Preparation and Modification of Polyethylenimine/Poly(ethylene glycol) diglycidyl ether/Polyvinyl alcohol Composite Porous Materials for Oil-Water Separation and Copper(II) Adsorption

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ABSTRACT

With industry development, wastewater containing oil pollution and heavy metals poses a significant threat to the environment. To address these issues, this study uses polyethyleneimine (PEI), polyethylene glycol diglycidyl ether (PEGDE), and polyvinyl alcohol (PVA) to prepare oil-water separation and heavy metal adsorption membranes through chemical crosslinking and freeze-thaw methods. The PEI/PEGDE/PVA membranes were fabricated by combining PEI and PVA in different proportions and exhibited an excellent diesel/water separation efficiency of 99.99%. A solution phase silanization method was then applied to convert the PEI/PEGDE/PVA membranes into superhydrophobic membranes, demonstrating an excellent water/chloroform separation efficiency of 99.80%. For the subsequent experiments, the durability was evaluated by cycling water/chloroform separation tests. The PEI/PEGDE/PVA and m-PEI/PEGDE/PVA membranes showed 99.70% demulsification efficiency for the emulsion solution. Furthermore, different ratios of PEI/PEGDE/PVA membranes were also used to remove copper(II) from the solution; the maximum adsorption amount of the membranes for copper(II) was up to 190 mg/g. This study proposes a new multifunctional composite membrane to effectively treat wastewater containing oil pollution and heavy metals, providing a feasible and effective treatment method to protect the environment and improve water quality.