A Smart Sponge to Control Oil and Chemical Spills

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Due to humans' heavy, global dependence on petroleum as an energy source and material, oil extraction and processing efforts happen in many environments and involve mass transportation across land and sea. The possibility and reality of environmentally devastating oil spills occurring in oil production is a stark reality that requires effective solutions to avoid further harmful impacts on the environment, animals, and humans. To remediate this need, we developed a 3-dimensional, inexpensive, multi-use polymer sponge that can selectively remove the spilled oil from water in large volumes. Using a soaking and drying process involving salt, chloroform, and a polyurethane polymer, we developed a porous polymer sponge structure that is hydrophobic but oleophilic. The polymer sponge was characterized using several techniques, such as scanning electron microscopy (SEM). The mercury intrusion analyses were used to determine the porous structures of the polymer and the surface area. The contact angles of water and oil droplets were measured to understand the hydrophobic and oleophilic behaviors of the sponge. The polymer sponge showed excellent properties for absorbing different oils rapidly from water 7-8 times their weight and can be recycled multiple times without losing its activities. Similarly, we tested various hazardous chemicals (e.g., benzene and toluene), and the polymer sponge showed excellent absorbing capacities. Therefore, this sponge can also clean up hazardous organic chemicals. This product can be a perfect choice for tackling large-scale oil or chemical spill removal by allowing us only to collect the oil or chemical and not interfering with the water.

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