



Editorial

Tobacco as a Source of Microplastics. Tobacco and Environment: World No Tobacco Day 2022



El tabaco como fuente de microplásticos. Tabaco y medioambiente: Día mundial sin tabaco 2022

World No Tobacco Day is celebrated on May 31, an event promulgated by the World Health Organization (WHO) with the aim of informing and raising awareness of the harmful and lethal effects of tobacco consumption. For this year 2022, the theme chosen for the campaign is *Tobacco, a threat to our environment*,¹ and aims to raise awareness among the general public about the environmental impact of tobacco, from its cultivation and production to its distribution, not to mention the waste it generates. This campaign will give tobacco users another reason to quit.^{2,3}

Indeed, the impact of tobacco on the environment begins with the cultivation of the plant, through curing, manufacturing, transport, consumption and the so-called post-consumption (second-hand tobacco [SHT], third-hand tobacco [THT] and fourth-hand tobacco [FHT]). It should not be forgotten that for some years now nicotine also has been consumed using electronic devices, the so-called electronic cigarettes (EC), which are also known to produce second-hand (SHV) and thirdhand vapor (THV) and environmentally polluting residues.^{4–9} Tobacco, in addition to its already proven and known toxicity, has been registered as a clear emerging contaminant, since both cigarette and EC consumption are also a source of exposure to heavy metals that are also considered contaminants: rare earth elements (REE), which come from the use and consumption of technological and electronic devices and which, when deposited on the ground, are absorbed by the tobacco plant and can accumulate. These are the so-called e-waste.^{4,10} As for FHT, up to 2/3 (4.5 trillion) of the cigarette butts (CB) consumed in the world end up being thrown on the ground, in the environment,^{2,3,11} but it is not only the volume of this waste that is the problem, but also the chemicals and toxic products they contain. The so-called THT and THV, is the accumulation of SHT and SHV gases and particles that accumulate on dust, surfaces and objects in indoor environments, as well as on atmospheric particles in outdoor environments.^{2,3,5,7,12} They have an effect on the environment and air quality, persist in homes even up to six months after smoking cessation, and can also react with oxidants and other components of the environment generating secondary pollutants, some of them even more toxic than their precursors.^{2,3,7,12}

Epidemiological studies that associated tobacco consumption with lung cancer¹³ have favoured the modification of cigarette design by tobacco industry.¹⁴ Since 1950, cigarettes have reduced

the nicotine and tar content, as well as that of other tobacco components. This reduction has been brought about by the incorporation of filters in cigarettes (with or without side holes), the selection of the type and variety of tobacco, the use of a more porous paper to wrap the tobacco, the use of cigarette smoking machine, as well as the incorporation of reconstituted tobacco into the blend.¹⁴ Most cigarette filters are made of a non-biodegradable material.^{11,13} Although the filter has been understood as a barrier that aims to eliminate toxins, thus reducing harm, it is currently known that it does not offer health benefits to smokers, and inhalation of the fibres also affects them.¹³ Fragments of the material from which the filters are made are separated from the filter during manufacture and are released when the cigarette is inhaled.¹³ The filter of most cigarettes in the West is made of cellulose acetate, a plastic that is neither biodegradable nor compostable,¹³ which is dissolved and spun into continuous synthetic fibres arranged in a bundle called tow, which is plasticized, molded and cut to a suitable length to act as a filter.¹⁴ These filters are a rod of 15,000 fibres and are a source of microplastics (MP).¹⁵

The MP as pollutants are small fragments (size range: 1 nm to <5 mm) (Fig. 1) of non-chemically modified and non-biodegradable polymers that have been found contaminating every ecosystem.¹⁶ Cigarette filters are recognized as a proven source of MP,¹⁵ and additionally, CB discharge toxic substances, such as nicotine, carcinogenic tar, and polycyclic aromatic hydrocarbons, that have strong toxic effect, which will cause serious damage to aquatic organisms.^{4,17} CB are one of the most common plastic pollutants in the environment, specifically, the smoked cigarette filters.^{15,17} When CB reach the environment might suffer a quick release of the strands, which can be detached as a microfibers (MF), or get fragmented over time. Large concentrations of fibres have been identified polluting the deep ocean sediments, which can be partially attributed to the strands detached from littered CB.¹⁵

Belzagui et al.¹⁵ found that CB detach approximately 100 small MF (<0.2 mm) per day, so, in a rough estimation, about 0.3 million tons of potential MF might be annually reaching aquatic environments from this source (Fig. 1). After entry into the ocean, MP can become globally distributed and have been found on beaches, in surface waters, seabed sediments and in a wide variety of biota (invertebrates, fish, birds, mammals), from the Arctic to Antarctic.¹⁶

