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TITLE:
TENSILE PROPERTIES AND THERMAL ANALYSIS OF CHLORELLA ALGAE FILLED PLA BIOFILM

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ABSTRACT

Global plastic waste pollution is a result of rising plastic waste production worldwide. Unavoidably, a different approach to lower this pollution is required. A whole solution does not consist just of increasing the recycling of plastic waste. Furthermore, a key component of sustainability is reducing the use of fossil-based plastic. Bio-based plastics are becoming more and more popular as a substitute for fossil-based polymers on the market. According to studies, biological feedstocks rather than fossil fuels can be used to produce goods with comparable performance characteristics. In particular, the creation of bioplastics from microalgae is a potential opportunity that should be investigated and enhanced. This study investigates the mechanical and physical characteristics of a bioplastic made from green algae and polylactic acid (PLA). In addition, this analysis identifies the possible compatibility of employing algae and PLA as a nonwoven composite to replace synthetic polymers that are not biodegradable. Additionally, this study examines the extent to which the adhesion between the matrix (PLA) and filler (algae) in biofilm composite may be exploited for end-uses purposes, as well as the underlying variables (concentrations of PLA and Chlorella) affecting the thermal and mechanical characteristics of the PLA-algae nonwoven composite. Tensile test shows the increasing of bioplastic tensile strength up to 13.186 N/mm^2. Thermal analysis by thermogravimetric analysis shows the thermal stability by monitoring the mass loss. Fourier transform infrared analysis shows that there are cross linkages between Chlorella and PLA. The film's performance may hint at its potential to be employed as bioplastic.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

Plastics are man-made polymers with a carbon structure that have several uses in daily life. Due to its desired qualities, such as low cost, transparency, light weight, great heat resistance, and a favourable weight to strength ratio, petroleum-based polymers are typically employed. It can be readily moulded into various shapes to create a wide range of materials. As a result, it has many different uses in the growing industrial sector. Overuse of these non-biodegradable, fossil-based polymers has had a significant negative influence on the environment, causing pollution, global warming, and the depletion of fossil fuels. They have a low potential for recycling and, on top of that, create pollutants during the recycling process. Furthermore, various polymers require different recycling methods, making the process of recycling plastic rather difficult. Only around 10% of the entire amount of plastic produced each year gets recycled; the remainder is thrown into landfills and ocean. These plastic wastes cannot be degraded by the natural microbes due to their intrinsic limitations. Ecosystems on land and in water are thus badly damaged. To address these issues, bioplastics synthesised from renewable sources are now being used as a promising option as they have properties like polymers derived from fossil fuels. Plastics may generally be categorised based on two characteristics: whether they are fossil- or bio-based, and whether they are biodegradable or not.

Bioplastics, as the name implies, are environmentally friendly and biodegradable, which can build a more sustainable and circular economy. Additionally, soil microorganisms could completely breakdown bioplastics without generating any negative by-products. Key metabolites including lipids, proteins, and carbohydrates may be used to create a variety of polymers that are used in the manufacture of bioplastics. About 2 million tonnes of bioplastics were produced in 2014, with starch and polylactic acid (PLA)-based polymers being the most frequently produced bioplastics. There are three types of bioplastics: (1) renewable bioplastics (plastics made naturally by plants or from renewable resources), (2) petroleum-based bioplastics (plastics derived from petroleum but biodegradable), and (3) mixed bioplastics (from