## ABSTRACT

The Membrane microbial fuel cell is a polymer electrolyte membrane with advantages in proton conductivity and good chemical stability, resulting in high electrical power generation. Polyeugenol is a natural-based electrolyte polymer and can be modified by adding a cross-linker with divinylbenzene to increase the structural density, which is expected to reduce the swelling degree. Another modification is the addition of sulfonate groups to enhance proton transfer in the polymer. This research aims to synthesize sulfonated eugenol-divinylbenzene copolymer (EDVBT) and create a microbial fuel cell membrane. The study begins with the synthesis of the eugenol-divinylbenzene copolymer (EDVB) through cationic addition polymerization. The EDVB copolymer undergoes sulfonation using acetyl sulfate. The synthesized product is characterized in terms of solubility, molecular weight, melting point, functional group analysis using Fourier Transform Infrared (FTIR), and thermal stability using Thermogravimetric Analysis (TGA). The microbial fuel cell membrane is characterized by swelling degree, proton conductivity, contact angle, and morphological analysis using Scanning Electron Microscopy (SEM). The synthesized EDVB copolymer resulted in a reddish-orange solid with a yield of 94%. It is soluble in organic solvents but insoluble in distilled water. The successful synthesis of the EDVB copolymer is indicated by the disappearance of the vinyl group (C=C alkene) absorption peaks from eugenol and divinylbenzene at wave numbers 1640 $cm^{-1}$ and 1632 $cm^{-1}$. TGA analysis showed a 5% and 10% mass reduction at 161.8°C and 236.48°C. The sulfonation product, EDVBT copolymer, appeared as a dark brown solid with a sulfonation degree of 29.31% and a cation exchange capacity of 0.996 meq/g. It is soluble in organic solvents but insoluble in distilled water. The molecular weight increased from 9366.19 daltons to 10464.34 daltons. The successful sulfonation of the EDVBT copolymer is indicated by the appearance of sulfonate group absorption peaks (-$SO_3H$) at 1192 $cm^{-1}$ (S=O), 1058 $cm^{-1}$ (S-O), and 879 $cm^{-1}$ (C-S). TGA analysis showed a 5% and 10% mass reduction at 178°C and 278.6°C. The polymer membrane resulted in a thin dark brown sheet. The swelling degree of the copolymer membrane after the addition of divinylbenzene was 9.06%. The EDVBT copolymer membrane exhibited a proton conductivity of $2.84 \times 10^{-6}$ S/cm and a microbial fuel cell membrane voltage of 0.003±0.078 V.



Keywords : copolymer eugenol-divinylbenzene, sulfonated, membrane microbial fuel cell


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