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TITLE:

THERMAL ANALYSIS & TENSILE PROPERTIES OF SPIRULINA ALGAE FILLED POLYLACTIC ACID

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ABSTRACT

Nowadays, the widespread use of plastic packaging causes environmental concern since it accumulates on landfills. As a result, biodegradable polymers are being launched to replace conventional plastic in the packaging industry. Currently, biopolymers are being explored intensively, and several of them show potential to replace non-degradable plastic but one biopolymer (polylactic acid (PLA)) stands out since it has the same qualities as traditional plastics such as polystyrene and polyester. Therefore, the thermal analysis and mechanical properties of spirulina algae-filled polylactic acid was investigated in this study. The blend of polylactic acid (PLA) and Spirulina algae was prepared as a film for further analysis. Fourier-transform infrared (FTIR) analysis was used to analyze the presence of functional group. The biodegradable plastic film composed of spirulina and polylactic acid blend was made through solution casting method. The blend was spread on the flat glass plate in order to produce the film with even thickness. The casted film is dried in room temperature until it is fully dry. The elasticity and strength of the film then was analyzed through tensile test. It was found that the film produced from PLA/Spirulina has more flexibility and reliability. The highest tensile strength of the film produced was found at 40/60% of PLA/Spirulina blend. The film's performance may hint at its potential to be employed as bioplastic.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

A rise in global population and the growth of industrialization led to excessive use of non-renewable energy mainly petroleum, coal, and natural gas. The overuse use of energy also causes various challenges to society such as the high cost of oil, emission of greenhouse gases (GHGs) from fossil fuel combustion, environmental deterioration, etc (Debeni Devi et al., 2022). Today's consumer needs materials that are inexpensive, versatile, and convenient in making plastics– a widely used material for many applications. Petroleum-based plastics, a major constituent of world plastic consumption, have production advantages from large economies of scale and mature technologies (Zeller et al., 2013). Bio-products production from microalgae can be more environmentally sustainable, cost-effective, and profitable, if these are coupled with processes such as wastewater treatment (Moreno Osorio et al., 2021).

Plastic and bioplastic are both types of polymeric materials, but they have some important differences. One of the main differences is their origin. Traditional plastics, also known as petroleum-based plastics, are made from fossil fuels such as oil and natural gas. Bioplastics, on the other hand, are made from renewable resources such as plant-based materials or a group of microorganisms (*Introduction to Bioplastics Engineering*, 2016). Another difference is their biodegradability. Traditional plastics are not biodegradable and can take hundreds of years to break down in the environment. Bioplastics, on the other hand, are biodegradable, meaning that they can be broken down by microorganisms in the environment (Rudin & Choi, 2013). A third difference is their environmental impact. The production of traditional plastics can have a significant impact on the environment, due to the consumption of fossil fuels and the release of greenhouse gases during production (Chong et al., 2021). Bioplastics, on the other hand, have a lower environmental impact as they are made from renewable resources and the carbon footprint of the production process is lower (Atiwesh et al., 2021). Finally, bioplastics are more expensive than traditional plastics because of the high cost of raw materials and the complexity of the production process. Overall, while both plastics and bioplastics are polymeric materials, they have different characteristics,