A complete solution for oil-spill cleanup

October 3 2012

Scientists are describing what may be a "complete solution" to cleaning up oil spills—a superabsorbent material that sops up 40 times its own weight in oil and then can be shipped to an oil refinery and processed to recover the oil. Their article on the material appears in ACS' journal *Energy & Fuels*.

T. C. Mike Chung and Xuepei Yuan point out that current methods for coping with oil spills like the 2010 Deepwater Horizon disaster are low-tech, decades-old and have many disadvantages. Corncobs, straw and other absorbents, for instance, can hold only about 5 times their own weight and pick up water, as well as oil. Those materials then become industrial waste that must be disposed of in special landfills or burned.

Their solution is a polymer material that transforms an oil spill into a soft, solid oil-containing gel. One pound of the material can recover about 5 gallons of crude oil. The gel is strong enough to be collected and transported. Then, it can be converted to a liquid and refined like regular crude oil. That oil would be worth $15 when crude oil sells for $100 a barrel. "Overall, this cost-effective new polyolefin oil-SAP technology shall dramatically reduce the environmental impacts from oil spills and help recover one of our most precious natural resources," the authors said.

More information: "A Novel Solution to Oil Spill Recovery; Using Thermodegradable Polyolefin Oil Super-absorbent (oil-SAP)" *Energy Fuels*, 2012, 26 (8), pp 4896–4902
DOI: 10.1021/ef300388h

Abstract

This paper discusses a novel approach that may provide a complete solution to combating oil spills. The technology is centered on a cross-linked polyolefin terpolymer (x–OS–DVB), containing 1-octene, styrene, and divinylbenzene units, which is an oil superabsorbent polymer (oil–SAP) with aliphatic and aromatic side chains that have similar solubility parameters (oleophilic and hydrophobic properties), with the hydrocarbons in crude oil. Some x–OS–DVB terpolymers, with desirable morphology (amorphous, low Tg, and high free volume) and lightly cross-linked (complete network) structure, show rapid oil absorption and swelling to reach a capacity 45 times their weight. The capacity of oil uptake (swelling) is inversely proportional to the cross-linking density. The combination of selective oil absorption (without water) and tough mechanical strength offers buoyancy, stability, and easy recovery on water surfaces. The recovered oil-swelled gel, containing more than 98% oil and 2% x–OS–DVB, is suitable for regular oil-refining processes (an economic, no waste, and no pollutant approach). The bulk side chains in x–OS–DVB result in a relatively low ceiling temperature for depolymerization and zero heating residue at 450 °C, well below the first distillation step (>600 °C) in oil refining. Furthermore, polyolefins are the most inexpensive polymeric material, with a large production capability around the world. Overall, this cost-effective new polyolefin oil–SAP technology shall dramatically reduce the environmental impacts from oil spills and help recover one of our most precious natural resources.

Provided by American Chemical Society