THE EFFECT OF RICE HUSK ASH SILICA ON THE STRUCTURAL AND ELECTRICAL PROPERTIES OF THE POLYSACCHARIDE-BASED ELECTROLTYE FILMS

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ABSTRACT

THE EFFECT OF RICE HUSK ASH SILICA ON THE STRUCTURAL AND ELECTRICAL PROPERTIES OF THE POLYSACCHARIDE-BASED ELECTROLTYE FILMS

Polymer from polysaccharide is widely use due to their safety compared to liquid electrolytes (LEs). However, the presence of hydrogen bonding between polysaccharide chains causes the polymer film to be brittle. This will affect its performance as polymer electrolytes (PE), as brittle film exhibits poor electrode-electrolyte contact, resulting in low ionic conductivity. The incorporation of plasticizers has been successful to address this issue, but with the expense of its mechanical strength. In contrast, the incorporation of filler was reported to improve the flexibility and ionic conductivity of PE while preserving its mechanical properties. Therefore, in this study, the inorganic filler of silica obtained from rice husk ash (RHA) was doped into the polysaccharide matrix. By using RHA as a filler, the byproduct can be employed economically while mitigating the environmental issues. The first objective of this study is to extract silica from RHA using precipitation method. The silica was successfully extracted as confirmed from Fourier transform infrared spectroscopy (FTIR) and energy dispersive x-ray (EDX) analysis. Moreover, the extracted silica has amorphous structure as examined from appearance of broad peak from x-ray diffraction (XRD) analysis and homogenous particle distribution observed from scanning electron microscopy (SEM) image. Then, the extracted silica (0.25, 0.50, 0.75, 1.00, and 1.25 wt %) was doped into the polysaccharide matrix with the presence of LiTf as conducting species using solution casting technique. An enhanced of ionic conductivity with value of 1.24×10^{-2} S cm^{-1} was obtained when 0.25 wt % silica was added. This is due to the increased amorphousness caused by the polymer-filler interaction, which thereby prevents hydrogen bonding from forming between TSP chains and also due to the presence of the new Li^+ ions conducting pathway, caused by the salt-filler interaction as observed from FTIR analysis. Further, when the weight percent of silica exceeds 0.25, ionic conductivity decreases. This is might due to that a higher concentration of silica could produce a more rigid structure that obstructs ion and polymer chain flow and reduces ionic conductivity. The production of flexible and highly conducting silica doped polysaccharide electrolyte films in this study is align with the objective of Sustainable Development Goal 7 (SDG7) and 12th Shared Prosperity Vision 2030 (KEGA12).