THE EFFECT OF STRUCTURAL AND MECHANICAL PROPERTIES ON FILLER FROM RICE HUSK ASH ON MG49-AMMONIUM TRIFLATE POLYMER ELECTROLYTES

NUR HANIS SYAZWANI BINTI MOHD BUSTAMAN

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This Final Year Project Report entitled **"The Effect of Structural and Mechanical Properties on Filler from Rice Husk Ash on MG49-Ammonium Triflate Polymer Electrolytes"** was submitted by Nur Hanis Syazwani Binti Mohd Bustaman in partial fulfilment of the requirement for the Degree of Bachelor of Sciences (Hons.) Physics, in the Faculty of Applied Sciences and was approved by:

Dr Khuzaimah Nazir
Supervisor
B.Sc. (Hons) Physics
Faculty of Applied Science
Universiti Teknologi MARA
Perlis Branch, Arau Campus,
02600, Arau, Perlis

Dr Nabilah Akemal Muhd Zailani
Co Supervisor
B.Sc. (Hons) Chemistry
Faculty of Applied Science
Universiti Teknologi MARA
Perlis Branch, Arau Campus,
02600, Arau, Perlis

Dr Siti Zulaikha Mohd Yusof
Project Coordinator
B.Sc. (Hons) Physics
Faculty of Applied Science
Universiti Teknologi MARA
Perlis Branch, Arau Campus,
02600, Arau, Perlis

Dr Rosyaini Afindi Zaman
Programme Coordinator
B.Sc. (Hons) Physics
Faculty of Applied Science
Universiti Teknologi MARA
Perlis Branch, Arau Campus,
02600, Arau, Perlis

Date: 25 JULY 2025

ABSTRACT

THE EFFECT OF STRUCTURAL AND MECHANICAL PROPERTIES ON FILLER FROM RICE HUSK ASH ON MG49-AMMONIUM TRIFLATE POLYMER ELECTROLYTES

As the world shifts toward more sustainable and efficient energy systems, polymer electrolytes have become essential components in the development of advanced electrochemical devices. However, their low ionic conductivity and insufficient mechanical strength, especially at room temperature, often limit their practical use. Traditional efforts to improve these qualities have generally relied on expensive, sophisticated, and environmentally unfriendly materials. To address these limitations of conventional polymer electrolytes, this study investigates the enhancement of MG49-$NH_4CF_3SO_3$ by incorporating rice husk ash (RHA) silica, which is considered a promising alternative due to its ability to improve ionic conductivity and mechanical strength through a sustainable and low-cost process. The aim was to evaluate the structural and mechanical effects of RHA on polymer matrices at different concentrations (2-10 wt.%). Solution casting was used to produce polymer films, which were then characterized using tensile testing, optical microscopy (OM), and Fourier Transform Infrared Spectroscopy (FTIR). FTIR analysis revealed a strong interaction between MG49, ammonium triflate, and RHA fillers. Peak shifts at 1031 cm^{-1} and 639 cm^{-1} indicate decreased crystallinity and increased complexation. As RHA concentration increased, particularly at 6 wt.%, OM analysis showed better filler dispersion and a more compact film structure. Tensile tests confirmed this, with the MR02 sample (2 wt.% RHA) exhibiting the highest tensile strength of about 1.2 MPa and improved flexibility. In contrast, pure MG49 film has a tensile strength of approximately 0.8 MPa and is more brittle. The findings demonstrate that 2 wt.% RHA offers the best balance of mechanical integrity and structural compatibility. In conclusion, the results indicate that 6 wt.% RHA (MR06) provides the optimal performance to enhance the mechanical and structural properties of the polymer electrolyte.

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