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Synthesis of PVDF-g-PSSA proton exchange membrane by ozone-induced graft copolymerization and its application in microbial fuel cells

Chen Li, Lei Wang*, Xudong Wang, Mengxiao Kong, Quan Zhang, Guangyuan Li

(Key Laboratory of Membrane Separation of Shaanxi Province, School of Environmental & Municipal Engineering, Xi'an University of Architecture and Technology, Yan Ta Road. No.13, Xi'an 710055, China)

Abstract

Thermally induced graft copolymerization of sodium styrene sulfonate (SSS) with ozone-preactivated poly(vinylidene fluoride) (PVDF) produced a PVDF-g-PSSS copolymer. Sulfonic acid proton exchange membranes (PVDF-g-PSSA) were then prepared using the solvent evaporation method. They were investigated with a Fourier transform infrared spectrometer and an X-ray diffractometer. The results indicate that the proton conductivity of the prepared membranes reached 0.046 S/cm when the degree of grafting was 50.52%. Results from a quartz crystal microbalance with dissipation monitoring indicated that the PVDF-g-PSSA membrane showed superior antifouling performance to that of a Nafion membrane. The performance of the prepared membrane in dual-chamber microbial fuel cells was also evaluated and compared with that of Nafion 117. Although the microbial fuel cell with the prepared membrane generated lower maximum power density (106.7 mW/m^2) than that with Nafion 117 (132.0 mW/m^2), it was more cost-effective because of its lower price and more simplified preparation process. In addition, its chemical oxygen demand (COD) removal (85%) was much higher than that of Nafion 117 (74%).

*Corresponding author: Tel.: +13509182229. E-mail addresses: wl0178 @126.com (L. Wang).

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