UNIVERSITI TEKNOLOGI MARA

EVALUATION OF VISCOELASTIC PROPERTIES OF OPMF BIOCOMPOSITES

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ABSTRACT

The past decades have shown a growing interest in natural fibres as reinforcing material in composites primarily due to environmental concerns and awareness of limiting petroleum resources to produce petroleum-based synthetic polymers. Since, thermoplastic polymer such as Linear Low Density Polyethylene (LLDPE) has difficulty in natural degradation, filling it with natural fibres such as oil palm mesocarp fibre (OPMF) is considered one of the solutions to improve its biodegradability. The objectives of this study are; (1) to study of viscoelastic properties of Oil Palm Mesocarp Fiber (OPMF) biocomposite by mechanical test via cyclic and stress relaxation test; and (2) to study the viscoelastic properties of OPMF due to the effect of chemical modification. OPMF was prepared by washing with detergent and oven-dried before being grinded and sieved. The OPMF grafting LLDPE (OPMF-g-LLDPE) was produced via twin-screw extruder and hot press moulding at varying fibres content from 10wt% to 60wt% with the presence of varying monomer, maleic anhydride (MAH) concentration at 5wt%, as well as constant initiator, dicumyl peroxide (DCP) at 2wt% in order to prepared samples from characterization and mechanical properties test. For the tensile test showed that at loading 50% of OPMF the maximum amount of tensile stress can be can be loaded. Next for the stress relaxation test showed that the higher relaxation rate at the loading of OPMF is 40% content that means the stress relaxation is becomes the fastest. Besides, the cyclic test showed as increasing the loading of OPMF after grafting polymerization process shows that the biocomposites become more elastic behaviour. From this study, it was found that the grafting copolymerization on the OMPF-LLDPE biocomposites can increase the viscoelastic behaviour.

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Chapter 1: Introduction

1.1. Research Background.

The definition of biocomposites is the combination between the natural fiber and polymer which are made from the fossil based material like petroleum. The petroleum is derivative non-biodegradable polymer or biodegradable polymer. Biocomposites resulting from natural fiber and crop/bioderived plastic (biopolymer/bioplastic) are to be expected more environmentally kindly and such composites are defined as green composites (Shinoj et al., 2011). Natural fiber reinforcement in plastics will produce in great strength composites with the added advantages of improved biodegradability, light weight, low cost and good mechanical performance (M.S. Sreekala et al., 2001). Matrix polymers are generally thermoplastic polymers derived from petroleum such as polypropylene (PP), high-density polyethylene (HDPE), low-density polyethylene (LDPE), and polystyrene (PS). These polymers are a cause to various environment problems as they do not easily degrade in natural environment.

It has been proven that natural fibers are suitable as reinforcement materials for composites as they combine great mechanical properties with ecological advantages. Fiber-reinforced are better than other conventional composites since natural fibers are abundant, light weight, inexpensive, renewable, biodegradable, and nonabrasive to processing equipment (Wong & Shanks, 2009). Many types of natural fibers have existed investigated for consumption in composite containing papyrus, pineapple leaf fiber, banana fiber, paper mulberry, kapok, pennywort, water hyacinth, sisal, oil palm empty fruit bunch, ramic, kenaf, reeds, cane, rye, oats, barley, wheat, rice husk, wood, jute straw, hemp and flax (Shira Taj et al., 2007).

Oil palm mesocarp fiber (OPMF) is one of the potential natural fibers to be used in biocomposites production. These fibers are lignocellulosic excess left over in the palm oil mill. Malaysia is the one of the biggest oil palm creating nations in the world. At present, there are 5.74 million hectares of oil palm planted region in Malaysia (MPOB, 2016). Moisture and oil palm biomass comprise of 78 to 82% of oil palm fruits and 14% of it is mesocarp fiber (Omar et al., 2011). Empty fruit bunches, palm kernel shell and oil palm mespcarp are the oil palm biomass which are accessible for additional exploitation.

Oil Palm Mesocarp Fiber (OPMF) are residue which is get from the production of palm oil palm, which are usually make used of for bio-composite or bio-compost application (Nordin et al., 2013). In bio-composite applications, OPMF fibers were used as filler mixed with a conventional resin/matrix to produce composite products such as automotive parts. It was reported that the surface of palm fibers