOLOGY

This documentary research was carried out at the Mexicali campus of the Tecnológico Nacional de México with the objective of carrying out an analysis of this important topic to make it known to the academic community, mainly to society in general through the different electronic media available, such as different social networks, forums, conferences, brochures, talks in classrooms and “one-on-one” awareness raising. On this campus, 10 so-called technological courses are taught, so the natural profile of its graduates goes hand in hand with the design, generation, use and use of technology (among other skills), so it will be a common practice for them to supervise and/or work with products that contain plastics, either as a work tool or for packaging. Hence the need for them and those in their charge to be aware of the use that is given to them and what it means to dispose of them (dispose of them) in inappropriate places.

With this study and its dissemination through the events mentioned below, it is intended to cover the gap that exists between the state of the art (which does exist) and the apathy to read and/or consult said knowledge.

The dissemination of the results obtained in the research was presented in the following forms:

1. In two institutional events that took place at the end of each semester in the facilities of the Institution itself called “The Hall of Science”. In the first event, the preliminary results were presented and in the second the final results, conclusions and recommendations.
2. We sought to raise awareness among society through the dissemination of the topic by providing links to videos found in the available electronic media.
3. As part of leadership training, talking about this topic with the “R11: one

on one” system was promoted, that is, providing random information to whoever wants to listen and carrying it out as a conversation between friends.

RESULTS

Below are the main findings found in the literature consulted about microplastics and their dissemination in the academic community.

MICROPLASTICS

The seas and oceans have been an essential part of any living being for more than 20,000 years. Since then, our species began to exploit this resource, but it has also been responsible for contaminating with a large volume of materials which are abandoned or discarded in seas or oceans. It is estimated that each year between 4 and 8 tons of marine litter smaller than 5 mm are found in open waters and coastal areas (Figure 3). The main form of contamination of these wastes is through industrial areas and widely populated areas that are primarily found in the Northern Hemisphere, Atlantic Ocean and Indian Ocean (Stephanis et al., 2013).

Unfortunately, this problem is not only for the seas, it has also reached the top of the world; Mount Everest (8840 m a.s.l.), where significant samples of polyester, acrylic, nylon and polypropylene fibers have been collected, which are part of the clothing and tents used by mountaineers in that extreme region of the world (Galilee, 2021).

Microplastics in animals

It is estimated that 80% of marine litter originates from plastics and some 260 marine species have directly or indirectly ingested plastics, which results in less development and that cannot be considered suitable for human consumption, in addition to the death caused by fish, cetaceans, turtles, sharks, seagulls and

others becoming entangled in multiple fibers, whether nets or bags of all sizes (Residuos Profesional, 2021; WWF, 2023).

Microplastics in humans and in drinks

Although at present there is no certainty of all the harmful effects on humans, the impact of both micro and nano plastics that swarm in the environment is undoubted. The main route of acquisition of these plastic particles by humans is through the ingestion of food products, consumption of drinking water and even through inhalation or dermal contact (Thompson et al., 2009). Food can be contaminated by direct exposure to the environment or by trophic transfer from organisms lower in the food chain (plankton) to those that are edible for humans (Morillo-Velarde, 2021).

Analysis of blood samples from anonymous donors showed that plastic particles were found in more than 70% of them; In half of these samples there was PET, in a third there was polystyrene and in a quarter there was polyethylene. On average, 1.6 micrograms of plastic material were measured for every millimeter of blood. The dangerous thing about this is that this tiny material can stick to the outer membranes of red blood cells, limiting their ability to transport oxygen to the body. Likewise, more than 80% of samples taken from patients undergoing surgery reveal particles of this material. Likewise, particles that are capable of crossing cell membranes and entering the bloodstream have been found in the placentas of pregnant women. A baby who for some reason does not receive breast milk is prone to receiving thousands of these microparticles through bottles, either due to their release when preparing the milk formula or in the process of heating the water or the excessive shaking of the bottle itself (Smg, 2020). The ingestion of microparticles through food products ranges from the domestic use of sea salt (Koelmans et

al., 2019) to the consumption of tap and bottled water (Kosuth et al., 2018; Rodríguez, 2021).

Microplastics in fishing in Mexico

Figure 4 shows a study carried out in three different regions of Mexico (La Paz, B.C.S., Puerto Morelos, Q.R. and Veracruz), in more than half of the fish collected at least one plastic piece was found such as fragments of bags and nets, this suggests the presence of microplastics in these fish (Reyes and Lorenzo, 2019).

