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Qatar University Life Science Symposium 2016: Biodiversity, Sustainability and Climate Change, with Perspectives from Qatar

Prevalence of microplastics in the marine waters of Qatar

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ABSTRACT

The issue of plastic pollution in the marine environment is of increasing global concern. As plastics typically have an intrinsic durability, water insolubility and slow degradation rates, debris has now become both ubiquitous and persistent in the marine environment. Overtime, plastic ultimately result in the generation of microplastics via photolytic, thermal and biological degradation processes. Although the potential threat of microplastics on marine ecosystems is well recognized, there is no baseline data available for the Arabian Gulf. The Environmental Science Center of Qatar University has now documented the first evidence for the prevalence of microplastics within the Arabian Gulf, specifically in the marine waters of Qatar Exclusive Economic Zone (EEZ). Qatar has an arid climate and is situated midway along the western coast of the semi-enclosed Arabian Gulf. Qatar's coastline is particularly susceptible to marine debris due to the county's rapid urbanization and economic development. Surface seawater samples were collected from 12 stations during May 2015 research cruise of the RV Janan. An optimized and validated protocol was developed for the extraction of microplastics from plankton-rich samples without loss of microplastics present. Plankton present in seawater samples may readily mask the identification of microplastics and lead to an underestimation of the quantity of microplastics present. The protocol involved sample digestion using solutions of 1M NaOH, 10M NaOH, and 16M HNO_3 in conjunction at different temperatures. Twenty mL of each solution was spiked with known quantities of reference polymer pellets, of varying diameters (63 μm to 4.70 mm) and used to digest the plankton biomass. The use of 1M NaOH proved to be a more efficient digestion treatment than 10M NaOH and 16M HNO_3 solutions. Although 10M NaOH, and 16M HNO_3 have been proven effective to mineralize plankton biomass, these solutions also resulted in some structural damage and discoloration of reference polymers with a low pH tolerance: polyvinyl alcohol, polyvinyl chloride, polystyrene, polyethylene, and nylon. After extraction, the microplastics were characterized using Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR) spectroscopy. In total 30 microplastics were isolated from the mineralized samples, with an average concentration of 0.71 particles m^{-3} (range 0 – 3 particles m^{-3}). Nine out of 30 were identified as polypropylene, with the majority either granular, sizes ranging from 125 μm to 1.82 mm, or fibrous, sizes from 150 μm to 15.98 mm. Microplastics were more prevalent in areas where nearby anthropogenic activities, including oil-rig installations and shipping operations, are present.

http://dx.doi.org/10.5339/qproc.2016.qulss.33

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Cite this article as: Castillo AB, Al-Maslamani I, Obbard JP. Prevalence of microplastics in the marine waters of Qatar. QScience Proceedings: Vol. 2016, QULSS 2016: Biodiversity, Sustainability and Climate Change, with Perspectives from Qatar, 33. http://dx.doi.org/10.5339/qproc.2016.qulss.33