Don't be corrosive. A novel image analysis method for the validation of microplastic extraction procedures.

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Abstract

Most applied procedures to extract microplastics from complex matrices – such as soils, sediments, or biological samples – imply a digestion step to eliminate the biogenic component. Since the digestion efficiency of different alkaline and oxidant agents can vary according to the composition of the examined matrix, possibly new digestion protocols will be developed in the future. The development of digestion protocols must consider that different chemicals at different incubation temperatures can attack different polymeric structures, potentially reducing the recovery of different microplastic types. In this view, corrosiveness tests represent a crucial key step in validating new microplastic extraction procedures.
In this study we developed a methodological approach based on image analysis to detect the corrosive effect of digestive solutions. To reach this goal, we performed an experiment to verify the detection of shape variations in different microplastic types (tested polymers: nylon, polyethylene, polyethylene terephthalate, polypropylene, polystyrene, and polyvinylchloride) treated with 10% KOH at 60 ∘C or 30% H2O2 at 50 ∘C. A treatment with Milli-Q ultrapure water at room temperature was used as control treatment.

Pictures of 540 microplastics (30 particles 6 polymers 3 treatments; size = 0.170 – 1.534 mm2) were taken before and after their treatment using a camera-equipped dissecting microscope (ZEISS SteREO Discovery.V20; AxioCam ERc5s camera). The 1080 images (2560 1920 pixel, 1143 pixel mm-1) were processed using the open-source software ImageJ and the shapeR package for R to obtain data on pre-post shape variations.
Results were in line with what was expected, showing that 10% KOH at 60 ∘C damaged polyethylene terephthalate, while nylon, polyvinylchloride, and polystyrene were susceptible to the 30% H2O2 treatment. According to our results, the proposed image analysis approach could represent a replicable method for quantifying the corrosiveness of digestive solutions on microplastics with different polymer compositions.

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