Modification of Pineapple Leaf Fibre to Reinforce Polylactic Acid Composite with Improved Mechanical Properties

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ABSTRACT

Natural fibres play a significant role in mass industries such as automotive, construction and sports. Many researchers have found that the natural fibres are the best replacement for the synthetic fibres in terms of cost, safety, and degradability due to the shortage of landfill and ingestion of non biodegradable plastic by animals. This study mainly revolved around pineapple leaf fibre (PALF) which is available in abundance in tropical countries and for its excellent mechanical properties. The composite fabricated in this study is highly compostable as both fibre and matrix is from natural based material. The matrix used which is polylactic acid (PLA) is made from corn starch, which gives the upper hand as both materials are renewable resources are easier to degrade by bacteria or enzyme. The PALF is treated with different alkaline percentage to remove excessive moisture in the fibre for better interfacial bonding with PLA. Thereafter the PALF is washed with distilled water several times before placing in vacuum oven. The dried PALF were later mixed with PLA through extrusion using fibre in percentage of 30 by weight for better bonding and afterwards the products of the mixture were pelletized using pelletizer. The pellets were placed in the specimen sized mould for hot compression and subsequently were cold pressed. The specimens were tested for tensile and flexure strength and the result was remarkable where a fluctuating graph can be seen for both tensile and flexure strength where 5% alkaline treatment showed the highest tensile and flexure strength among the alkaline solution. It can be concluded that the alkaline concentration affects the strength of the composite and the 5% NaOH solution is the best percentage of alkaline treatment for PALF.

Keywords: alkaline treatment; composite; mechanical properties; natural fibres

Introduction

Each year, million tonnes of plastics are being produced and a portion of it always finds its way to the ocean. In a groundbreaking study "*Plastic waste inputs from land into the ocean*", published in the journal *Science* estimated that in 2010 alone, almost 8 million tonnes of plastics were washed into the ocean from 192 coastal countries. The non biodegradability characteristic of the plastic has made it harmful to the environment. However, there are many studies being conducted on various material to find the suitable substitute for plastics[1]. The biocomposite found to be a better replacement for plastics in term of biodegradability, cost, and safety[2]. Biocomposite is made of two or more materials combined to achieve a better a multiphase material with desired properties and can be degraded by enzyme or bacteria[3].

In this study, Pineapple leaf fibres (PALF) were used as the fibre and polylactic acid (PLA) as matrix for PALF acts a good reinforcement material for this biocomposites due to the high cellulose content in the fibre compared to other plant fibers and the chemical