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Fabrication of Nonfluorinated and Superhydrophobic/Superoleophilic PDMS/PMMA Electrospun Membranes for Vacuum-driven Separation of Moisture from Virgin Coconut Oil

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ABSTRACT

Virgin coconut oil (VCO) is a highly beneficial substance in our daily lives. Its composition predominantly consists of saturated fatty acids ~94%. During the extraction process of VCO, a small amount of moisture content may be present in the final product. The moisture content typically needs to be kept at very low levels to ensure product stability and shelf life. Separating emulsions is a challenging task primarily because of the tiny droplet size. Recently, there has been a growing interest in the exploration of nanofibrous membranes fabricated through electrospinning. Vacuum-driven separation using membranes has gained significant interest as it offers a fast and efficient method for emulsion separation. In this work, a nonfluorinated superhydrophobic/superoleophilic nanofibrous membrane was fabricated through electrospinning via a mix of polydimethylsiloxane/polymethyl methacrylate (PDMS/PMMA) to form nanofibrous membranes for vacuum-driven separation of VCO emulsions. The synergic properties of PDMS/PMMA nanofibers, such as high surface area (46 m^2/g), mesoporous (~4 nm), and superhydrophobicity (WCA ~151°) of the membrane was able to demulsify and separate water (≤100 ppm) from oil-rich emulsions with effective separation efficiency. The incorporation of methyl groups ($-CH_3$) provides an effective hindrance to the passage of water droplets, resulting in a higher permeability rate for the successful separation of VCO emulsions.

Keywords: PDMS/PMMA nanofibrous membrane, Electrospinning, Vacuum-driven filtration, Oil rich Emulsion

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