WO3/TiO2 superhydrophilic and underwater superoleophobic membrane for effective separation of oil-in-water emulsions

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WO_3/TiO_2 superhydrophilic and underwater superoleophobic membrane for effective separation of oil-in-water emulsions

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Abstract

Tungsten trioxide (WO_3) and titanium dioxide (TiO_2) decorated commercial stainless steel meshes (SSM 304) were fabricated by chemical deposition and dip coating. WO_3 and TiO_2 particles were firmly and uniformly coated on the membrane surfaces, forming rough micro-nano double structures with underwater superoleophobicity, large contact angles and low oil-adhesion characteristic. Furthermore, the as-prepared membranes achieved effective oil-in-water (O/W) emulsions separation with high efficiency up to 98.5% or more. The separation of O/W emulsions was easily implemented under gravity with water fluxes of more than 200 L m^{-2} h^{-1} or low pressure with water fluxes up to 1300 L m^{-2} h^{-1} or more. In addition, the superhydrophilic membranes with WO_3/TiO_2 coatings were demonstrated for high oil rejection, stable underwater superoleophobic properties after abrasion treatment and steady water permeation flux after several cycles.

Keywords: tungsten trioxide; titanium dioxide; superhydrophilic; underwater superoleophobic; oil-in-water emulsions separation

1 Introduction

Among various kinds of water pollution, the oily wastewater has serious