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Molecular gelators: Solid oil recovery

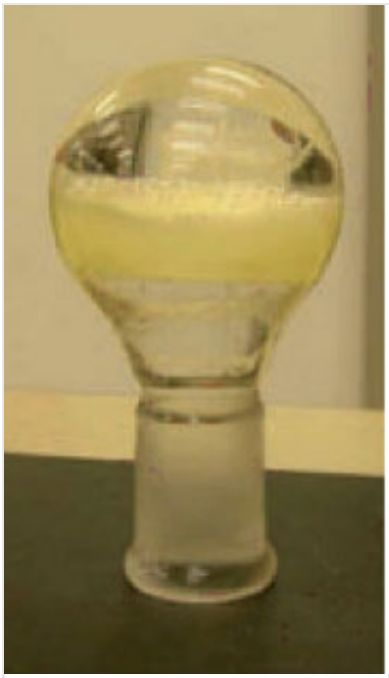
Anne Pichon

Nature Chemistry doi:10.1038/nchem.804
Published online 23 July 2010

A sugar-derived amphiphilic molecule has been prepared that immobilizes oil into a solid from a mixture with water and enables its subsequent recovery.

Subject terms: General chemistry

Oil spills cause much damage to marine and coastal environments, and are extremely difficult to clean up. An appealing strategy is to trap the oil using phase-specific molecular gelators, but the materials investigated so far have met with only limited success. Now, George John and co-workers from the City College of New York and the University of Maryland in the USA, have prepared[1] amphiphilic molecules based on open-chain sugar alcohols (mannitol and sorbitol) that can selectively solidify the oil phase from a mixture with water and subsequently release it.



The researchers reacted vinyl esters bearing long alkyl chains with each end of the open sugar alcohols to give dialkanoate derivatives. In oil, the dialkanoate molecules stack together to form fibre-like architectures, which further entangle to immobilize the organic phase into a strong gel. In water, however, this assembly does not occur — probably hindered by the formation of hydrogen bonds between water and the gelator. The amphiphiles acted as efficient phase-specific gelators in a variety of oil–water mixtures (for example, with diesel or pump oil, and with various water samples and oil-to-water ratios). The solidified oil can then be simply scooped out of the aqueous solution.

The gelators are not only cost-effective and convenient — synthesized from abundant, environment-friendly molecules in a one-step procedure — but also recyclable and reusable. The gel is thermoreversible and disassembles on heating, which means that the trapped diesel can be recovered by vacuum distillation nearly quantitatively.

References

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doi:10.1002/anie.201002095 (2010)

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Nature Chemistry ISSN 1755-4330 EISSN 1755-4349