Novel Nanostructured Metal Powder by Simple Hot Water Treatment: An Economic and Sustainable Oil-Water Separation

Bhattacharyya, Anusha (School: Little Rock Central High School)

Oil spills and oil-contaminated industrial wastewater have raised major environmental concerns because of their catastrophic damages to marine and freshwater life, plants, animals, and humans that are exposed to those waters. Most of the oil pollution comes from industrial run off (11%), transportation (34%), natural seeps (47%), oil spills (3%), and others (5%). According to the Environmental Protection Agency, it only takes one gallon of oil to contaminate one million gallons of water and approx. 4.4 million tons oil get released into the ocean every year. Therefore, finding ways to clean oil spills and treat industrial oily waste water using superhydrophobic and superoleophilic material is very important. However, to produce oil-water separators owning special superhydrophobic and superoleophilic properties still suffer from challenges such as high costs and complicated fabrication processes. In this study, my first research goal was to fabricate an inexpensive and efficient superhydrophobic and superoleophilic material to remove oil from water. My second research goal was to do this by a simple and economic method to create the needed surface roughness (nanostructure) on Zinc metal power. I used a new method to nanostructure Zinc Powder called Hot Water Treatment (HWT) which is very cheap and simple compared to current nanostructuring methods. The nanostructured Zinc powder was then simply coated with low surface energy 1-Dodecanethiol to make Nano-functionalized Zinc powder. It showed the much needed superhydrophobic and superoleophilic properties. The efficiency of Nano-functionalized Zinc powder was 99.9% for cyclohexene and 96% for crude oil removal from water. HWT allows for simple and cheap nanostructuring for efficient and economic oil water separation.

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