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TITLE:

DEVELOPMENT OF BIOPLASTIC FROM GREEN ALGAE

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ABSTRACT

Algae are a group of organisms that are mostly aquatic, photosynthetic, and nucleus-bearing, but lack the real roots, stems, leaves, and specialised multicellular reproductive systems found within plants. It can be found in many sorts of water, including salt, fresh, and brackish (a mix of salt and fresh water). Blue-green algae (BGA), green algae, red algae, and brown algae are the four types of algae. Besides, these algae produce gigantic molecules called polymers that can be used to make bioplastics. This can become the opportunity to alter the ecosystem which becomes worst because of pollution, especially plastic pollution. Plastic pollution can become a threat to sea life, the environment, and human health. This issue has become a responsibility for us to find the solution for it.So, a decision was made to reduce the consumption of petroleum-based plastic by establishing an appropriate blend type to make algae bioplastics called algae-starch bioplastics in the presence of plasticizers such as sorbitol and glycerol in this research. The algae-starch bioplastics samples were then tested to a Fourier Transform Infrared Spectroscopy (FTIR) test as well as a water absorption test. With the FTIR test different types of functional groups in the algae-starch bioplastics that were created using both methods were able to be detected. Then, from the water absorption test, an observation could be done on how the water absorption of algae-starch bioplastics decreased as the amount of corn starch added increased.

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BACKGROUND

1.1 Introduction

In 2021, global plastic production is reaching 390.7 million metric tonnes. It is anticipated to triple by 2050, accounting for a fifth of global oil use. Normal plastic that we use in our daily lives can take up to 1000 years to degrade in landfill, causing potentially harmful compounds to leak into the soil and water. This scenario had generated a significant environmental pollution caused by plastic pollution was being called as "White Pollution". This is because it can live in nature for centuries before decaying.

Furthermore, this white pollution is having a negative influence on marine life and human health. For example, marine debris has caused entanglement, suffocation of marine creatures, reduced ability to dodge predators, and many other issues. Microplastics have also been found in water, air, and food samples, posing a threat to human health. With all of these serious repercussions, developing bioplastic that is simpler to biodegrade has emerged as one option to reducing plastic waste.

With the help of biological agents, plastic can be rapidly degraded to its fundamental ingredients. Various microorganisms have the capacity to physiologically transform certain plastic polymers into simpler compounds via aerobic and anaerobic mechanisms. It was recently discovered that various varieties of green algae increase polymer biodegradation and lower the energy required for degradation, because produced enzymes with simple or complex toxin systems include a reduction in activation energy to weaken the chemical bonds in the polymer.

These green algae produce a polymer that is 100% vegetarian and 100% biodegradable. It does not emit any hazardous compounds into the environment because it breaks down into very little fragments. During this final year project, extensive research is conducted to develop bioplastic from green algae and to evaluate the bioplastic. Spirogyra is the species of green algae utilized in this study.

1.2 Literature Review

Biodegradable polymers can be produced by using plant, bacterial, and algal waste which is also known as renewable resources (Puppala et al., 2012). With enzymatic action by the microorganism, biodegradable polymers can be decomposed into sources like water, methane, carbon dioxide, inorganic chemicals, and biomass. (Nurhajati et al., 2019) has demonstrated that biodegradable plastic can be determined by standardized tests over a specific time periods to reflect the available disposal conditions. From a study by (Puppala et al., 2012) biodegradable plastic does not pollute the environment as they just produce microorganisms like bacteria, fungi, and other that decomposes when degrading. Normally, to produce biodegradable plastic from starch, vegetables that contain high-starch content like vegetable and corn oil, wheat, corn, and potatoes were utilized (Maheshwari and Ahilandeswari, 2009). It is because, these kinds of vegetables are rich in polysaccharides, proteins, and lipids (Paraseptiangga et al., 2018).

Next, Polysaccharides are known as molecules where many monosaccharides are combined by glycosidic linkages (Venugopal et al., 2019) that can be found in plants, bacteria, and fungi which work as an energy store and structural supports (Brigham et al., 2017). Besides that, (Paraseptiangga et al., 2018) mention that polysaccharides have their own potential to be utilized as biodegradable material. This is because there are components in polysaccharides that have a wide spectrum of solubility. In example, polysaccharides component like cellulose is insoluble in water while starch is soluble in hot water, and there are pullulan and gum arabic that can easily dissolve in cold water (Guo et al., 2017). However, some polysaccharides are more hydrophilic than synthetic plastics, which may cause rapid rupture (Wahab and Razak et al., 2016). This will cause issues in food packaging sectors because of the low moisture barrier characteristics (Lavorgna et al., 2010).