New membranes could slash fractional distillation emissions

Original article by Mason Wakley. Adapted by Nina Notman.

How can advances in materials science make one of the world's most energy-intensive chemical processes more sustainable?

A Scientists are developing membranes that can efficiently separate the hydrocarbons in crude oil. These materials could help reduce energy demand and carbon dioxide emissions compared with conventional separation methods.

Crude oil is a fossil fuel that contains a mixture of valuable hydrocarbons including diesel and petrol. Refineries currently use fractional distillation to separate these hydrocarbons, a process that accounts for around 1% of the world's global energy use. This separation method also emits more than 160 million tonnes of carbon dioxide annually.

Estimates suggest that using membranes to separate the hydrocarbons in crude oil could reduce the energy required for the separation by up to 90% and slash carbon emissions.



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Are membranes the way to sustainably separate crude oil?

Fractional distillation separates hydrocarbons based on their boiling points. Membranes, meanwhile, can be fine-tuned to separate molecules by their size, shape and chemical reactivity. Many labs around the world are currently seeking suitable materials for these membranes.

Three recent breakthroughs

In June 2026, three groups announced three different types of materials that had shown promising results when used to separate crude oil in their labs.

Researchers at Exactmer, a company spun out of Imperial College London, revealed an ultrathin polymer membrane with permanent pores each smaller than a nanometre in size. Meanwhile, another group in Saudi Arabia, at King Abdullah University of Science and Technology, shared a membrane made of covalent organic frameworks, a novel type of material that has exceptionally high numbers of permanent pores. While a third team, from the Korea Advanced Institute of Science and Technology, repurposed an existing membrane – polyacrylonitrile – that's current uses include water treatment and kidney dialysis.

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'Membrane-based hydrocarbon fractionation is [now] moving from a promising idea toward a more practical technology,' says Sheng Guo, a researcher at Nanjing University in China who wasn't involved with any of these projects.

This is adapted from the article **'A materials breakthrough': membranes to separate crude oil could slash energy costs** in *Chemistry World*. Read the full article: bit.ly/4ysCuzP

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