BEHAVIOUR OF DIFFERENT MICRO-PLASTICS DURING DEGRADATION IN FRESH AND SEA WATERS, WITH FOCUS ON SYNTHETIC MICROFIBERS.

S. Rossouw, N. Grassineau and J. Brakeley

Earth Sciences Department, Royal Holloway University of London,

EGHAM, Surrey, TW20 0EX, UK

1) Experiment in laboratory and indoor using nine different types of plastic, to determine their degradation after being submitted to natural UV light and chemical degradation
2) Check the evolution on 3month-period
3) From this outcome, a study has been started to determine the effect of household washing machines on the release of synthetic fibres

EXPERIMENT PROTOCOL

A) 12 different types of plastic, collected on a beach, have been cut each into nine similar pieces, making 8 sets, and weighed.

B) 6 sets were displayed on a tray and put on a roof of a building and be subjected to natural UV light (Fig 1)

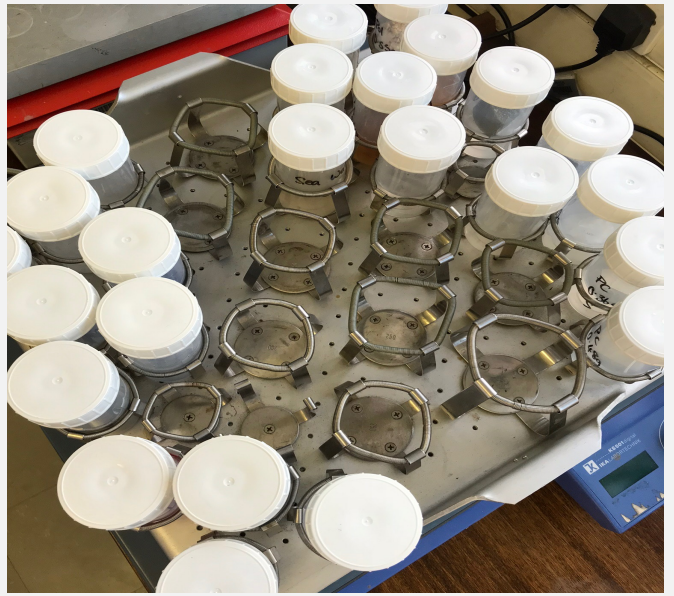
C) 2 sets were immediately submitted to a shaking table at low rpm for 24h, to mimic the mechanic movement of waves, or river flow, one set in fresh water (tap water), and one in sea water (Fig 2)

D) After 24 hours, they were left to dry and weighed, and the waters were filtered, and filters examined with a microscope.

E) Two sets were retrieved at the end of each month, and operations C and D were repeated.

Fig 1:
Tray with the 8 set of 12 different types of plastics, installed on the roof

Fig 2:
Shaking table experiment, with one set of fresh water, and one of seawater.



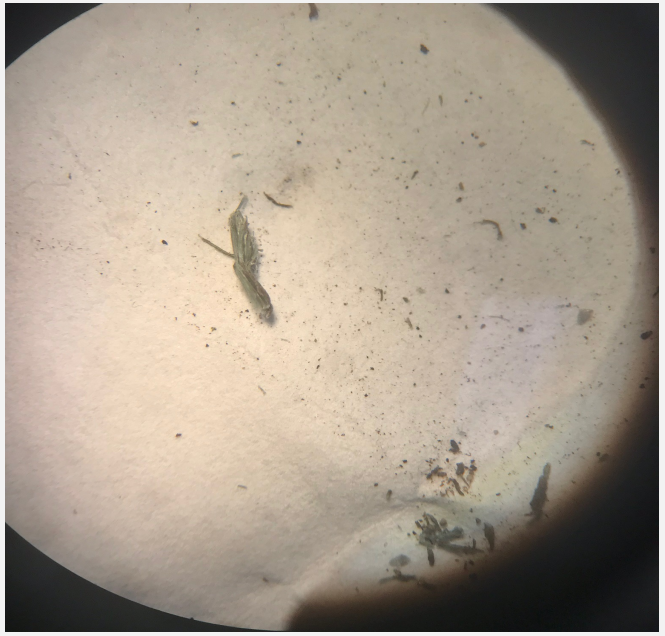
MAIN FINDINGS

- Out of the 12 different types of plastic, the wrapper, fish line, and nylon rope, were the ones that degraded the quickest

