MICROPLASTICS & NANOPLASTICS
IN THE MARINE ENVIRONMENT

I will start this editorial with some staggering numbers. Every year worldwide, more than 8,000,000 tons of plastic end up in our seas. In a business-as-usual scenario, this is expected to increase to 16,000,000 tons by 2030 and 32,000,000 tons by 2050. If no action is taken our seas are expected to contain 1 tonne of plastic for every 3 tonnes of fish by 2025, and by 2050, more plastic than fish by weight.[1]

Biodegradation of plastic is a process that results in total or partial conversion of organic carbon into biogas and biomass associated with the activity of microorganisms (bacteria and fungi) capable of using plastic as a carbon source.[2] This process is temperature-dependent and, in some cases, complete degradation can only be achieved above 50°C. Such conditions are rarely met in the marine environment. In addition, the polymers most commonly used (e.g. polyethylene & polypropylene) are not readily biodegradable; they are only subjected to weathering and fragmenting into micro- and nanoplastics; these remain in the environment for hundreds of years.

Microplastics are considered to comprise plastic particles ≤ 5mm which may fragment to secondary nanoplastics. These are generally considered to include plastics ≤ 100nm. The microplastics released in the sea primarily originate from laundering of synthetic textiles [which release fibre-forming polymers], tyre tread abrasion of car tyres & city dust [including abrasion of objects such as synthetic cooking utensils and abrasion of infrastructure such as building coatings].[1]

One overlooked consideration relates to the additives which are found in plastics such as stabilisers, plasticisers, flame retardants and pigments. It is estimated that approximately 225,000 tonnes of such additives are released into our seas annually. This number is envisaged to increase six-fold to 1.2 million tonnes per year by 2050.[1]

The micro- and nanoplastics enter the food-chain through their ingestion by zooplankton and small fish; studies have also identified sea-salt as an entry point.[3] On a side-note it is also worth noting that synthetic fibres have also been detected in beer, honey, sugar and tap water!

In the food-chain, the impact of nanoplastics and microplastics on humans is not well-understood. Studies have been advocated in the following areas:

- The effect of microplastic and nanoplastic ingestion and accumulation on the microbiome and on the embolization of small vessels, inflammation and immunoreactions;
- The amount of microplastics and nanoplastics in food and when these are transferred between trophic levels such as when fish products are used to feed poultry and livestock.

I wish to end this editorial with the following ponderation. A global study[4] published in 2017 presented the first global analysis of *all mass-produced plastic ever manufactured.* It revealed that approximately 9% has been recycled, 12% incinerated, and 79% accumulated in land-fills or the natural environment. Against this backdrop, we must talk the talk and walk the walk. Taking Japan as an example it managed to achieve 90% recycling of plastics by reducing drastically the production of **coloured** plastic bottles. Industry agreed to make transparent PET. Previously it produced blue, green and red plastic containers which, upon recycling, produced amber-coloured plastic which no-one wanted to re-use.

Everyone has the responsibility to be the guardian of future generations. We must ACT… now…

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Publisher:
Medical Portals Ltd
The Professional Services Centre
Guzi Cutajar Street, Dingli
Malta, Europe

Production: Outlook Coop

Printing: Europrint Ltd

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GMMS German-Maltese Medical Society · MMSA · MPSA · ADS

The magazine is distributed free of charge to all Maltese doctors, pharmacists & dentists, as well as students of the aforementioned professions, with a print run of 3500 copies.

Annual subscription rates outside Malta: Six issues €90 or equivalent, worldwide