Response surface-based optimization of the biodegradation of a simulated vegetable oily ballast wastewater under temperate conditions using the Antarctic bacterium *Rhodococcus erythropolis* ADL36


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**ABSTRACT**

Discharge of vegetable oily ballast wastewater constitutes serious hazardous pollution to the environment due to its toxic effects on aquatic organisms and terrestrial animals consuming the waste. The damage is especially severe if the release of this waste occurred in temperate waters where biodegradation by existing marine microorganisms is limited due to the cold conditions. Biodegradation using cold-tolerant microorganism added to palm oil wastewater before discharge has never been studied as a method of remediation. This study aims to investigate the biodegradability of vegetable oil (palm oil) at 15°C by a cold-tolerant Antarctic bacterium under saline conditions for such purpose. The strain was cultured at different oil concentrations, temperature, pH, and inoculum size. Furthermore, the degradation of the oil was optimized using response surface methodology (RSM). Gravimetry and gas chromatography were utilized to monitor the biodegradation of the oil components. The results of the study show that maximum growth and biodegradation occur at 1% (v/v) of the oil, at 25°C, pH 6.8, and an inoculum size of 5% (v/v). The use of RSM resulted in an increase in bacterial growth of about 1 log unit. In conclusion, this study demonstrates a possible use of an Antarctic bacterium for the bioremediation of palm oil oily ballast wastewater in temperate waters.

**Keywords:** Palm oil; Oily ballast wastewater; *Rhodococcus erythropolis* ADL36; Bioremediation; Antarctica

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