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POST-CONSUMER POLY(ETHYLENE TEREPHTHALATE) BASED MEMBRANES USING ELECTROSPINNING TECHNIQUE

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Poly(ethylene terephthalate), commonly known as PET, is a thermoplastic polymer resin. Recycling efforts of PET waste are essential to minimize the environmental impact. Therefore, a type of chemical recycling of PET waste was investigated in this study. Several solvent systems in different ratios were tested to dissolve post-consumer PET water bottles. The PET-based membranes were prepared using post-consumer PET water bottles and a solvent system of trifluoroacetic acid and dichloromethane in 1:5 ratio. Electrospinning technique was used to prepare the fibrous membrane. Several instrumental parameters were optimized to obtain the best fibrous membrane, which has a minimum diameter and a lesser number of beads formed. The best selected membrane was synthesised setting the flow rate as 0.5 mL/h, distance from the needle tip to the collector drum as 10 cm, voltage as 21-22 kV and collector drum speed as 700-702 rps. Several PET solutions were also prepared based on PET concentration, and 15% (w/v) of PET solution resulted in the best membrane. The average diameter of fibres in different PET membranes was determined, and the membrane prepared from 15% PET solution recorded the smallest diameter of 752.3 ± 88.80 nm. The membrane was characterized using Fourier transform infrared spectroscopy, X-ray fluorescence analysis and thermogravimetric analysis. The Fourier transform infrared spectra of PET based membrane clearly showed C=O stretching band around 1720 cm^{-1} and phenyl C-H and ethyl C-H stretching bands around 2900-3000 cm^{-1}. Furthermore, X-ray fluorescence analysis confirmed that this membrane does not contain any heavy metals bound to it. Thermogravimetric analysis revealed that PET membrane starts to decompose at temperatures of around 450 °C to 460 °C. This study revealed that a PET based membrane can be prepared using PET water bottle pellets.

Keywords: Dichloromethane, Electrospinning, PET membrane, Poly(ethylene terephthalate), Trifluoroacetic acid