Preparation of Sulfonate – Grafted Silica/Chitosan Hybrid Membrane for Proton Exchange Membrane

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ABSTRACT

Sulfonate-grafted silica/chitosan hybrid membrane has been successfully prepared by in-situ sol-gel method. In this method, grafting of sulfonate onto silica surface was carried out along with membrane formation. Silica sol that was obtained from sodium silicate, and amido sulfonic acid were mixed with chitosan solution. The mixture was stirred for 30 minutes and aged at 60 °C for 8 hours. The results showed that sulfonate could be grafted onto the silica surface as indicated by the FTIR spectra. Silica loading is greatly affect the membrane characteristics including water retention, % swelling, tensile strength, and ionic conductivity. Water retention, % swelling and tensile strength decrease with the increase of silica loading. On the other hand, ionic conductivity and acid capacity increase with the increase of silica loading. The increase is related to the amount of silica that carries sulfonate groups. However, there is limitation on the silica loading where membrane cracked if the loading was greater than 1.5 g silica/g chitosan. The ionic conductivity and acid capacity of the membrane can take the values of about 4.2 x 10⁻⁶ S/cm and 1.34 meq/g, respectively. Sulfonate-grafted silica/chitosan hybrid membrane with loading silica 1.3 to 1.5 g silica/g chitosan has a good characteristics and can be used as proton exchange membrane.

Keywords: hybrid membrane, grafted sulfonate, silica, chitosan, acid capacity, ionic conductivity, proton exchange membrane
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