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TITLE: DEVELOPMENT OF BIOPLASTIC FROM GREEN ALGAE *SPIROGYRA SP.*

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ABSTRACT

Green algae have always been the focus of researchers in biodiesel production studies. However, there is a possibility that the study of characteristics in green algae has identified a polymer that is the root of bioplastic production based on green algae. In this study, we have identified a suitable blend type to produce algae bioplastics, namely algae-starch bioplastics in the presence of plasticizers, namely sorbitol and glycerol. The bioplastics were produced on a small scale to obtain a number of samples before they were tested for Fourier transform infrared spectroscopy (FTIR) and water absorption. The difference between the samples produced is in the weight of corn starch, namely, 1 g, 2 g, 3 g, and 4 g. The 4 samples used the same amount other than corn starch, namely dried algae (1 g), distilled water (35 ml), sorbitol (2.6 ml), and 99.8% glycerol (1.3 ml). Each bioplastic blend will be dried for 4 hours and 30 minutes to obtain bioplastics that do not contain moisture content. After each bioplastic has been produced, two studies have been conducted to get a proper analysis of our project bioplastics. Utilizing FTIR analysis, the bioplastic was given a characteristic evaluation. Each sample has a similar spectrum, indicating that the functional groups present have similar chemical compositions. These functional groups include the hydroxyl group in alcohol and phenol (O-H), the aliphatic saturated hydrocarbon chain (C-H), and ester, ether, and carboxylic acids, as well as the anhydride group (C-O) and alkenes (C=C). Since the derived water absorption rate for 4 g of starch is 63.72%, plasticizer volume and starch weight must be adjusted in order to develop a composition that can withstand the moisture content of the environment. The bioplastic's 1:4 weight ratio of green algae and corn starch looks to be the most efficient when compared to alternate weight ratios, and it has the potential to replace current synthetic plastic.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

With an estimated 10,000–100,000 metric tonnes of plastic floating on the ocean's surface, 270 million metric tonnes of plastic were created worldwide, with 80% coming from terrestrial sources and 20% from aquatic ones (Roser, 2018). Plastic trash production could harm the ecosystem and have an impact on humans, plants, and animals if it continues at this rate (Balaseragam, 2018). This is the case because the majority of plastics are made of non-biodegradable polymers that are manufactured from petrochemicals. A biodegradable polymer (bioplastic) has been developed by scientists as an alternative due to concerns about the economy, ecology, and safety (Maulida et al., 2016). Bioplastics are said to be more practical because they are environmentally benign and biodegradable (Siah et al., 2015). The abundance of agricultural waste, such as corn kernels, is viewed as a brilliant replacement for synthetic plastic in Southeast Asia. This is happening because corn starch includes a lot of amylopectin-rich starch. This may result in the plastics' binding becoming stronger (Li et al., 2016). Bioplastics can be produced from a wide range of materials, mostly agricultural crops like corn. This does, however, create questions about the sustainability of these feedstocks, such as the conflict over human consumption of water and land resources (Bastos Lima M., 2018). Furthermore, "green" plastic derived from food sources like cassava, corn, or sago has a low water barrier. Since *Spirogyra sp.* is a renewable resource, algae have therefore been developing as a novel and prospective biomass source to create bioplastics (Machmud et al., 2013). However, the growth of bioplastics is dependent on costs and processes, which call for additives like fillers, colourants, and plasticizers. In the starch-based bioplastic, the plasticizers glycerol and sorbitol provide flexibility in the polymer structure by reducing intermolecular tensions and glass transitions of the material and raising the mobility rate of the polymer chains (González-Torres et al., 2021; Blick et al., 2015). The improved plasticizer is crucial since it can make plastic more flexible and supple, which will aid in reducing the rate of water absorption (Godwin, 2000). Additionally, this study was carried out to utilise the agricultural waste that was dumped in Malaysia, specifically corn, with the application of green algae like spirogyra sp. and eventually support a waste-to-wealth sector (Sultan et al., 2017).

1.2 Literature Review

1.2.1 Green Algae *Spirogyra Sp.*

Researchers have recently become interested in the genus *Spirogyra* because of its potential biotechnological and industrial applications. One of the most popular green filamentous freshwater macroalgae is called *Spirogyra* because of the chloroplasts' helical or spiral orientation (Krupek et al. 2014). More than than 400 different Spirogyra species in existence. This genus, which has long, vivid filaments of grass-green colour and spiral-shaped chloroplasts, is photosynthetic. When it is most plentiful in the spring, it has a vibrant green colour, but it eventually turns yellow. *Spirogyra* is a plant that thrives in chilly, freshwater streams in the wild. It secretes a mucous layer that makes it feel slippery. This freshwater algae can be found in small, stagnant bodies of water, shallow ponds, ditches surrounded by vegetation at the edges of major lakes, rivers, and streams. When conditions are right, *Spirogyra* creates thick mats that float on top of the water or barely below it. Blooms clog filters and give off a grassy odour, especially at water treatment facilities (Ramaraj et al., 2015). The location of the study on green algae has been changed to Jitra, Kedah, from the original location of this project, Bukit Besi, Terengganu where no culture of green algae is easily collected on a large scale. The location that focus on the green algae search process are drains, abandoned pools, and waterways.

Figure 1.2.1.1: The green algae is found above the water ditch. (Jitra, Kedah)