Synthesis of Novel Resin from Post Consumer PET Waste and Methyl Ricinoleate for Two Pack Surface Coating

By

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Thesis Submitted to the University of Sri Jayewardenepura for the Award of the Master of Science in Polymer Science and Technology

2016

DECLARATION

The work described in this thesis was carried out by me under the supervision of Dr.M.A.B. Prashantha, Senior lecturer, Department of Chemistry, University of Sri Jayewardenepura and a report on this has not been submitted in whole or in part to any university or any other institution for another Degree/Diploma.

....   13/06/2016.........................

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CERTIFICATION

I certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the University for the purpose of evaluation.

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LIST OF ABBREVIATIONS

PET / PETE	Polyethylene terephthalate
LDPE / PELD	Low density polyethylene
LLDP / LLD	Linear low density polyethylene
HDPE / PEHD	High density polyethylene
PVC	Poly vinyl chloride
PP	Polypropylene
PS	Polystyrene
PA	Polyamide
PBT	Polybutylene terepthalate
PPS	Polyphenylene sulfide
PPO	Polyphenylene oxide
PSU	Polysulphone
ABS	Acrylonitrile butadiene styrene
SPI	Society of plastic industries
PUR	Polyurethane
PMMA	Poly (methyl methacrylate)
MSW	Municipal solid waste
EG	Ethylene glycol
HDI	Hexamethylene Diisocyanate
TDI	Toluene Diisocyanate
MDI	Diphenylmethane4, 4'Diisocyanate
IPDI	Isophorone Diisocyanate
BHET	Bis (2-hydroxyethyl) terepthalate

ASTM	American society of testing and materials
FTIR	Fourier transformed infra-red
DSC	Differential scanning calorimetry
MA	Maleic anhydride
TPA	Terepthalic acid
DMT	Dimethyl terepthalat
TPR	Thermoplastic polyester resin
AARG	Annual average rate growth
NaOH	Sodium hydroxide
KOH	Potassium hydroxide
CO_2	Carbon dioxide
g	Gram
h	Hour
kg m^{-3}	Kilograms per cubic meter
mol dm^{-3}	Moles per cubic decimeter
ml	Milliliter
rpm	Rounds per minute
g / mol	Gram per mole
g / ml	Gram per milliliter
k/Pa	Kilo pascal
KJ / mol	Kilojoule per mole
J / (kg.K)	Joule per kilogram Kelvin
mPa.s	Millipascal second

mt	Million tonnes / Metric tonnes
°C	Centigrade

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AKNOWLEDGEMENTS

I would like to express my heartfelt gratitude to research supervisor Dr.M.A.B.Prashantha, Senior Lecturer of the Department of Chemistry, University of Sri Jayewardenepura, Sri Lanka for the encouragement, guidance and support extended to me at all times during the research work. His interest, enthusiasm and commitment were always a source of inspiration to me.

I am extremely grateful to former Dean of the Faculty of Graduate Studies, Prof. P.M. Jayaweera, Head of the Department of Chemistry, for providing facilities to undertake this research project at the Polymer Research Laboratory of the University of Sri Jayewardenepura, Sri Lanka. My sincere thanks express to Dr.Manoj Chinthaka, Senior Lecturer of the Department of Chemistry, University of Sri Jayewardenepura, Sri Lanka for providing facility to undertake the FTIR testing analysis. Even, I am grateful to thanks Dr. Jagath Premachandra, Senior Lecturer of the Department of Chemical and Process Engineering, University of Moratuwa, Sri Lanka, for providing facility to undertake the DSC thermo analysis of my samples. My grateful thank goes to Mr. Sisira, Mr. Suranga and Mrs. Ramya, the staff of the Polymer Research Laboratory for their assistance and friendly cooperation.

A special thanks to my parents, brothers and sisters for the encouragement and support given to me. Even, I would like to express appreciation to my beloved wife who has supported me throughout entire process. At the end, I thank all those who helped me directly or indirectly in the study.

ABSTRACT

The problem of plastic waste is now a global one and waste PET represents one of the most successful examples of polymer plastic recycling. The intermediate product was BHET, which obtained from the glycolysis process and highest yield of BHET, 66 % was obtained at temperature 198 °C after 90 minutes reflux in the presence of zinc catalyst while stirring continued at100 r.p.m speed. The castor oil was extracted by solvent extraction and percentage oil content of castor seeds was found to be 31.34 % of the total weight of 210 g. The castor oil was transesterified into methyl ricinoleate by methanol with sodium methoxide as catalyst. The BHET was readily polyesterified with maleic anhydride and methyl ricinoleate to obtain the polyester resin in the absence of acid catalyst. The reaction vessel was heated at temperature 135°C for 150 minutes while continues stirring. At 135°C, the kinetics plots were demonstrated that the first order reaction due to linearity. Polyester resins were formulated as two pack coating application which reacted with HDI as cross linking agent. The mixed compositions were coated on different surfaces such as glass, rubber, plastic, metal and wood and performance of the film has been evaluated accordingly.