MELT REACTION OF POLYMER BLENDS COMPRISING POLY(ε-CAPROLACTONE) AND EPOXIDIZED NATURAL RUBBER

JURITA CHE MAT

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

MAY 2008

ACKNOWLEDGEMENTS

In the name of ALLAH the most Beneficent, the most Merciful.

Alhamdulillah, I have completed this research. I wish to express my thankful and appreciation especially to my supervisor Dr. Chan Chin Han for her consistent guidance and her willingness to help me throughout my work. A lot of gratitude to my co-supervisor Assoc. Prof Sim Lai Har, to all the lecturers and staff in Faculty of Applied Sciences and also to my friends, who have contributed their help in completing my research.

TABLE OF CONTENTS

ABSTRACT

MELT REACTION OF POLYMER BLENDS COMPRISING POLY(ε-CAPROLACTONE) AND EPOXIDIZED NATURAL RUBBER

Poly(ε-caprolactone) (PCL) is a semicrystalline polymer and epoxidized natural rubber with 25 mole % epoxidation level (ENR-25) is an amorphous polymer. Blends of PCL with ENR-25 were prepared using solvent casting method. Terminal hydroxyl group of PCL may trigger reaction between the constituents at relatively high temperature since the epoxy group from ENR-25 provides reactive site. Glass transition temperature (T_g) for neat PCL and neat ENR-25 are -65.5 °C and -42.7 °C, respectively. Two T_gs are observed over the entire composition range. This reveals immiscibility between PCL and ENR-25. DSC traces display an exothermic peak when PCL/ENR-25 blends were annealed at temperature ranging from 324 up to 330 °C. It turns out that rate of melt reaction of PCL/ENR-25 blends stays approximately constant for respective blends with increasing T_as. FTIR studies indicate the ring opening of epoxy group in ENR-25 after melt reaction of PCL/ENR-25 blends. Two phases morphologies formed in the blends as observed under polarizing optical microscope (POM) at T_c = 35 °C before melt reaction.

CHAPTER 1

INTRODUCTION

1.1 General

The introduction of polymers into market has made a significant contribution for the enhancement of the standard of living globally since the end of Second World War. Polymer is defined as macromolecule or giant molecule that is built up by repeating units of small, simple chemical units, which are connected by covalent bond. The small repeating units that built up the polymer are called monomer. Examples of polymer are poly(ethylene) (PE), poly(vinyl chloride) (PVC), polystyrene (PS) and etc. (Allock et al., 2003).

There are two types of polymer, which can be classified as natural polymer and synthetic polymer. Natural polymer is the polymer that exists in nature, for instance, natural rubber. Synthetic polymer is the man made macromolecule, for example, PS (Sun., 2004). Polymer can be further divided into three classes that consist of thermoplastic, thermoset, and elastomers. Thermoplastic is a linear polymer with long, continuous, and covalently bonded atoms, for example, PE. Meanwhile, thermoset consists of crosslinks and cannot be softened by heat. The individual chain is joined to each other by covalently bonded crosslink, for instance, vulcanized rubber. Elastomer is a flexible polymer that is in the