THE EFFECT OF RICE HUSK ASH SILICA (SiO_2) ON THE STRUCTURAL AND ELECTRICAL PROPERTIES OF THE POLY (METHYL METHACRYLATE) (PMMA) / 50% EPOXIDIZED NATURAL RUBBER (ENR 50)-BASED ELECTROLYTES FILMS

SITI NURNI KAMILLA BINTI ABDULLAH

Final Year Project Proposal Submitted in
Partial Fulfilment of the Requirements for the
Degree of Bachelor of Science (Hons.) Applied Chemistry
in the Faculty of Applied Sciences
Universiti Teknologi MARA

AUGUST 2024

THE EFFECT OF RICE HUSK ASH SILICA (SiO_2) ON THE STRUCTURAL AND ELECTRICAL PROPERTIES OF THE POLY (METHYL METHACRYLATE) (PMMA) / 50% EPOXIDIZED NATURAL RUBBER (ENR 50)-BASED ELECTROLYTES FILMS

SITI NURNI KAMILLA BINTI ABDULLAH

Final Year Project Proposal Submitted in
Partial Fulfilment of the Requirements for the
Degree of Bachelor of Science (Hons.) Applied Chemistry
in the Faculty of Applied Sciences
Universiti Teknologi MARA

AUGUST 2024

Fakulti Sains Gunaan

SUBMISSION FOR EVALUATION
FINAL YEAR PROJECT 2 - RESEARCH PROJECT/

THE EFFECT OF RICE HUSK ASH SILICA (SiO2) ON THE STRUCTURAL AND ELECTRICAL PROPERTIES OF THE POLY (METHYL METHACRYLATE) (PMMA) / 50% EPOXIDIZED NATURAL RUBBER (ENR 50)-BASED ELECTROLYTES FILMS

Name	:	SITI NURNI KAMILLA BINTI ABDULLAH
Student ID	:	2021603398
Program	:	AS245
Course code	:	FSG671
Mobile Phone	:	
E-mail	:	Camillanurni@gmail.com

** Please attach the Turnitin summary report, with your name clearly stated, at the end of your report and submit it together.*

Approval by Main Supervisor:

I certify that the work conducted by the above student is completed and approve this report to be submitted for evaluation.

Supervisor's name	:	DR. NABILAH AKEMAL MUHD ZAILANI
Date	:	26/07/2024
Turnitin Similarity %	:	29%
Signature	:	

DR. NABILAH AKEMAL MUHD ZAILANI
Pensyarah Kanan
Fakulti Sains Gunaan
Universiti Teknologi MARA
Cawangan Perlis
02600 Arau, Perlis

< Put this form as the front page of your report >

ABSTRACT

THE EFFECT OF RICE HUSK ASH SILICA (SiO_2) ON THE STRUCTURAL AND ELECTRICAL PROPERTIES OF THE POLY (METHYL METHACRYLATE) (PMMA) / 50% EPOXIDIZED NATURAL RUBBER (ENR 50)-BASED ELECTROLYTES FILMS

Previously, the brittle issues of poly(methyl methacrylate) (PMMA) films was solved by blending it with epoxidized natural rubber (ENR 50). The ionic conductivity of the polymer electrolyte (PE) system achieved ~10^{-5} S cm^{-1}, but it is still inadequate for energy storage systems. The incorporation of plasticizers has been successful in solving this issue, though at the expense of its mechanical strength. In contrast, the addition of filler was shown to improve the flexibility and ionic conductivity of PE while maintaining its mechanical properties. Therefore, in this study, different amounts of silica (SiO_2) filler from rice husk ash (RHA) (i.e., 0.25, 0.5, 0.75, and 1 wt.%) were incorporated into the PMMA/ENR 50-based PE system using solution casting technique. The SiO_2 with an average particle size of 75.76 micrometers was extracted from RHA using the precipitation method. The structure and purity of the silica were confirmed using Fourier transform infrared spectroscopy (FTIR) and energy-dispersive X-ray spectroscopy (EDS), respectively. X-ray diffraction (XRD) and scanning electron microscopy (SEM) studies confirm the amorphosity of the silica. Meanwhile, the effects of adding the different percentage of silica from RHA on the structural and electrical properties of the PMMA/ENR 50-based electrolyte films were analyzed by using FTIR and electrochemical impedance spectroscopy (EIS), respectively. Flexible and free-standing film of PMMA/ENR 50-based electrolyte at highest ionic conductivity of 1.37×10^{-3} S cm^{-1} was observed with addition of up to 0.5 weight % of SiO_2. This was due to the increased amorphousness caused by the polymer-filler interaction, as well as the presence of a new Li ions conducting pathway caused by the salt-filler interaction, confirmed by FTIR analysis. Thus, the preparation of flexible and highly conducting silica doped PMMA/ENR 50-based PE films in this study aligns with the objectives of the 12th Shared Prosperity Vision for 2030 (KEGA12), and Sustainable Development Goals 7 (SDG7).

TABLE OF CONTENTS

		Page
ABSTRACT		iv
ABSTRAK		v
ACKNOWLEDGEMENTS		vi
LIST OF TABLES		ix
LIST OF FIGURES		x
LIST OF SYMBOLS		xii
LIST OF ABBREVIATIONS		xiii
CHAPTER 1: INTRODUCTION		
1.1	Background	1
1.2	Problem Statement	3
1.3	Objectives	5
1.4	Significance of Study	5
CHAPTER 2: LITERATURE REVIEW		
2.1	Polymer Electrolytes	6
2.2	Poly (methyl methacrylate) (PMMA) as polymer host	8
2.3	50% Epoxidized natural rubber (ENR 50)	11
2.4	Filler in polymer electrolyte system	13
	2.4.1 Rice Husk Ash as filler	15
2.5	Salt as the dopant in PMMA/ ENR 50 electrolyte system	17
2.6	Characteristic techniques	18
	2.6.1 Particle Size Analyzer (PSA)	19
	2.6.2 Fourier-transform infrared spectroscopy (FTIR)	20
	2.6.3 X-Ray diffraction analysis (XRD)	27
	2.6.4 Scanning Electron Microscope (SEM)	29
	2.6.5 Electrochemical Impedance Spectroscopy (EIS)	32