SYNTHESIS OF WASTE COOKING OIL BASED POLYURETHANE SOLID POLYMER ELECTROLYTE: THE EFFECT OF METAL SALTS

MARINA BINTI ABU HUSIN

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

JANUARY 2016

ACKNOWLEDGEMENTS

Alhamdulillah, all praises, glory and thanks to Allah, the almighty Lord of the world. Peace and blessing to Nabi Muhammad S.A.W., all the Prophets, his families and all muslims. Upon completing of this project, I would like to express my special gratitude to many parties. My heartfelt thanks goes to my supervisor Madam Syuhada Mohd Tahir for her untiring guidance and advice throughout the course of this study.

I will always be grateful to Madam Syuhada's advice and guidance on experimental design, detailed assistance, and kind encouragement. Without her supervision and constant help, this thesis would not have been possible. I would like to thank my FYP-mate, Rahmatina binti Huzaizi who always supporting me and helping each other during lab works and discussion. Special thanks to master student under supervision of my supervisor, Wan Norfirdaus bin Wan Salleh who constantly helping me throughout the activity in the lab.

In addition, I would especially like to thank all the lab assistants at Faculty of Science Laboratory, UiTM Pahang who in many ways contributed to the success of my research. Not forgetting fellow classmates who have also gave valuable advices and suggestions in completing this project. Last but not least, I would like to express the deepest appreciation to my parent, Abu Husin bin Abu Bakar and Rohani binti Abu Bakar, my brother and sister for their endless pray, support and encouragement throughout this project.

Marina binti Abu Husin

TABLE OF CONTENTS

ABSTRACT

SYNTHESIS OF WASTE COOKING OIL BASED POLYURETHANE SOLID POLYMER ELECTROLYTE: THE EFFECT OF METAL SALTS

Polyurethane (PU) based on polyol, derived from waste cooking oil has been synthesized and characterized for potential use as a base material for electrolytes. One-pot epoxidation and hydroxylation process of waste cooking oil formed a polyol with %FFA value of 10.4%, acid value of 20.7 mg KOH/g and iodine value of 45.72 I_2/100g. Polyols, metal salts, plasticizer and solvent together with 2, 4'-diphenylmethane diisocyanate were used to synthesize the polyurethane solid polymer electrolyte via solution casting technique. Three types of metal salts used are lithium chloride (LiCl), lithium perchlorate ($LiClO_4$) and sodium chloride (NaCl). Ethylene carbonate (EC) plasticizer was used to enhance the ionic conductivity of the polymer electrolytes. The formation of urethane linkages and the chemical interaction between segmented PU and cation/anion from metal salts were confirmed by Fourier transform infrared (FTIR) analysis. Thermal studies carried out by Thermogravimetric analysis (TGA) and Differential scanning calorimetry (DSC) has proven the occurrence of polymer-salt complexation as well as gave information about the polymer chain dynamics and plays a vital role in ionic conduction. The highest ionic conductivity value is 3.02×10^{-5} S/cm recorded by PU-LiCl electrolyte. These observations indicated the synthesized PU possessed favorable properties to act as a base material in polymer electrolytes.