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Behaviour of different micro-plastics during degradation in fresh and sea waters, with focus on synthetic microfibers

Simone Rossouw, Nathalie Grassineau, and James Brakeley
Royal Holloway, University of London, United Kingdom of Great Britain and Northern Ireland
(simone.rossouw.2016@live.rhul.ac.uk)

The rising concern over plastic pollution has spiked the number of studies being undertaken globally in a large variety of environments. Microplastic studies have only recently started and there is still so much unknown. One important question to answer is how do different microplastics behave during degradation and how fast does it happen.

In this study, a range of plastic waste was tested in both tap water (fresh water conditions) and salt water (marine conditions) to observe if the water chemistry and timescale plays a significant role in degradation. The samples were exposed to natural weathering and UV light for up to 3 months and then checked for variation including their change of weight. The aim of the study was to determine if different types of plastic waste degrade differently combined with the impact of varying lengths of exposure and water medium. Following this, to reconstitute the natural aquatic environment, the samples were placed in water on a shaking table for 24 hours, and observations were made to assess their propensity for degradation.

Although the time scale was short, different degrees of degradation occurred between each type of plastic studied, with some samples losing significant mass, some none and some gaining mass. As expected, the low density plastics showed very quickly visible signs of decay, and some fragmentations, and therefore this indicates that they are quickly becoming available for small organisms at the bottom of the food chain. In opposition, hard plastics are more resistant with little degradation or none. However this study highlights specific issues with the media in which the plastics are found, particularly in the marine environment, where some harder materials become “encrusted” with sea salt, increasing their density. This means that by slowly sinking within the marine water column, they become available to all marine fauna, not just at the surface.

Although all microplastic particles require attention, the most common and abundant type found in fresh waters are synthetic fibres, with their source likely to be from washing machine effluent and sewage treatment. Following the findings above, the focus of the study turned to non-natural fibres by exploring the comparisons between water pollution from general household laundry and industrial manufacture of synthetic textiles. Methods involving collecting effluent from washing machines and industrial manufacturing machines have been tested and the resulting samples digested with hydrogen peroxide. This study shows evidence of great losses of synthetic fibres from garments, at industrial scale as well as household level. This highlights the pressing issues

that urban areas need to face with current waste water management to increase recycling and the capture of microplastics.