# *Eichhornia crassipes* : The Innovation of Bioplastics

Felicia Angie Hosea and Kelly Leora Wibawa
Supervisor : Andry Permana
*Center for Young Scientists, SMPK Cita Hati West, Surabaya/Indonesia, angiehoseaaa@gmail.com*
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## 1. Introduction

Plastic pollution have undeniably took its toll on our world. Indonesia being the second largest contributor to marine plastic pollution, is estimated to emit around 200,000 tonnes of plastic waste each year. In the other hand, Indonesia is also being dealt with another major water pollution, *Eichhornia crassipes*. It is a common water hyacinth. Its rapid growth covers the surface of the lake/pond it inhabits, blocking sunlight from going through. Without sunlight, the phytoplankton cannot photosynthesize and produce the energy they need. They are the base of the aquatic food web, and with it gone, larger consumers would not have their basic source of food, causing a massive death of the underwater life. Therefore, this research aims to create biodegradable plastics to reduce plastic pollution, and to utilize *Eichhornia crassipes* as an addition to the base of the bioplastic to restore balance in the aquatic life of Indonesia.

## 2. Research Method

In this research, 3 samples were made with 60ml of water, 10g of corn starch, 5ml of 25% acetic acid, 10ml of glycerol, and a variation of 0g, 0.5g, and 2g of *Eichhornia crassipes*.We began the procedure by taking 10g of corn starch to be dissolved in 60ml of water. Then, 5ml of acetic acid and 10ml of glycerol. This process was repeated for the 3 samples and they were all heated at 180℃ and stirred until it forms a thick component. For the first sample, no dried and pounded *Eichhornia crassipes* was added after the heating. For the second and third sample, 0.5g and 2g of *Eichhornia crassipes* was added respectively. All of the three samples were heated inside the oven at 100℃ for 30 minutes and were left to dry for 120 hours.

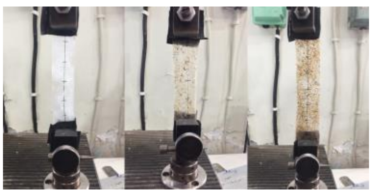

Image 1- Samples 1, 2 and 3

The next procedure was testing each of the samples for its maximum weight, elasticity, and Young's Modulus. The test was done in *Baristand Industri Surabaya* and the Young's Modulus was calculated with the formula as follows :

$$E\ (Pa) = \frac{\textbf{Tensile Stress}\ (F/A)}{\textbf{Tensile Strain}\ (\triangle L/L)}$$

The biodegradability test was then conducted by weighing the initial mass of the samples and burying it in 4cm of Humus soil for 5 days. The final masses were then obtained to find the percentage of how much the bioplastic degraded.

## 3. Results

The results of the test for maximum weight, elasticity, and Modulus Young is presented in this table below :

| | Maximum Weight /N | Elasticity/% | Young's Modulus/Pa |
|---|---|---|---|
| **Sample 1** | 1.56 | 1.0 | $3.57 \times 10^6$ |
| **Sample 2** | 3.52 | 0.7 | $1 \times 10^6$ |
| **Sample 3** | 5.32 | 0.5 | $4.8 \times 10^6$ |

Table 1 — Maximum weight, Elasticity, and Modulus Young results.

The results of the biodegradabilty test is presented below :

| | Sample 1 | Sample 2 | Sample 3 |
|---|---|---|---|
| **Initial Mass/g** | 3.26 | 3.46 | 4.14 |
| **Final Mass/g** | 2.56 | 2.73 | 1.36 |
| **Weight loss/%** | 21.47 | 21.10 | 67.15 |

Table 2 — Biodegradability test results.

From the results above, all of the samples were able to biodegrade naturally in Humus soil. The sample with the most *Eichhornia crassipes* had the greatest maximum weight, but the least elasticity. Meanwhile, sample with none of the *Eichhornia crassipes* had the least maximum weight, but the greatest elasticity.

## 4. Conclusion

Based on the results above, we can conclude that, a biodegradable plastic can be made using natural ingredients to reduce plastic pollution, and the addition of *Eichhornia crassipes* does increase the bioplastic's maximum weight capacity. For further improvements, we would like to experiment with the utilization of only the *Eichhornia crassipes* cellulose (through delignification process), and use it as the sole base of the bioplastic with Chitosan as its additive. We also plan to test the soil contents before and after the degradation process and research on the Phytoremediation property of *Eicchornia crassipes.*

## 5. Literature

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