

**THE EFFECT OF FILLER FROM RICE HUSK ASH ON MG30- CALCIUM  
TRIFLATE POLYMER ELECTROLYTES**

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## ABSTRACT

### THE EFFECT OF FILLER FROM RICE HUSK ASH ON MG30 CALCIUM TRIFLATE POLYMER ELECTROLYTES

Energy storage devices are widely used in various electronic and industrial applications. However, they often face several critical challenges that compromise their safety and performance. Common issues include high flammability, electrolyte leakage, dendrite formation during charge-discharge cycles, and insufficient mechanical support. Additionally, these devices are generally unsuitable for long-term use due to thermal instability and material degradation, posing potential safety risks to users. To address these limitations, composite polymer electrolytes (CPEs) have emerged as a promising solution. In this study, CPEs were developed by incorporating silica ( $\text{SiO}_2$ ), extracted from rice husk ash (RHA), into a polymer matrix consisting of 30 wt. % poly(methyl methacrylate)-grafted natural rubber (MG30) and calcium triflate ( $\text{Ca}(\text{OTf})_2$ ) as the dopant salt. Various concentrations of  $\text{SiO}_2$  (2 wt. %, 4 wt. %, 6 wt. %, 8 wt. %, and 10 wt. %) were examined to determine the effect of filler content on the electrolyte properties. The samples were fabricated using the solution casting method combined with a simple precipitation technique. Structural, morphological, and mechanical properties were characterized using fourier transform infrared spectroscopy (FTIR), optical microscopy (OM), and tensile testing. Among the samples, the CPE containing 8 wt. %  $\text{SiO}_2$  demonstrated the strongest molecular interactions and effective bonding between MG30, the salt, and the silica filler. Although OM analysis showed a somewhat non-uniform surface at this concentration, the sample exhibited the highest tensile strength ( $\sim 1.2$  MPa) and a notable elongation at break ( $\sim 370\%$ ). Therefore, the 8 wt. %  $\text{SiO}_2$  CPE showed superior performance and holds significant potential for safer and more efficient energy storage devices.

## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENT</b>	iii
<b>ABSTRACT</b>	iv
<b>ABSTRAK</b>	v
<b>TABLE OF CONTENTS</b>	vi
<b>LIST OF TABLES</b>	viii
<b>LIST OF FIGURES</b>	ix
<b>LIST OF ABBREVIATIONS</b>	xi
 <b>CHAPTER 1 INTRODUCTION</b>	
1.1 Research Background	1
1.2 Problem Statement	4
1.3 Research Questions	5
1.4 Objectives	5
1.5 Significance of Study	5
1.6 Expected Output/Outcomes/Implication	6
 <b>CHAPTER 2 LITERATURE REVIEW</b>	
2.1 Introduction to Polymer Electrolytes	7
2.1.1 Solid Polymer Electrolyte	8
2.1.2 Gel Polymer Electrolyte	8
2.1.3 Composite Polymer Electrolyte	9
2.2 Polymer Host	10
2.2.1 30 % poly(methyl methacrylate)-grafted-natural-rubber (MG30) as Polymer Host	11
2.3 Calcium Triflate as Dopant Salt	12
2.4 Silica from RHA as Filler	13
2.5 Structural Properties of CPEs based RHA	14
2.6 Mechanical Properties of CPEs based RHA	17
 <b>CHAPTER 3 RESEARCH METHODOLOGY</b>	
3.1 Introduction	20
3.2 Material	20

3.3	Preparation of Polymer Electrolytes	22
	3.3.1 Preparation of RHA Silica	22
	3.3.2 Preparation of Solid Polymer Electrolyte	23
	3.3.3 Preparation of Composite Polymer Electrolytes	24
3.4	Sample Characterization	25
	3.4.1 Fourier Transform Infrared Spectroscopy (FTIR)	25
	3.4.2 Optical Microscopy (OM)	26
	3.4.3 Tensile Test	27
3.5	Experimental designs/ Flow chart	30
 <b>CHAPTER 4 RESULTS AND DISCUSSION</b>		
4.1	Fourier Transform Infrared Spectroscopy (FTIR)	33
	4.1.1 Introduction	33
	4.1.2 The Infrared Spectrum of Silica	34
	4.1.3 The Infrared Spectrum of SPE Thin Film	36
	4.1.4 The Infrared Spectrum of CPE Thin Film	37
4.2	Optical Microscopy (OM)	39
	4.2.1 Introduction	39
	4.2.2 Morphology Studies of SPE Thin Film	39
	4.2.3 Morphology Studies of CPE Thin Film	40
4.3	Tensile	43
	4.3.1 Introduction	43
	4.3.2 Mechanical Strength at Different Concentration of the Silica	43
 <b>CHAPTER 5 CONCLUSION AND RECOMMENDATIONS</b>		
5.1	Conclusion	46
5.2	Recommendations	47
 <b>CITED REFERENCES</b>		48
<b>APPENDICES</b>		51
<b><i>CURRICULLUM VITAE</i></b>		67