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Polymer membranes from polyvinylidene fluoride or cellulose acetate improved graphene oxide used in the UF process

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ABSTRACT

In this paper, the study aimed at comparing laboratory-produced membranes from two different polymers containing graphene oxide (GO). The membranes according to the phase inversion method using commercial graphene oxide (2 mg/100 g matrix) were produced. Due to GO properties, it is possible to improve the permeability of the membrane concerning the macromolecular compounds, and increasing the permeate flux. The polymer matrix was formed from polyvinylidene fluoride (PVDF) or cellulose acetate (CA) dissolved in dimethylacetamide or acetic acid (AA), respectively. Polyethylene glycol (PEG), was used as a plasticizer. The membranes were evaluated by determining their thickness, Young's modulus, tensile strength at break, and pore size distribution. The presence of the GO in the membrane causes an increase in hydrophilicity of the surface, which was expressed by decreasing the contact angle from 77° to 43° for the PVDF/GO, and from 60° to 36° for the CA/GO membranes. The permeability, membrane resistance, and retention of the produced membranes for water and bovine serum albumin (BSA) in the ultrafiltration process using an OSMONICS KOCH apparatus under transmembrane pressure ranging from 0.1 to 0.6 MPa at 25°C was determined. It was obtained that membranes with GO have an appropriate pore size distribution for the UF process. The highest permeability (J_v = 0.13 $m^3/(m^2\ h)$), good rejection reaching over 90% for BSA initial concentration C = 0.75 g/dm^3 was reached.

Keywords: Polyvinylidene fluoride; Cellulose acetate; Graphene oxide; Bovine serum albumin; Ultrafiltration

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