UNIVERSITI TEKNOLOGI MARA

EVALUTION ON MECHANICAL PROPERTIES OF SILICON DIOXIDE (SIO_2) BIOCOMPOSITE

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ABSTRACT

Linear low density polyethylene (LLDPE) was blended with filler SiO_2 at a ratio up to 6% by extrusion to study the mechanical properties of the product. The Maleic Anhydride (MAH) was grafted into LLDPE-SiO_2 to determine the possible reaction. Dicumyl peroxide used as an initiator. The LLDPE-g-MAH composite filled with SiO_2 were extruded and melt-pressed in order to prepare samples for mechanical properties test. It showed 4% wt. of SiO_2 have the highest tensile strength and Young's Modulus while 6% wt of SiO_2 is the highest ductility. From this study, it is found that SiO_2 and MA can improve the strength of polymer but must be at the right amount.

Keywords— Linear low density polyethylene (LLDPE), silicon dioxide (SiO_2), maleic anhydride, extrusion, mechanical properties

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Polymer is the most widely used materials in chemical industries. The development of polymers from renewable resources has received more attention in recent years, in particular due to volatility of crude oil prices and the desire to avoid landfill disposal. It is possible to synthesise both thermoplastic and thermosetting polymer from bio-based chemical which usually derived from plants.

Biocomposites are the combination of natural fibre or biofibre with polymer matrices. Natural fibres act as the reinforcement or filler that provides strength and stiffness where the properties of the composite are controlled by properties of the fillers. Meanwhile, the matrix holds the fibres together and to transfer externally loads to the reinforcement. It also protects the reinforcement from environmental and mechanical damage. The advantages of bio-based products such as light weight, high specific strength and biodegradability make them dominant in various applications including automotive parts, furniture and medicine.

Silicon dioxide (SiO_2) is one of the most commonly inorganic composites that have been used in polymer. Other than that, TiO_2, ZnO and $CaCO_3$ are the most commonly used inorganic nanoparticles. SiO_2 nanoparticles have been proved by recent study about the ability of it to improve the mechanical and thermal properties of various polyolefins. Oil palm mesocarp fibre (OPMF) is one of the potential natural fibres to be used in biocomposites production. Recent study has been focused on the mechanical of the surface of oil palm mesocarp fibres (OPMF) containing silica bodies. Naturally, silica bodies are essential for growth, mechanical strength, fungal pathogens, physical barriers (nature defence) to enzymatic degradation and rigidity. Silica is an inorganic amorphous oxide formed by polymerization processes within plants. Some researchers suggested that the inclusion of silica bodies in composites prevent a sliding motion between the filler and matrix. In contrast, by excluding the silica bodies can increased and improved contact area between the filler and matrix. Therefore, this study is trying to mimic the contain of SiO_2 in oil palm mesocarp fibre (OPMF).