Abstract

A thermoplastic polymer blend was developed from the poly(ethylene-*co*-methyl acrylate) (EMA) and poly(vinylidene fluoride) (PVDF) by the melt-blending technique. The prepared blend shows a matrix-droplet morphology in which PVDF forms a droplet phase in the EMA matrix. The blend was characterized by various techniques and its thermal, mechanical, microstructure and rheological properties were investigated. With the incorporation of PVDF, blend modulus increases indicate the crystallization of the PVDF and the presence of specific interactions between the polymers.

A microfiltration membrane was developed by a *selective-etching* method from the EMA/ PVDF blend for water purification application. The membrane was prepared in two ways. By the first approach, the EMA phase was swelled and partially etched from the EMA/PVDF blend, and the membrane properties were recorded. An asymmetric membrane was formed but there was no control over the size of the pores. The generated structure was microporous with a pore size >1 μm. Hence, this preparation method showed poor separation efficiency against microbes, and the membranes underwent fouling and decreased the efficiency. By the second approach, the membranes were prepared by the selective dissolution of the complete PVDF phase from the EMA/PVDF blend. With respect to the membrane, the pore size was in the microporous range, and the water permeability and compaction were recorded by using cross-flow filtration set-up. The developed membrane shows better compaction resistance attributed to the elastomeric nature of the EMA copolymer.

The surface of the prepared membrane was modified with various nanoparticles to achieve better antifouling and antibacterial properties. The antifouling properties of the membrane were recorded by using bovine serum albumin (BSA) as a model foulant, and antibacterial properties were studied by using *Escherichia coli* (*E. coli*) and *Staphylococcus aureus* (*S. aureus*) as model bacterial strains. The membrane surface was modified by means of a reduced graphene oxide (rGO)/polyethylene imine (PEI) composite, and the modified membrane shows a better antifouling property. Subsequently, the membrane surface was modified by lysozyme-derived particles and MoS_2 nanosheets. The modified membranes respectively show high antibacterial and antifouling properties over the control EMA membrane.

Keywords: EMA/PVDF blend; membrane water flux; microfiltration membrane; selective etching; antibacterial property; antifouling property