

Hong Kong as a hotspot of microplastic pollution

Small plastic debris, known as microplastics, is an emerging global environmental issue affecting different water environments, in particular, the oceans. Most scientists classify microplastics as plastic debris with a particle diameter of less than 5 mm. They can be manufactured in this size class or they can also be a degraded product of larger plastic debris in the environment. Spillage and littering from marine vessels and direct inputs from coastal activities are some of the common ways that plastics can go into the oceans.

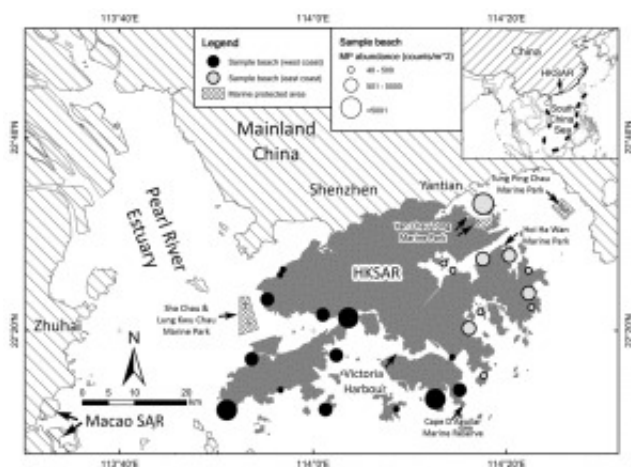


Fig. 1. Locations of the 25 sample beaches (circles). The size of the circle is proportional to the microplastic abundance at that beach. Black circles are beaches on the west coast and grey circles are those on the east coast.

Unlike larger plastic refuse, the sizes of microplastics overlap with the food sources of a variety of marine organisms, including zooplanktons, fishes and sea birds. Accidental ingestion of microplastics by organisms is known and common. Ingested microplastics not only can cause internal abrasion in the organism's digestive system, but the toxic organic pollutants adsorbed to the surface of the particles, such as pesticides, can also transfer to the organism, leading to health problems and even death. In order to formulate effective mitigation measures on this issue, one has to understand the distribution, quantity and characteristics of microplastics in the environment.

With over 500 beaches formed along the coastline of Hong Kong, the local marine environment is susceptible to microplastic pollution. In 2014, we surveyed 25 sandy beaches in Hong Kong during the rainy season (Fig. 1). At each beach, plastic debris were separated from sands, sorted and counted. Microplastics (< 5 mm) was also put into two groups: (1) EPS and (2) fragments.

Our samples consist of a total of more than 154,000 plastic items collected from 25 beaches. 91%

of them were microplastics and among which, EPS were most abundant (92%). The dominance of EPS in the plastic mix is not surprising because EPS are extensively used in China and in Hong Kong as buoys, take-away food containers and insulation boxes for fresh and refrigerated food. During the rainy season, mismanaged EPS debris follows the rainwater, going into the storm water drains and streams, then into the ocean. Some of them will be transported by currents and strand on the beaches. The average number of microplastic pieces found on these 25 local beaches was 5,600 items per square metre. Comparing to similar studies carried out in South Korea and Easter Island (Fig. 2a), the abundance of microplastics in Hong Kong's is 50% higher than that of the former and 7 times higher than that of the latter. This indicates that Hong Kong is a hotspot of microplastic contamination.

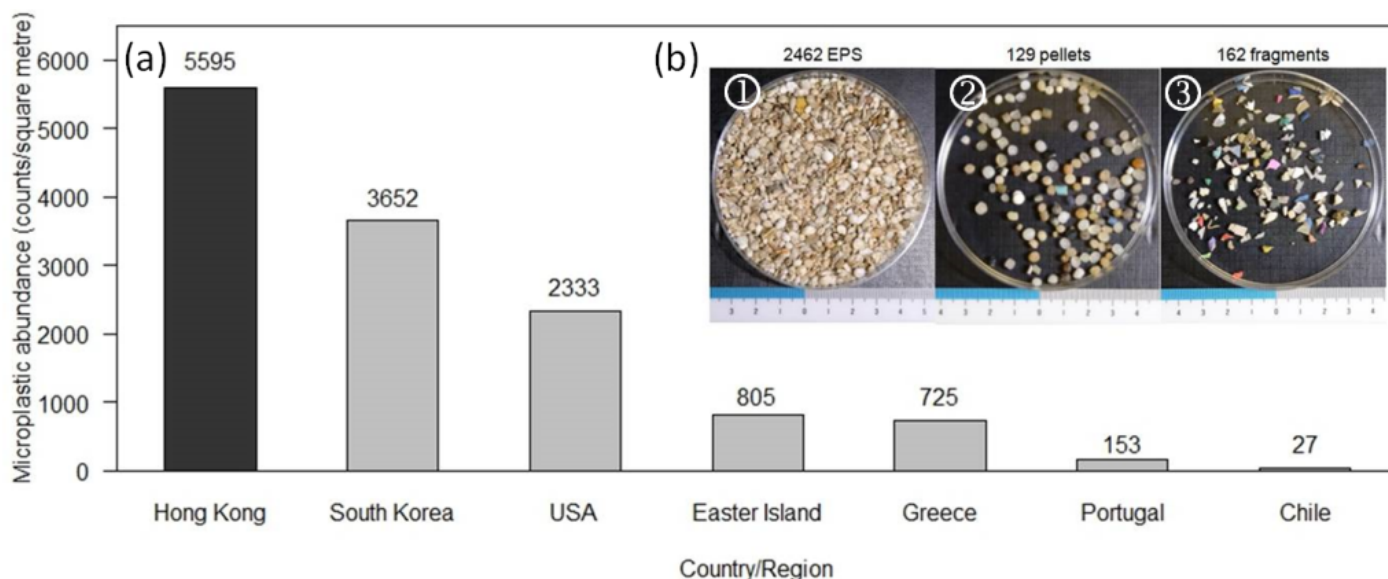


Fig. 2. (a) Bar chart comparing the average microplastic abundance at beaches of Hong Kong with other regions/countries; (b) microplastic sample collected from a beach in Victoria Harbour. Microplastics were classified into three groups: (1) expanded polystyrene (EPS), (2) fragments and (3) pellets.

Statistical analysis confirms that microplastics were significantly more abundant on the west coast of Hong Kong than the east coast (see Figure 1 for definition). This suggested that the Pearl River, lying to the northwest of Hong Kong, is a potential source of the local plastic pollution. In addition, the numbers of small EPS and fragments are also found to be closely associated to those of their large counterparts, which suggested that the break-down processes of larger plastic debris are also responsible for the large number of microplastics found on the beaches. Although beach clean-up activities may remove large plastics and thereby reducing microplastics, there is no doubt tackling the plastic pollution from source is the best way to prevent plastics from going into the ocean. Once plastics have found their ways into the ocean, they are extremely difficult and costly to be removed.

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