

**OPTIMIZATION OF LIGNIN DEGRADATION OF EMPTY OIL PALM
BUNCHES USING THE LIGNINASE ENZYME COMPLEX OF
*STREPTOMYCES CYANEUS***

ABSTRACT

Empty Oil Palm Bunches (TKKS) are abundant lignocellulose biomass in Indonesia composed of lignin, hemicellulose, and cellulose. Lignin as a complex aromatic polymer envelops cellulose so that it inhibits the enzymatic hydrolysis process, so pretreatment is needed to increase access to cellulose as a bioethanol raw material. In this study, pretreatment was carried out biologically using the bacterium *Streptomyces cyaneus* (InaCC A927) which is able to produce ligninase enzyme complexes (lignin peroxidase, manganese peroxidase, and lacase). The study aimed to determine the optimal conditions of lignin degradation by *Streptomyces cyaneus* using the Response Surface Methodology (RSM) and measure the activity of the resulting ligninase enzymes, including lignin peroxidase (LiP), manganese peroxidase (MnP), and lacase. The research stages include TKKS preparation, bacterial rejuvenation, pretreatment according to Design Expert 13 design, as well as lignin removal analysis and enzyme activity tests from the coarse extracts produced. The results showed that the optimal condition of lignin degradation was achieved at pH 6, an incubation period of 21 days, and a substrate concentration of 7 g with lignin removal of 16.008% and a final lignin content of 29.43%. The highest activity of the ligninase enzyme in these conditions was LiP 261.29 U/mL, MnP 74.38 U/mL, and lacase 7.16 U/mL. These results confirm the potential of *Streptomyces cyaneus* as an effective biological pretreatment agent in degrading lignin TKKS, thereby improving the efficiency of biomass conversion to bioethanol and supporting the use of palm oil waste as a renewable energy source.

Keywords: TKKS, *Streptomyces cyaneus*, lignin, ligninase complex, RSM