



Super separation: an innovative filter (left) separates oil from water with unusual quickness. Drops of oil (yellow) pass through the small filter pores, while the water (white) remains behind on the surface. At the Membrane Technology Lab, Dr. Helmut Meyer (right) discusses new test results with chemical engineer Martina Mutter, who helped engineer the effective filter.

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Nature as the model: energy-saving separation of emulsions

The trick with the pores

Oil and water don't mix. Water is the greatest thorn in the side of chemists because it interferes with a lot of production processes. Researchers from Bayer MaterialScience and Bayer Technology Services have now developed a water-repellent filter permeable only by oil. The secret of the invention is its ultrahydrophobic coating, modeled on a lotus leaf.

Numerous processes, such as the production of polyol, a polyurethane precursor, generate oily organic liquids containing disruptive water. Martina Mutter of Bayer Technology Services removes the water using a new membrane technology. The chemical engineer puts a couple of drops of water on a swatch of fabric. Instead of soaking through, the drops bead up. The results are different with a drop of oil: the material soaks it up hungrily, letting it pass through, only to smear on the table underneath.

This little experiment could have a big impact, because it shows how oil and water can be separated virtually without any energy input. As a positive side effect, "the water also washes the oil clean of all salts, such as those that disrupt polyol production," explains Mutter. The secret of the smart filter is

its coating. Dr. Daniel Duff, nanotechnology expert at Bayer Technology Services, calls it "hydrophobic", or water-repellent. "The coating ensures that the drops of water don't wet the material and penetrate it if the mesh size is smaller than the drops," he explains.

Four years ago, Dr. Helmut Meyer of Bayer MaterialScience collaborated with specialists at Bayer Technology Services to prove that intimate oil/water mixtures can be separated by filters. Meyer's team has applied for patents on the techniques they developed to clean polyol and polycarbonate in preparation for manufacturing plastics.

A team of experts from Bayer Technology Services is now working on the ideal, durable coating for high-tech filters. A rough layer on the plastic fabric yields optimum results thanks to the "lotus effect". For the fabric, the Bayer

researchers use three-dimensionally woven fibers made of metal threads. In addition, they already are developing the process, for example with wound filters and tubes for separating oil and water. Under the tough conditions of everyday production, the fabric has to withstand tons of water. In a large production facility, for instance, over 100,000 tons of polyol pass through the filter every year. However, the chemical industry will not be the only one to benefit from the new filters: potential applications likewise exist in the petroleum and food industries.

www.lotus-effekt.de



This website contains information on the lotus effect from the University of Bonn.