

**EFFECT OF LITHIUM TRIFLATE (LITF) SALT ON
POLYSACCHARIDE BASED NATURAL SOLID
POLYMER ELECTROLYTE**

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This Final Year Project Report entitled “**Effect of Lithium Triflate (LiTf) Salt on Polysaccharide Based Natural Solid Polymer Electrolyte**” was submitted by Nur Jannah binti Abdul Halim 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

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ABSTRACT

EFFECT OF LITHIUM TRIFLATE (LITF) SALT ON POLYSACCHARIDE BASED NATURAL SOLID POLYMER ELECTROLYTE

Currently, liquid electrolytes (LEs) that have been used in many electrochemical devices, face safety concerns due to leakage problems. Consequently, natural solid polymer electrolytes (SPEs) that are leak-proof, biodegradable, and flexible are widely studied. Polysaccharides are commonly used in natural polymers since they are effortlessly found in nature. Moreover, the oxygen atoms in polysaccharides will likely act as coordinating sites with the salt, supplying a mechanism for ion conduction. Thus, in this research, flexible and self-supporting polysaccharide-based polymer electrolyte films from pectin peel doped with different amounts of lithium triflate (LiTf) were prepared using solution casting technique. As the optimal quantity of salt is essential in producing highly conducting SPE, the effect of different amounts of LiTf salt on the structural, electrical, and morphological properties of polysaccharide-based electrolyte films was analysed using Fourier Transform Infrared Spectroscopy (FTIR), Electrochemical Impedance Spectroscopy (EIS), and Optical Microscopy (OM), respectively. Solid, flexible, and self-supporting films of polysaccharide-based polymer electrolytes were successfully acquired by the addition (10, 20, 30, 40 and 50%) of LiTf salt. As proven by FTIR analyses, there occurs complexations between the LiTf cation and the polysaccharide coordinating sites (OH and C=O). This interaction has minimized the formation of hydrogen bonding between polysaccharide chains, hence explaining the formation of flexible. Also the polymer-salt interaction contribute to the improvement in the amorphous phase of the system. This can be further confirmed by the smooth morphology observed via OM analysis at high addition of salt (40% and 50%) LiTf. The improved in the amorphous phase and minimize formation of hydrogen bonding in the LiTf-doped polysaccharide-based PE had contributed to the increase in the ionic conductivity of the system with salt content. The EIS analysis shows that the highest conducting sample P5 (50 wt% LiTf) exhibits ionic conductivity of $3.87 \times 10^{-5} \text{ S cm}^{-1}$ which is four orders of magnitude higher than pure polysaccharide films. Overall the P5 sample has potential to be applied in lithium-ion batteries as its ionic conductivity is sufficient for the requirement of the devices. The production of natural SPE in this study will contribute to Sustainable Development Goals 7 (SDG7) catering affordable and clean energy as well as 12th Shared Prosperity Vision for 2030 (KEGA12) which aimed for a green economy.

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