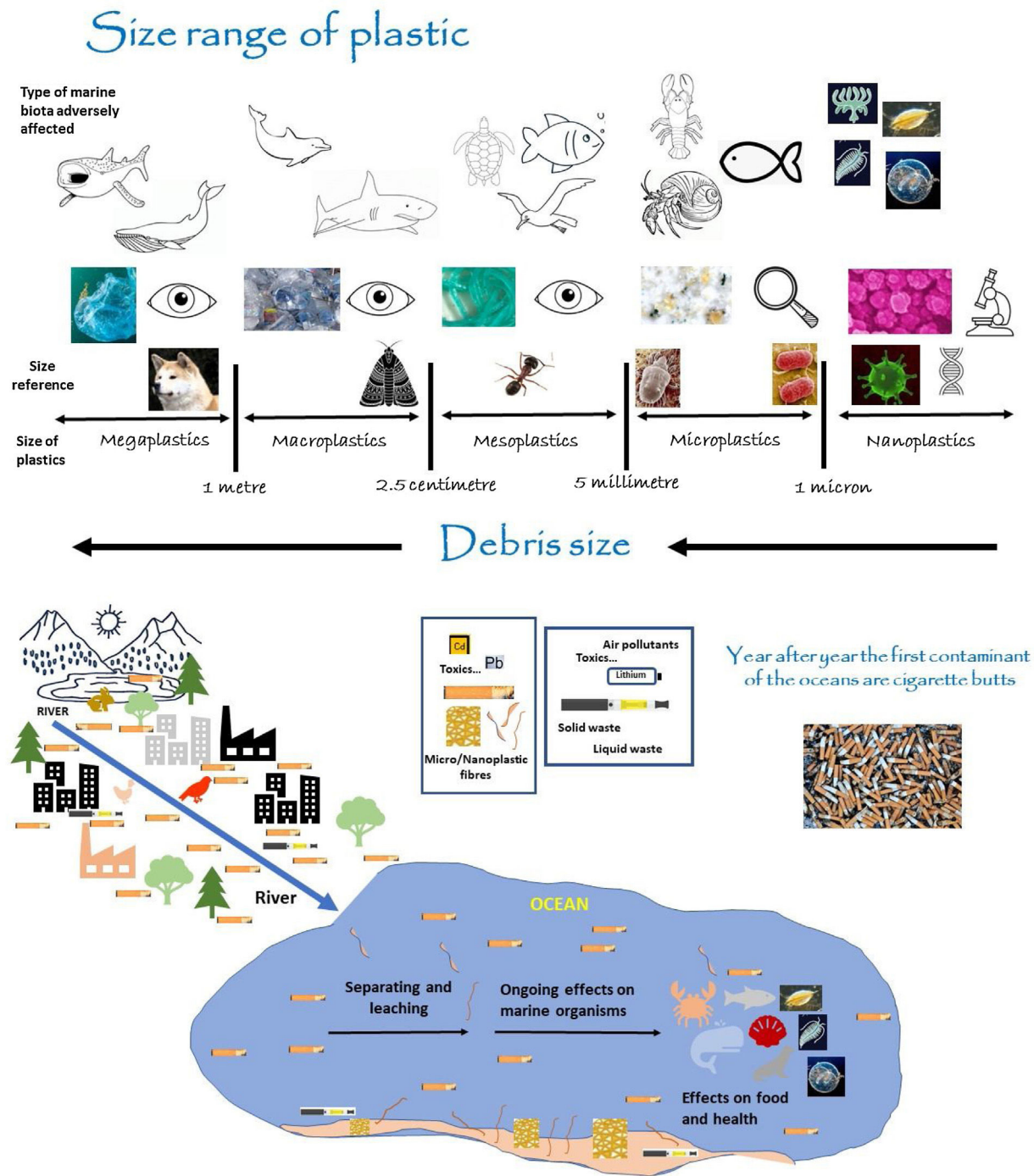


Fig. 1. UP: size range of plastic pieces (A more scientifically rigorous definition of plastic pieces might refer to nano-, micro-, meso-, macro and mega-size ranges, although this has not yet been formally proposed for adoption by the international research community, Ref.: 16). BELOW: Fates and effects of smoked cigarette butts in the environment. Modified from Ref.: 17.

MP from CB are non-natural harmful particles with low degradation rate, which means potential high exposure and risk to aquatic environment and can be introduced into the food chain because they are easily ingested by a variety of aquatic organisms causing toxicity to fish and microorganisms.^{16–18} Particles at the smaller end of the size spectrum (It has been shown that CB even act as a transport for nanoplastics by absorbing them¹⁹) have been shown to cross membranes into cells, some tissues have been shown, in vitro, to exhibit a response to the presence of particles; i.e., causing inflammation and cell damage, followed by healing responses and fibrous encapsulation of particles.¹⁶ The potential accumulation of

MP in the food chain, especially in fish and shellfish (species of molluscs, crustaceans and echinoderms) could have consequences for the health of human consumers.¹⁶

We cannot forget the current use of EC and devices that heat tobacco, they pollute the environment and require an appropriate disposing of “vape” cartridges and lithium-ion batteries because it contains heavy metals and without proper disposal, could release toxic chemicals to the environment.⁵

Smoked CB are the most encountered type of litter around the world. When smokers discard their butts into the environment, the single-use plastic filter, the remnant tobacco and paper wrap

and the toxic compounds that remain in them cause harm to the environment. Cigarette filters are composed of more than 15,000 fibres strands which can be detached in a MF size range or eventually get fragmented into lower sizes. This MF can be introduced to the trophic chain and can be easily ingested by a wide range of organism including human. Therefore, a new form of pollution from cigarettes is added to the environment with proven damage to ecosystems and therefore to humans. This pollution cannot be ignored and should be treated by the scientific and social communities as an important MP source that harms our planet and its biodiversity.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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