

Plastic and microplastic: Macroproblems



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SCUOLA

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PLASTIC AROUND US

If you look around and try to guess what materials are the objects that you use every day made of, you will see that most of them are plastic. Food containers, such as bottles of water and soft drinks, shopping bags, shampoo containers, disposable plates, glasses, cutlery, straws, the pen, the ruler, the folder, the glue stick, the mobile phone, the computer, the remote control, chairs and tables, the clothes made of synthetic material. The list goes on: we are living in a period that has been called the "**Plasticene**", the era of plastic.

The world production of plastic is about 350-400 million tons per year, a huge amount. Plastic is a very used material because it has a low cost and unique characteristics, it is versatile, lightweight, hygienic, and particularly durable. The problem is that many of the plastics, especially packaging, are used for a very short period of time, only a few months. Then, they are thrown away, burned or abandoned in the land or in the sea, where they can remain for hundreds or thousands of years. Plastics break into smaller fragments by the action of atmospheric agents and UV rays from the sun. Plastic pieces smaller than 5 mm are called **microplastics**; they can be very little and not visible to the naked eye, they can be observed only under a **microscope**. Microplastics have different colours and shapes, can be filaments, spheres, sheets, granules (Figure 1).

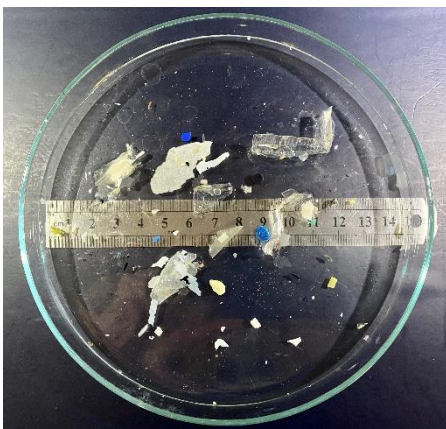


Figure 1. Plastic fragments collected during a sampling of zooplankton in the Ligurian Sea, off the coast of Livorno (courtesy of Dr. Nicola Nurra, Pelagosphaera, University of Turin). The photograph shows all the fragments collected in about 200 m³ of sea water, corresponding to about half of the water contained in a sports pool.

Microplastics are small, but represent a macro-problem, perhaps even more than plastic. In fact, microplastics that are in the sea can be ingested by aquatic animals which can confuse them with food particles. Microplastics accumulate in the stomach and intestine, reducing the possibility of taking food and compromising the survival of the organism; sometimes they can also migrate and accumulate in other tissues of the animal.

Larger marine organisms can take microplastics indirectly, eating other contaminated animals. Through the food chain, microplastics can cause health problems for both animals and humans. Microplastics end up in our plate through fish and seafood, such as molluscs, but also through sea salt and water. It has been calculated that in a single week we eat up to 2000 fragments, a total of about 5 grams of plastic, the weight of the pen that you use every day.

Plastics and microplastics pollute the sea, but not only. Microplastics have been found in the rain, in the snow, in the alpine glaciers, in the arctic areas, in places far from the cities. The problem therefore affects the whole Planet, we are all involved.

MICROPLASTICS AS VEHICLES OF CONTAMINANTS

One problem with microplastics is that they can be composed by toxic components and can also absorb and carry many other contaminants presents in the sea. These include molecules called **endocrine disruptors**, which can interfere with the **endocrine system** of animals, including humans. Endocrine disruptors alter the normal regulation of development, growth, reproduction, metabolism, immunity and behaviour. Numerous studies indicate a relationship between exposure to these contaminants and the increase of problems such as male infertility, early puberty, obesity, diabetes, some forms of cancer.

MICROPLASTICS UNDER THE RESEARCHERS' LENS

Microplastics are a “hot-topic” for scientists.

Some researchers are evaluating the presence of microplastics in the environment; they take samples from the sea, rivers, glaciers, then they proceed with microplastics characterization, they evaluate shape, size, number, material of which they are formed.

Other researchers are more concerned with the effects of microplastics on living beings; they study the effects they have on aquatic organisms, such as molluscs and fish, or laboratory animals.

