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# Two-Step Thermoresponsive Membrane with Tunable Separation Properties and Improved Cleaning Efficiency

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## Abstract

We developed two-step thermoresponsive membranes that have two different lower critical solution temperatures. To achieve this, poly(2-dimethylaminoethyl methacrylate)-*block*-poly(*N*-isopropylacrylamide) (PDMAEMA-*b*-PNIPAM, PDN) was introduced into a polyethersulfone (PES) ultrafiltration membrane. The combined Fourier-transform infrared spectroscopy, nuclear magnetic resonance spectroscopy, attenuated total reflection Fourier-transform infrared spectroscopy, and field-emission scanning electron microscopy results showed that PDN was successfully synthesized, and introduced into the PES membrane. The

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