- Nylon rope produced the most microplastics, from the first experiment to the 3-months UV radiation, with increasing results (Fig 3)

- Despite evidence of decay the samples in the seawater experiment, some of them gained weight, due to salt crystals forming on them. Effect increasing with plane surfaces (Fig 4)

Fig 3:
Microscope view of fibers from the nylon fishing rope.
(scale across 8mm)



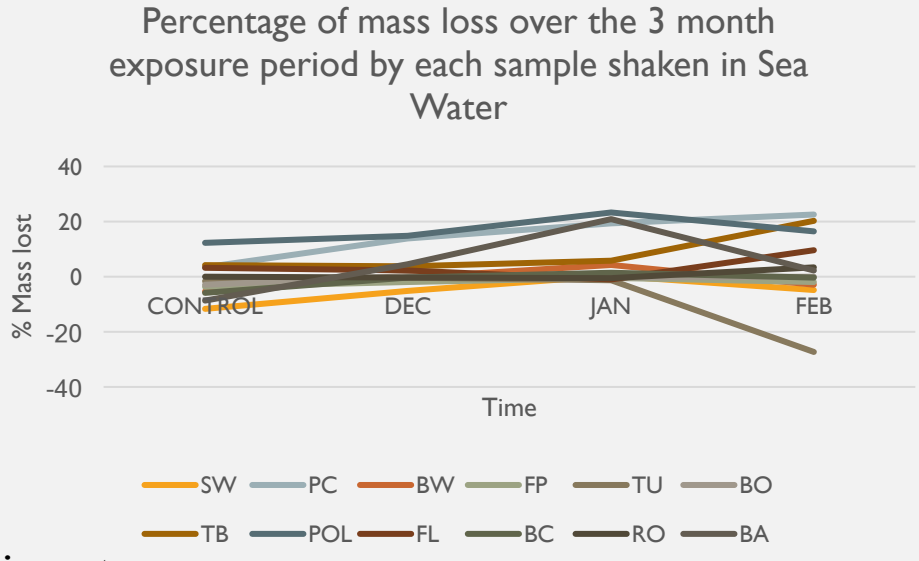


Fig 4:
Results for the seawater experiment

CONCLUSIONS

1) Plastic decay occurred straightaway in the water, and even after only 3 months, UV radiation increased the decay effect considerably especially for samples containing fibers

2) Harder materials became "encrusted" with sea salt, increasing their density (Fig 5). This means that by slowly sinking within the marine water column, they become available to all marine fauna, not just at the surface.

3) Following the findings above, the study focuses to non-natural fibres by comparisons between water pollution from general household laundry and industrial manufacture of synthetic textiles (Fig 6). Methods involving collecting effluent from both settings with samples digested by hydrogen peroxide. So far, the study shows evidence of great losses of synthetic fibres from garments, at industrial scale as well as household level (up to 5% in the first wash, and more later)

Fig 5:
Microscope view of cubic crystal salts on food packaging (scale across 1 mm)

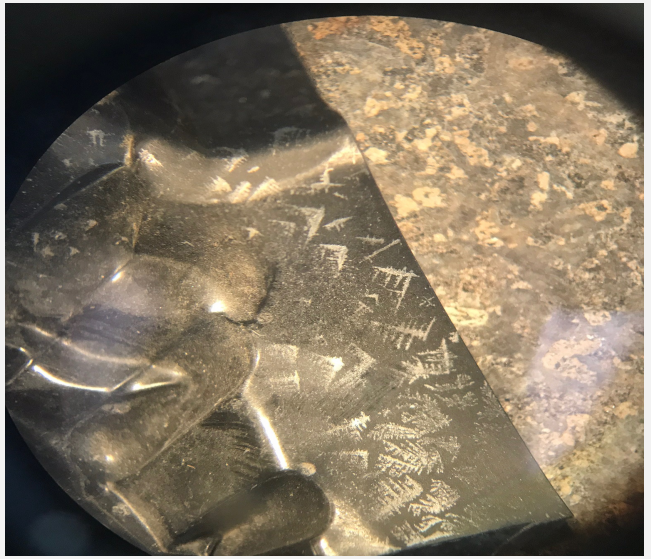


Fig 6:
Colibri Towelling, Glodina, SA