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CHARACTERIZATION AND PROPERTIES OF RECYCLED PERFLUOROSULFONATED MEMBRANES

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As more and more perfluorinated polymer membrane is used in various applications, there will be a vast amount of used membrane materials waiting to be reprocessed. Considering the economic factors, it will make good sense to develop a sustainable technology to recycle and reuse the old membranes. To this point, a recycling technique involves the membrane dissolution, separation and re-casting to prepare perfluorinated sulfonic acid (PFSA) membranes. In this study, a solution of perfluorinated sulfonic acid (PFSA) polymer was prepared from dissolution of the used Flemion® chlor-alkali membrane in the mixture of water, ethanol and 1-propanol. The produced solutions were re-casted to obtain PFSA membrane. X-ray diffraction, ATR spectroscopy, water uptake and ion exchange capacity measurements are used to investigate the structure and properties of the PFSA membranes.

According to the XRD results, dissolution process and recasting conditions do not affected the crystalline phase of prepared films. It was found by ATR spectrum that the functional groups of the recycled PFSA polymer are the same as those of the fresh Flemion® membrane and no defection in chemical structure of the polymer was observed. The swelling behavior is regarded as an important characteristic of the ion-exchange membranes, which determines water uptake capabilities that in turn related to the membranes electrochemical properties. It was found that the type and solubility parameter and solvent composition affect the water sorption of the prepared membranes.

The ion exchange capacity (IEC) of the membranes was determined. It was found the type, composition of used dissolution solvent and dissolution conditions changes slightly the IEC of prepared membranes. The results show that IEC of prepared membranes changes with dissolution process. Overall, the results from this study confirms that he recycling process doesn't affect the chemical structure of the polymer significantly.