Simultaneous Separation of Microplastic and Oil-Water Mixtures With HDTMS Modified Magnetite Coated Surfaces

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Our world has experienced major disasters over the past 50 years. Global warming and water pollution are the main causes. Birds and other creatures cannot be rescued and lose their lives on an oil-contaminated ocean surface. There is therefore a need for an effective separation method that can deliver results quickly. In this project, a surface has been synthesised that can simultaneously separate oil and microplastics from water. Human hair and steel mesh surfaces were coated with Fe3O4 (magnetite) and HDTMS (hexadecyltrimethoxysilane) for magnetic and hydrophobic properties. The coatings were applied by thermal sintering and laser, and the durability and performance differences between the methods were investigated. The effect of oil on separation was evaluated in experiments with five different oil types and different oil-water ratios, and the effect of six different microplastic types and sizes on filtration and clogging was compared. The morphology of the coated surfaces was evaluated by CO2, FE-SEM and EDS point analysis and it was observed that the laser treated surfaces increased hydrophobicity and water contact angle up to 157.87 degrees. Due to its fibrous structure, human hair showed higher permeability in oil-water separation compared to steel mesh (92.95%). While the permeability ratios varied according to the oil type, the highest ratio was obtained for diesel oil (93.66%). Laser treatment generally improved the separation efficiency (79.04%). It was also observed that larger microplastics were separated with higher efficiency and PET was the easiest microplastic to separate with 78.93%. The results show that laser treatment improves the performance of surfaces and makes a significant difference in the separation capacity of different surface types.

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