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Covid-19-derived plastic debris contaminating marine ecosystem: Alert from a sea turtle

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The Sars-CoV-2 (Covid-19) coronavirus pandemic has made drastic changes to human lives since January 2020 (Nicola et al., 2020). During the pandemic, the consumption of personal protective equipment (PPE) such as face masks has increased substantially. Some such items escape appropriate waste management and end up in the ocean (Prata et al., 2020; Parashar and Hait, 2021). This improperly discarded PPE has become a concern as a threat to marine life (Hiemstra et al., 2021; Gallo et al., 2020; Parashar and Hait, 2021). This study indicates that changes in human life in the pandemic are beginning to affect marine life. Precautionary actions including establishment of appropriate waste management of personal protective equipment and use of safe additives are urgently needed.

On 10 August 2021, a face mask (14 cm × 9 cm) was found in the feces of a juvenile green turtle, by-caught alive in a set net off the northeast coast of Japan. Although sea turtles have been monitored in this region over the last 15 years (n = 76), face masks had never been found before the Covid-19 pandemic and this is the first detection. Fourier-transform infrared spectroscopy identified the mask as polypropylene. Estrogenic active benzotriazole-type UV stabilizers standards. The relative standard de...
FTIR analysis identified the mask as polypropylene, a common material used in disposable face masks. The total 42.9 g of fresh feces held 35.1 g (81.8% of the total mass) of artificial debris, including the mask; 3.3 g (7.7%) of natural debris (wood fragments); and 2.3 g (5.4%) of Pedunculata (gooseneck barnacles) (Table 1). Other items (Sargassum, Zosteraceae, natural debris) were found in small amounts (<2 g, Table 1). These items have been found in previous dietary study in this region (Fukuoka et al., 2016). The polymers in the artificial debris were identified as plastic (mainly polypropylene and polyethylene) which considered to have floated or drifted near the surface owing to their low density. Wood fragments and gooseneck barnacles can float or be attached to drifting materials. Sea turtles often ingest floating or drifting debris near the surface (Casale et al., 2008; Fukuoka et al., 2016). Hence, we considered that this turtle ingested the drifting face mask while feeding near the surface.

As the pandemic continues, the usage of disposable PPE continues. Unless appropriate waste management is instituted, the ingestion of PPE and its breakdown products, such as microplastics, will increase in a variety of marine life very soon (Prata et al., 2020; Parashar and Hait, 2021; Hiemstra et al., 2021; Gallo Neto et al., 2021). The turtle in this case excreted the mask; however, the physical consequences of debris ingestion in many marine species are under discussion (Kühn et al., 2015). Polypropylene masks are widely used to control corona virus spread. However, plastics potentially contain endocrine-disrupting additives and can sorb hazardous chemicals from seawater (Teuten et al., 2009). In fact, we detected benzotriazole-type UV stabilizers (UVPS, UV329, UV9, UV327, and UV234) in 4 out of 5 brands of face masks we tested, at 1.4 to 848 ng/g (Table 2). This concentration range is similar to those detected in plastic bottle caps, shopping bags, and food packaging (Sakuragi et al., 2021). Estrogenic activity of UVPS and UV329 was recently reported (Sakuragi et al., 2021), and aryl-hydrocarbon-receptor ligand activity of UV9 was reported (Nagayoshi et al., 2015). Thus, exposure of marine organisms which ingest PPE wastes to the chemicals and the consequent endocrine-disruption are of further concern. It is therefore urgently needed to study the ecotoxicological consequences of the ingestion of waste PPE by marine organisms and physical injuries. As a precautionary action, it is necessary to establish appropriate waste management systems to stop the entry of PPE into the environment, and the use of safer additives to PPE (Takada et al., 2022).

CRediT authorship contribution statement

Takuya Fukuoka: Conceptualization, Formal analysis, Investigation, Resources, Writing - original draft, Writing - review & editing, Visualization, Funding acquisition. Fumiki Sakane: Methodology, Validation, Formal analysis, Writing - review & editing. Chihiro Kinoshita: Conceptualization, Investigation, Resources, Writing - review & editing, Funding acquisition, Supervision. Kaoruko Mizukawa: Methodology, Validation, Formal analysis, Resources, Writing - review & editing, Funding acquisition, Maintenance of monitoring survey. Katsufumi Sato: Resources, Writing - review & editing, Funding acquisition, Supervision, Maintenance of monitoring survey.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence
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