



Potential Production of Bioplastic from Water Hyacinth (*Eichornia crassipes*)

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ABSTRACT

The purpose of this research was to determine the potential and capability of water hyacinth (*Eichornia crassipes*) as bioplastics. The produced bioplastic was naturally biodegradable and can be used for natural conservation without environmental destruction. The study was experimental using various compositions of water hyacinth, characterized by tensile strength and biodegradability tests to determine the potentiality and capability of water hyacinth as a source of bioplastic. In making the bioplastic, we extracted the water hyacinth and utilized glycerine as a plasticizer, water as the solvent, corn-starch as a thickener, and vinegar. After mixing all materials on a pan, the mixed solution was placed on a stainless surface and dried. After a 3-day curing period, the results showed that different mechanical and decomposition properties were obtained. Based on the results of the study, water hyacinth is one of the suitable materials that can be used to produce a new and sustainable bioplastic material. It is organic and accessible, thus making it a candidate for innovation in the creation of bioplastic. Therefore, we believe that the use of water hyacinth is a potential bioplastic material that is beneficial to the environment and the community.

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1. INTRODUCTION

Plastics is the term commonly used to describe a wide range of synthetic or semi-synthetic materials that are used in a huge and growing range of applications. Everywhere you look, you will find plastics. We use plastic products to help make our lives cleaner, easier, safer, and more enjoyable. Water hyacinth (*Eichornia crassipes*) is one of the world's most obtrusive oceanic plants and is known to cause critical biological and socio-economic impacts (Wilkes & Aristilde, 2017; Geyer et al., 2017; Trivedi et al., 2016; Shah et al., 2008).

Plastic waste accounts for about 10 percent of the total volume of average trash. Of that amount, very little can be recycled, including waste plastics made from synthetic polymers (Gautam et al., 2007; Loelovich, 2018; Encinar & Gonzales, 2008). Plastic takes 300-500 years for it to decompose or break down completely. Burning plastic is not a good choice either. Plastic that does not burn completely, below 800°Celsius, will form dioxane (Webb et al., 2013). Compound this is what is dangerous (Geyer et al., 2017).

Apart from the environmental problems that have been caused, there are also new problems, namely the source of plastic raw materials which are increasingly running out. Because, plastic conventional raw materials are made from petroleum and natural gas (Malachová et al., 2020). A method that has been researched and appropriate is the search for sources of raw materials alternative plastics that are renewable and can be rapidly degraded by soil, namely biodegradable plastic or bioplastic.

The study focuses on producing alternative ware made from natural materials that are naturally degradable for natural conservation without environmental destruction (Limboonruang & Phun-Apai, 2018). Plastic has been a highly valued material on earth for its usefulness as an integral part of human life due to its versatility and applications, however as non-biodegradable it will take many years to get degraded and as a result, they get accumulated in the environment as waste (Villamagna & Murphy, 2010).

2. METHOD

The experimental study was used four treatments with three trials conducted: (a) T1 Control; (b) T2 200 mL of water hyacinth decantation + 10 g of glycerine; (c) T3 200 mL of water hyacinth decantation + 20 g of glycerine; (d) T4 200 mL of water hyacinth decantation + 30g glycerine. The water hyacinth had been gathered from the swampy area of Impao. Before water hyacinth was used, water hyacinth was washed, thoroughly chopped into small pieces, and boiled for 30 minutes to get water hyacinth extract. Water hyacinth extract then was added by 30 mg of liquid cornstarch and 30 g of glycerin, and then cook over low heat until a sticky mixture was obtained. The sticky mixture is poured on a stainless steel tray and dried for three days. After three days of drying, tensile strength and biodegradability tests were tested to determine the potential and ability of water hyacinth as a source of bioplastics.

3. RESULT AND DISCUSSION

Table 1 shows that in terms of the Tensile Strength T2 got the mean of 400g, T3 got the mean of 630g, T4 got the mean of 900g which is comparable to the (control) commercial plastic that can hold 2000gms. It shows that the more glycerine it has, the heavier it can carry. **Table 2** shows that in terms of biodegradability T2 got the mean of 8 days, T3 got the mean of 14.6 days, T4 got the mean of 22.6 days. This means that biodegradable plastics can decompose faster than T1 (control) commercial plastics that can decompose for 150 days or more.

Table 1. Results of the tensile strength.

| Treatments | Trial 1 | Trial 2 | Trial 3 | Total | Mean |
|---------------------------|-----------|-----------|-----------|-----------|-----------|
| T1 Control | 2000 gms. | 2000 gms. | 2000 gms. | 2000 gms. | 2000 gms. |
| T2 200ml WH+10g glycerine | 4 | 3 | 5 | 12 | 4 |
| T3 200ml WH+20g glycerine | 6 | 7 | 6 | 19 | 6.333 |
| T4 200ml WH+30g glycerine | 10 | 9 | 8 | 27 | 9 |

Table 2. Biodegradability of bioplastics.

| Treatments | Trials 1 | Trials 2 | Trials 3 | Total | Mean |
|-----------------------------|----------|----------|----------|----------|-------------|
| T1 Control | 150 days | 150 days | 150 days | 150 days | 150 days |
| T2 200ml WH +10g glycerine | 10 | 8 | 6 | 24 | 8 Days |
| T3 200ml WH +20g glycerine | 15 | 12 | 14 | 42 | 14.666 Days |
| T4 200ml WH + 30g glycerine | 20 | 23 | 25 | 68 | 22.666 Days |

4. CONCLUSION

The water hyacinth capability was tested when utilized as a bioplastic material in terms of tensile strength concerning the amount of 10, 20, and 30 g of water hyacinth. 10 g of water hyacinth has the lowest performance. The 20 g of water hyacinth has the average weight capacity, and the 30 g of water hyacinth has the highest weight capacity out of the three concentration levels. In terms of biodegradability, the 10 mg level is the fastest to degrade and next to the 20 g. The 20 g is the second fastest to degrade, and 30 g is the last.

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6. AUTHORS' NOTE

The author(s) declare(s) that there is no conflict of interest regarding the publication of this article. The authors confirmed that the data and the paper are free of plagiarism.

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