

ABSTRACT

Ferdiaz Arya Mudzafar, 24020221140062. Utilization of Brown Seaweed Sap (Sargassum duplicatum) as an Ecoenzyme Antibacterial Agent in Bioplastic Formulations of Sodium Alginate, Carboxymethyl Cellulose, and Polyvinyl Alcohol (under the guidance of Agung Suprihadi and Athanasia Amanda Septevani).

*The main problem with conventional fossil-based plastics is that they are difficult to decompose and contribute to environmental pollution. One sustainable alternative is the development of bioplastics from seaweed polysaccharides, including sodium alginate. However, bioplastics based on pure sodium alginate have weaknesses in terms of mechanical properties and antibacterial activity. This study aims to utilize the by-product of alginate extraction, namely *S. duplicatum* sap, which is rich in minerals, fermented as an antibacterial additive, while optimizing the total utilization of seaweed biomass. The sap was fermented with varying concentrations of EM4 and fermentation times to obtain the best antibacterial activity against *E. coli* and *S. aureus*. Bioplastic formulations combining alginate, PVA, CMC, and ecoenzymes produced several variations. Based on antibacterial activity tests and physical, chemical, and mechanical properties, the sample with 5% (v/v) ecoenzyme and 3% (v/v) PVA concentration (P3E5) was selected as the best formulation because it was able to inhibit bacterial growth while maintaining adequate mechanical strength. The selected bioplastic was characterized in terms of thickness, density, solubility, water contact angle, and mechanical tests including tensile strength, elongation at break, and Young's modulus. The selected samples were further characterized using FTIR spectra, which showed differences in intensity in several absorption bands, while SEM morphology tests showed a rougher surface and higher porosity than the control. Overall, the combination of alginate, PVA, CMC, and ecoenzyme produced bioplastics that have the potential to be used as environmentally friendly bioactive food packaging.*

Keywords: *bioplastic, carboxymethyl cellulose (CMC), sodium alginate, polyvinyl alcohol (PVA).*