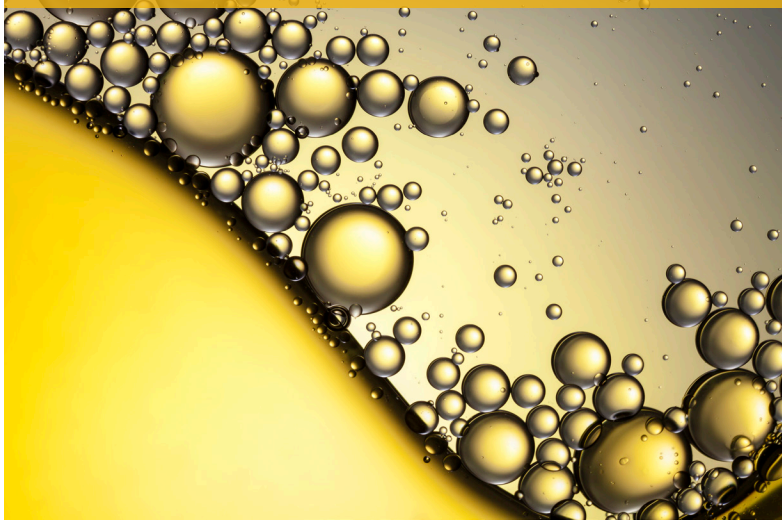
جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

TECHNOLOGY OPPORTUNITY



Revolutionary Smart Material Offers Highly Controllable Oil-Water Separation

Reusable membrane has myriad environmental benefits

This remarkable smart material represents a low-cost, environmentally friendly solution for any industry that needs to separate oil and water in controlled manner. Inspired by the natural ability of fish scales to repel oil, innovators at KAUST have developed smart surfaces that can alternately attract and repel oil in an aqueous solution. The smart surfaces are made by grafting a block copolymer onto common, low-cost porous materials, such as non-woven textiles and polyurethane sponges. The surface can switch between repelling oil/attracting water and vice versa. These materials can be regenerated and recycled many times, making them a sustainable and highly cost-effective solution for many applications (e.g. oil spill cleanup). This highly controllable method of separating oil and water can be of benefit to wide range of industries, including petrochemical, pharmaceutical, chemical, and many more.

Benefits

- **Witchable/Tunable:** This smart material can be switched on demand to attract either water or oil
- **Reusable:** The same material can be easily cleaned and reused multiple times for a variety of separation purposes
- **Scalable:** Hundreds of meters of membrane can be used to attract and repel oil
- **Cost-effective:** Block copolymer can be grafted onto inexpensive and readily available materials

Applications

- Pharmaceuticals
- Drug delivery
- Oil and gas
- Oil-water separation
- Oil spill cleanup
- Microfluidics droplet manipulation
- Chemical or biosensors
- Wastewater cleanup
- Antifouling

Opportunity

This technology is part of KAUST's technology commercialization program that seeks to stimulate development and commercial use of KAUST-developed technologies.

Opportunities exist for joint development, patent licensing, or other mutually beneficial relationships.

For More Information

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Technology Details

This material allows for the selective and controlled separation of oil and water. Unlike prior systems, the smart material is not simply hydrophobic or hydrophilic; rather, it has the ability to switch from superoleophilicity and superoleophobicity as needed.

How It Works

The novel aspect of the technology is that it is "switchable." By changing pH, the material attracts oil and repels water. In the case of an acidic solution, the material attracts water and repels oil. In this way, either oil or water can be removed from an oil-water mixture, depending on the pH of the water.

The smart surfaces are achieved by grafting a block copolymer—comprising blocks of pH-responsive oleophilic/hydrophobic materials. KAUST's block copolymer grafting strategy can easily extend to other substrates, including metal, metal mesh, filter paper, cloth, polymeric foams, and some nanoparticles.

Why It Is Better

This material represents the first-ever switchable and reusable smart material for controlled oil-water separation. Existing materials designed for oil-water separation are either superhydrophobic or superhydrophilic, which means these materials can only be used for a pre-designated oil-water separation process. With KAUST's breakthrough technology, the same substrate can switch from oleophobic/hydrophilic to oleophilic/hydrophobic, simply by altering the pH in the oil-water solution. This enables users to selectively separate either oil or water from an oil-water solution, offering a highly versatile, on-demand approach.

In addition, the material is reusable. The membrane merely needs to be rinsed with water and dried with nitrogen flow. This can be done at room temperature and does not involve the use of extreme heating or organic solvent washing processes.

IP Protection

KAUST has a patent pending for this technology.

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