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TITLE:
**SYNTHESIS OF BIOFILM FROM POLYLACTIC
ACID (PLA) AND GREEN ALGAE
[MORPHOLOGICAL ANALYSIS OF
CHLORELLA]**

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ABSTRACT

In this era, the usage of plastic packaging is on the high demand as many people are using it. Along with the consequences, the usage of plastic packaging raises environmental concern as it put our Earth on danger. Hence, we have come for an alternative to make a biodegradable biofilm by using solution casting method. In this research, Polylactic Acid (PLA) was used because it melts more easily because it has a lower melting point. Not only that, polylactic acid also is used because it comes from a renewable source. The spirulina-algae was used because it is biodegradable and cost-effective. For the casting method, the PLA and spirulina-algae are dissolved in dichloromethane (DCM) and being casted for the analysis. Fourier Transform Infrared Spectroscopy test (FTIR) was used to indicate the presence of organic and inorganic compounds in the biofilm produced. Thermal Gravimetric Analysis (TGA) shows that the mass of spirulina decreases as temperature increases. The last analysis is morphological analysis which has been done that shows the surface of the spirulina.

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CHAPTER ONE

BACKGROUND

1.1 Introduction

In this globalization era, the number of people and the growth of industrialization are increasing day by day. This massive globalization has used a lot of excessive non-renewable resources such as plastic that has been made by petroleum-based plastics. The study state that the U.S Energy Information Administration (EIA) predicted that energy consumption will rise by 50% from 2020 to 2045 (Debeni Devi et al., 2022). If this would happen, then it will affect our environment and the Earth such as the greenhouse effect. Not only for the environment, but it will also affect the society such as, the cost of the oil will increase as the demand for the oil is increase. Plastics is a synthetic or semi-synthetic materials that use polymers as a main ingredient. The usage of plastics is very well-known and common in Malaysia. This is because plastics is being used for many other processes. Their plasticity makes it possible for plastics to be moulded, extruded, or pressed it into any solid objects of various shapes. Not only that, but plastics is also common to be use because of their properties such as lightweight, durable, flexible and the most important one is because it is low in cost. The most industry that uses plastics is food industry. This is because most of them use plastics to package the food. Because of this situation, the waste of plastics has been built up on a landfill and affects the environment. Therefore, this alarming conditions and situations need a fast and an effective alternative and a sustainable source of energy such as renewable source of energy. Hence, we have conducted research regarding this issue and we have developed a new project which is a biodegradable biofilm. Biofilm, in accordance with its name as “bio”, it is an eco-friendly biofilm where it were produced by a renewable source ingredients. Biofilm is an assembly of surface that associated microbial cells that is enclosed in an extracellular polymeric substance matrix such as polysaccharides. Nowadays, terrestrial crops such as potatoes and corn are used to derive bioplastics and this leads to competition with food supplies as well as consumption of large land areas, water and nutrients, which making this kind of bioplastics production not sustainable for long term effect. This makes it important to synthesize a new bio-based biodegradable plastic polymers by developing an in-depth

understanding of biomass structure which can manufacture new biodegradable plastics. (Chia et al., 2020). Hence, in order to encounter this problem, we have conducted an experiment by using microalgae species which are *Chlorella* and *Spirulina*.

1.2 Literature Review

1.2.1 Algae

Algae is a simple, non-flowering and typically an aquatic plant of a large group that includes the seaweed and many single-celled forms. Algae are single or multicellular organisms that live in water or in humid places. For a single algae, which is known as an alga, is a member of a group of majority of aquatic photosynthetic organisms of the kingdom Protista. These organisms have chlorophyll (an organic pigment that is capable of absorbing and channeling the energy of sunlight), which is why they are able to perform photosynthesis that is the transformation of luminous energy into chemical energy, capturing carbon dioxide to form complex organic compounds (along with water and mineral salts) and releasing gaseous oxygen, during the process of organic synthesis. Algae are considered the “true” lungs of planet Earth, stealing this epithet from large forest patches, such as the Amazon rainforest. Algae are distinguished from seagrass (angiosperms) because, unlike the latter, they do not have a vascular system (xylem and phloem). Algae on the seafloor have a holdfast and transport nutrients through the body by diffusion, while seagrasses are flowering vascular plants with roots and an internal transport system. Algae have many types of life cycles and they do have their range in size from microscopic *Micromonas* species to giant. Not to forget, there are many types of algae in this world. Algae, an autotrophic group (capable of producing their own food through an anabolic process) and one where there is a great diversity of organisms. Due to this great variability, algae are generally divided into two categories which are macroalgae and microalgae. Microalgae are only visible through magnification equipment and they constitute the phytoplankton and thus live in surface waters, suspended in the water column and restricted to the euphotic zone. Phytoplankton constitute the base of the marine food chain-feeding invertebrates such as crustaceans (copepods), mollusks (mussels) or vertebrates (juvenile sardines). Meanwhile for the macroalgae or known as seaweed, it is perfectly visible to the naked eye. It is a macroscopic marine algae that can reach several meters in length. (Pereira, 2021)