The ingestion of micro or nanoplastics can cause intestinal blockage or create a feeling of satiety that leads fish to reduce or lose their ability to feed, this results in the reduction of growth and/or reproduction rates of marine fauna which is indispensable for human sustenance. Along with these problems, another negative effect is that some micro or nanopollutants can be retained (adsorbed) on the surface of the microplastics, which are then transported along with the microplastic particles to the intestines or digestive tract (Li et al., 2018). For this reason, people who have a predilection for bivalve mollusks such as mussels, clams, oysters, among others, must be especially careful because these organisms are consumed in their entirety by humans (Wright et al., 2013).

DISSEMINATION OF RESULTS

Figure 5 shows the “Science Hall 2022-1” event where the preliminary results of this research were announced. In this first opportunity, the academic community was informed of the meaning of the indiscriminate use of plastics and how these become microplastics that can be ingested by living beings without anything preventing them.

This institutional event, where family members and students from other institutions are invited, is held at the end of each semester and brings together an average of 600 people,

including students (85%), teaching and administrative staff, and family members (15%).

Figure 6 shows a view of the attendance at the second institutional event where the final results, conclusions and recommendations were presented. It was carried out using a poster, the results, conclusions and recommendations reached by the work team in this investigation were explained to the attendees (without face masks).

CONCLUSIONS/ RECOMMENDATIONS

The review of the state of the art on this important topic indicates that there is an increasing content of microplastics in bottled water, so it is very likely that there will be greater contamination by microplastics as there is greater processing of these and due to emerging knowledge. Scientific knowledge of the above does not allow us to affirm what the adverse effects of ingesting these microscopic particles are; It is necessary to continue obtaining more scientific evidence (Rodríguez, 2021).

In the presentations that were carried out to present this research, the work team realized that the majority of students did not know about the negative effects of microplastics, they did not know how they were generated or how to avoid them. It is amazing to experience the eagerness to learn about these issues and how to minimize them, but promoting these issues does not necessarily make people definitively change their habits or behaviors. In fact, students normally sign up to support and disseminate them, but it is necessary to work and constantly promote these issues in order to generate a permanent impact on them and on society (Hernández et al, 2022; Delgado, 2019).

Some advice or recommendations that are given to those interested in learning more

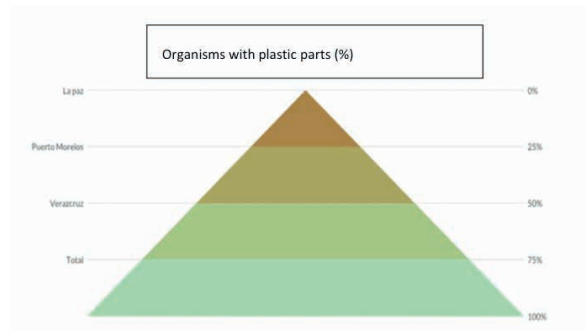


Figure 4. Marine fauna with plastic pieces (%)



Figure 5: Preliminary report on the impact of plastics on living beings



Figure 6: Work team stand

about and applying this topic to achieve the goal of zero waste are:

- Minimize the use of plastic water bottles
- It is better to use stainless steel bottles
- Reduce and-or eliminate plastic straws (straws)
- These are reusable
- Use reusable plastic bags for your errands.
- They were taught to make their own bags with canvas to use them many times
- Avoid buying some products wrapped in plastic
- Mainly fruits and legumes
- Avoid as much as possible the use of disposable products (commonly called foam)
- This is one of the issues that cause the most resistance to eliminate its use
- Avoid or eliminate the use of disposable diapers (they last up to 400 years to degrade)
- Although most of those who receive this information about diapers know it and these types of cloth products are already sold today, washing them to reuse them is a titanic task.

The large amount of microplastics found in practically all ecosystems not only in Mexico, but throughout the planet indicates a serious deficiency in their management, and also highlights evidence of the poor regulation carried out by governments in this regard, which is causing a deterioration. increasingly noticeable environmental. Therefore, it is of utmost importance to be aware of the use of plastic and its consequences. Environmentally educating the population, technically and financially supporting research and

implementing strict application of existing regulations are necessary to prevent this problem from continuing. In fact, it is not so necessary to develop new laws and regulations, it is enough to apply the existing ones.

It is possible to reduce plastic consumption if we use other materials, such as glass or cardboard, reuse and recycle some plastic products, such as canvas, bags, containers, packaging, etc. In addition to the fact that society in general must stay informed and updated on this topic from reliable sources, this is also extremely relevant.

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