The Solution to Pollution Is...Plastic? Accelerating Oil Spill Remediation by Using Polymer Exposure to Destabilize Emulsions

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One of the most dangerous components of an oil spill is the emulsion that forms between the spilled oil and surrounding seawater, as this submerged emulsion can last for many years and is difficult to remediate. This research identified materials that could accelerate the separation of such emulsions, allowing oil to float to the oceanic surface, increasing the efficacy of traditional oil spill removal techniques. This experiment was motivated by an earlier observation that certain plastic containers appeared to destabilize the oil/water emulsions stored within them. Emulsion instability as a result of contact with different plastics was measured using three different tests: 1) visual separation of a column of emulsion over time, 2) growth rate of a drop of emulsion, and 3) microscopic imaging. Open source image analysis software was used to facilitate the large-scale batch processing of data. Twelve plastics were analyzed and compared to glass. A bioassay was conducted to verify that the most destabilizing plastics would have no negative environmental impact if used to aid oil spill remediation. The most destabilizing plastics were poly-methyl-pentene (PMP), acrylonitrile butadiene styrene (ABS), and nylon 6-6. The plastics that stabilized emulsions included nylon 6-12 and high-density polyethylene (HDPE). Based on regression analysis, plastics that destabilize oil/water emulsions are 1) highly branched, and 2) likely to be at the extreme ends of the polarity scale. These properties can be exploited in future work to develop an effective polymer-based emulsion removal method, negating the need for toxic chemical dispersants.

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