

## ABSTRACT

Sultan Akmal Rabbani Kurniawan. 24020221140072. **Utilization of Water Hyacinth (*Eichhornia crassipes*) Biochar as an Adsorbent and Immobilization Matrix for Dark Septate Endophyte (DSE) Fungi for Phenol Waste Remediation** (under the guidance of Agung Suprihadi and Irma Melati).

Phenol wastewater treatment can be carried out using adsorption and biodegradation methods to prevent the negative impacts of phenolic compounds. This research aims to optimize water hyacinth-based biochar as an adsorbent and to develop a Fungi Biochar Immobilized Complex (FBIC) by utilizing immobilization techniques using alginate on biochar and the Dark Septate Endophytes fungus strain *Cladosporium tenuissimum* to enhance the ability to reduce phenol. The research was conducted using a Completely Randomized Design (CRD), which included three stages: (1) optimization of the production process of water hyacinth-based biochar, (2) optimization of biochar adsorption process conditions with parameters of contact time, initial phenol concentration, and biochar dosage, and (3) development of the Fungi Biochar Immobilized Complex (FBIC) and evaluation of its ability to reduce phenol. Phenol concentration and phenol reduction efficiency were calculated from the remaining phenol concentration after testing using a spectrophotometer at a wavelength of 550 nm. Data were analyzed using the One-Way ANOVA method followed by Duncan's test. Biochar from the stem part of water hyacinth at 550 °C was the best combination result with an efficiency value of 65.06% in the biochar screening. A 24-hour contact time showed optimum results in reducing phenol with an efficiency value of 79.75% in the optimization of the contact time parameter. A phenol concentration of 50 ppm showed optimum results with a reduction efficiency value of 66.49% in the optimization of the initial phenol concentration. A dosage of 1% showed optimum results with an efficiency value of 87.26% in the optimization of biochar dosage. Biochar as a reducing agent showed the best results with an efficiency value of 72.37% in the FBIC effectiveness test in reducing phenol compared to other agents. Based on the test results, FBIC has not yet been able to optimally reduce phenol due to the inhibition of active sites and biochar pores by alginate as a supporting material in the immobilization process.

**Keywords:** *Water Hyacinth, Biochar, Dark Septate Endophyte, Fungi Biochar Immobilized Complex (FBIC), Adsorption.*