Other scientists study the microplastics in human beings. Very small plastic fragments have even been found in the placenta, the organ that serves to feed and protect the foetus; therefore, even before birth, children can be exposed to microplastics, with consequences that must be clarified.

In our laboratory at the University of Turin, we have demonstrated that chemical contaminants carried by microplastics collected in the sea cause fat to accumulate in specialized cells and thus could lead to obesity (Figure 2).

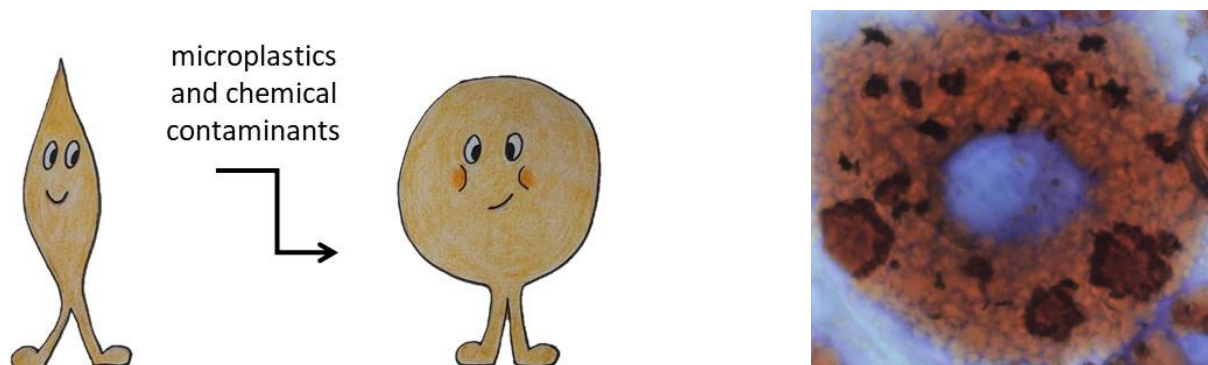


Figure 2. Microplastics can carry contaminants that stimulate the adipocytes (fat cells) to accumulate fats and to change their shape, becoming round such as soccer balls.

On the right you can see a photograph taken under the microscope. The cytoplasm of the cell is full of fats (stained in red; the nucleus is coloured in blue).

WHAT CAN YOU DO TO FIGHT THE PLASTIC POLLUTION?

Yes, *you* can do a lot in your normal daily life! For instance:

- Do not leave plastic on the beach, in the sea, at the playground, in the streets
- At school, at the sport field and while you are travelling, use your water steel bottle instead of plastic bottles
- Try not to use disposable dishes, cutlery, plastic straws
- Reduce, reuse, recycle plastic
- And above all, become the "master": teach good behaviours to your friends and family.

Glossary

Plasticene: plastic is so present and used in the world today, that we can say that we live in a new geological era, the Age of Plastic

Microplastics: small plastic fragments, maximum 5 mm (half a cm) large

Microscope: scientific instrument used to see very small living organisms and objects in high definition; depending on the type of microscope used, different final magnifications can be obtained, ranging from 40 times to even 500,000 times

Endocrine disruptors: chemical compounds that our body can exchange for hormones, the natural "postmen" carrying information for the regulation of all physiological functions

Endocrine (hormonal) system: it is formed by many glands distributed throughout the body; these glands produce hormones that, conveyed by the blood, reach all the cells of the body

SITOGRAPHY

https://www.reach.gov.it/sites/default/files/allegati/SostanzeChimiche_AmbienteSalute_Microplastiche_.pdf (Bollettino di informazione: “Le microplastiche” - Ministero della transizione ecologica)

<https://www.mite.gov.it/pagina/decalogo-il-cittadino-sugli-interferenti-endocrini> (“Conosci, Riduci, Previeni gli interferenti endocrini. Un Decalogo per il cittadino sugli interferenti endocrini” - Ministero della transizione ecologica)

<https://www.youtube.com/watch?v=sQaeUeOH5MU&list=PLr2fsmC87aFw0oj4gSGd3AGD Sud4Kk5Kc> (“Le colture cellulari per studiare gli interferenti endocrini” - Finestre sulla ricerca di Sharper – La notte dei ricercatori 2020)