

UNIVERSITI TEKNOLOGI MARA

**INTEGRAL MEMBRANE FROM
PSF/PVA/ QUATERNIZED CHITOSAN
CROSS-LINKED WITH RHA SILICA
POWDER FOR LI/MG SEPARATION**

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ABSTRACT

Membrane separation technology is one of the most effective methods to recover Li^+ from salt-lake brine. Due to its high competition with Mg^{2+} , a new technique known as quaternization process is applied in membrane technology to develop a positively charged membrane which scientifically proven can separate high valent cation and low valent cation. The technique of quaternization required grafting quarternary ammonium groups, which serves as the positive charge carriers, onto the polymer chain. In this study, chitosan was quaternized with chlorohydroxypropyl trimethylammonium chloride (CHTAC) to formulate positively charge membrane. The quaternized chitosan (QCS) was then blended with polysulfone/polyvinyl alcohol and rice husk ash silica (RHAS) powder where the RHAS powder acted as a cross-linking agent. The formulation of the membrane consisted of two different loading concentrations of QCS at 2.5wt% and 5wt.%, and the loading of RHAS powder were varied at 0wt.%, 0.5wt.% and 1wt.%. The membranes were the characterised through Fourier Transform Infrared Spectroscopy (FTIR), Field - Emission Scanning Electron Microscopy (FESEM), Thermogravimetry Analysis (TGA), Zeta Potential Analysis (ZP), X-Ray Diffractometer (XRD) and contact angle. The RHAS powder was also characterised through X-Ray Diffractometer (XRD), Energy Dispersive X-Ray Fluorescence (EDXRF), Scanning Emissions Microscopy (SEM), and Fourier Transform Infrared Spectroscopy (FTIR). The performance of the membrane was analysed through pure water flux analysis, antifouling analysis, and separation process between Li^+ and Mg^{2+} . According to data collected by EDXRF and XRD analysis, the modified extraction process had successfully extracted 98.24% of SiO_2 and the RHAS powder had an amorphous structure respectively. From the membrane characterisation, the membrane incorporated with lower QCS, at 0.5wt.% RHAS powder exhibited smaller pore size, had better thermal stability and improved membrane hydrophilicity. However, from zeta potential analysis, higher loading of QCS exhibited more positive charges compare to lower loading of QCS. Overall, the membrane containing RHAS powder had better and stable pure water flux and good antifouling behaviour especially at lower loading of QCS, and membrane incorporated with QCS showed a rejection towards Mg^{2+} then able to recover high amount of Li^+ through the separation process. Whereas some membrane suffers with inhomogeneous structure which had influenced its characteristic and performance. Amongst all membrane, it can be concluded that membrane B1 with lower QCS loading with 0.5wt.% of RHAS powder demonstrated the best characteristic and performance compared to other membranes. Hence, the formulation of membrane B1 has potential to be used for lithium recovery with additional advantage of utilising biomass in the membrane formulations.

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TABLE OF CONTENT

CONFIRMATION BY PANEL EXAMINERS

AUTHOUR'S DECALARATION

ABSTRACT

ACKNOWLEDGEMENT

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS

LIST OF NOMENCLATURES

CHAPTER ONE: INTRODUCTION

- 1.1 Background of Study
- 1.2 Problem Statement
- 1.3 Research Objectives
- 1.4 Scope and Limitation of The Study
- 1.5 Significance of The Study

CHAPTER TWO: LITERATURE REVIEW

- 2.1 Sources of Lithium
 - 2.1.1 Lithium Extraction Methods
 - 2.1.2 Lithium Extraction from Brine
- 2.2 Mechanism of Membrane Filtration Process
 - 2.2.1 Adsorption Membrane
- 2.3 Polymer Selection for Membrane
 - 2.3.1 Polysulfone (PSF)
 - 2.3.2 Polyvinyl Alcohol (PVA)

2.3.3	Chitosan(CS)	26
2.3.4	Membrane Synthesis Method	27
2.3.5	Phase Inversion Method for Integral Membrane Formation	29
2.4	Polymer Blending	30
2.5	Quaternization Process	32
2.6	Rice Husk Ash as Cross-linker	35
2.6.1	Silica Extraction Method	38
2.7	Surface Charge of Membrane	40

CHAPTER THREE: RESEARCH METHODOLOGY 42

3.1	Research Framework	42
3.2	Materials	46
3.3	Membrane Preparation	46
3.3.1	Preparation of Silica Powder from RHA	46
3.3.2	Preparation of PVA/RHAS Solution	47
3.3.3	Preparation of Quaternized Chitosan (QCS)	48
3.3.4	Preparation of Hybrid Membrane Solution from PVA/RHAS/QCS Using Solgel Method	48
3.3.5	Preparation of Polysulfone (PSF) Solution	49
3.3.6	Preparation of Integral Membrane from PSF/PVA/RHAS/QCS	49
3.4	Characterization of Integral Membrane	50
3.4.1	Fourier Transform Infrared Spectroscopy (FTIR)	51
3.4.2	Field - Emission Scanning Electron Microscopy (FESEM)	51
3.4.3	Thermogravimetry Analysis (TGA)	51
3.4.4	Surface Charge Analysis (Zeta Potential)	52
3.4.5	Contact Angle	52
3.4.6	X-Ray Diffractometer (XRD)	52
3.5	Characterization of RHAS powder	53
3.5.1	Fourier Transform Infrared Spectroscopy (FTIR)	53
3.5.2	X-Ray Diffractometer (XRD)	53
3.5.3	Energy Dispersive X-Ray Fluorescence Spectrometer (EDXRF)	53
3.5.4	Scanning Electron Microscopy (SEM)	54
3.6	Membrane Performance Analysis	54