CHARACTERIZATIONS OF PECTIN / CARRAGEENAN BLEND FOR POLYMER ELECTROLYTES

FARIHAH BINTI JAAFAR

BACHELOR OF SCIENCE (Hons.)
APPLIED CHEMISTRY
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA

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FARIHAH BINTI JAAFAR

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This Final Year Project Report entitled **"Characterizations of Pectin / Carrageenan Blend for Polymer Electrolytes"** was submitted by Farihah binti Jaafar in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Applied Chemistry, in the Faculty of Applied Sciences, and was approved by

Dr. Nabilah Akemal Muhd Zailani
Supervisor
B. Sc. (Hons.) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Dr. Khuzaimah Nazir
Co-Supervisor
B. Sc. (Hons.) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Dr. Siti Nurlia binti Ali
Project Coordinator
B. Sc. (Hons) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Dr. Nur Nasulhah binti Kasim
Head of Programme
B. Sc. (Hons.) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Date: __________

ABSTRACT

CHARACTERIZATIONS OF PECTIN / CARRAGEENAN BLEND FOR POLYMER ELECTROLYTES

Extensive study is being conducted to determine whether polymer electrolytes (PEs) derived from naturally occurring polymers, such as pectin, are superior to liquid electrolytes. Although pectin-based polymer electrolyte are safe for the environment, their hydrogen bonding causes brittleness of the film. To overcome the brittleness issue, this study aims to blend pectin with carrageenan at different ratio (0:100, 20:80, 40:60, 60:40, 80:20, and 100:0) using solvent casting technique. Then, the structural, morphological, mechanical, and electrical properties of the system were studied to determine the best polymer blend ratio. At a composition of 40:60 (PE40), a flexible and free-standing film of pectin/carrageenan blend was effectively generated, demonstrating the polymer blend's synergistic impact. The tensile strain result increased from 0.5557% of pure pectin to 0.7833% of PE40, indicating an enhancement in the flexibility of the polymer blend film. This is likely attributed to the polymer blend interaction, as revealed by FTIR investigations, which prevents hydrogen bonding between the individual polymer chains. The conductivity value increased to 6.58×10^{-7} S cm^{-1} as a result of the enhanced flexibility of the polymer blend film with the favorable adhesion between electrode and electrolyte. PE40's morphology was also improved as a result of the smooth film production and decrease in rough surface. 15 wt% of LiTf was also incorporated into the best composition of the polymer blend. The interaction between the salt's Li^+ ions and the polymers' oxygen atoms was identified by FTIR analysis. The ionic conductivity of PE40 rose by one order of magnitude, from 6.58×10^{-7} S cm^{-1} to 2.95×10^{-6} S cm^{-1}. The existence of conducting species from LiTf caused an increase in ionic conductivity. The blend system's amorphous phase and additional potential coordinating sites at the ideal ratio also made it easier for Li^+ ions to travel. The optical micrograph of PE40+LiTf shows pores, which confirms the study's findings by showing the formation of new ion pathways as a result of the interaction between polymers and the salt. As the materials used in this study were safer for the environment, the PE that was produced will support both the 12th Shared Prosperity Vision 2030 (KEGA12) and Sustainable Development Goal 7 (SDG7).

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