The Application of Graphene Oxide and Methyltrimethoxysilane Hydrophobic Aerogels on the Absorption of Oil Spills

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Mechanical recovery oil spill cleanup methods are unable to clean oil that sinks below the surface, and other methods can cause more pollution (in-situ burning). A method that is environmentally friendlier and effective at cleaning sunken oil is sorbents, which work by adsorbing oil, but due to a lack of hydrophobicity many soak up water as well. Hydrophobic aerogels mitigate this issue, demonstrating potential for absorbing oil and repelling water and being a good candidate for oil spill cleanup. This investigation aims to study the effect of oleophilic and hydrophobic graphene oxide (GO) and hydrophobic methyltrimethoxysilane (MTMS) on the oil adsorption capacity of silica-based high porosity aerogels. Aerogels were constructed using a rapid supercritical extraction method patented by the Union College aerogel lab. All standard aerogel construction protocols were followed. Four aerogel types were constructed with varying amounts of MTMS and GO: 25% MTMS, GO + 25% MTMS, GO + 50% MTMS, and GO (0% MTMS). Samples of each gel type were tested for oil absorption on a longitudinal scale of 2-7 minutes depending on the durability of the aerogel. The MTMS gels adsorbed about 12 times their weight in oil, and the GO gels adsorbed 6-7 times their weight; however, the MTMS gels collapsed. The effect of absorption time on absorption capacity was then studied, as samples were soaked and massed after varying time periods. To more closely replicate the conditions of an oil slick, aerogel samples were tested in an oil-water mixture, the water was dyed with fluorescein. The exact amount of oil at the beginning of adsorption should theoretically be close to the difference in mass of the sample; the two values were negligibly different for each sample.

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