

**Optimisation of biodegradation conditions for waste canola oil by cold-adapted
Rhodococcus sp. AQ5-07 from Antarctica**

ABSTRACT

Background: The potential waste canola oil-degrading ability of the cold-adapted Antarctic bacterial strain *Rhodococcus* sp. AQ5-07 was evaluated. Globally, increasing waste from food industries generates serious anthropogenic environmental risks that can threaten terrestrial and aquatic organisms and communities. The removal of oils such as canola oil from the environment and wastewater using biological approaches is desirable as the thermal process of oil degradation is expensive and ineffective. Results: *Rhodococcus* sp. AQ5-07 was found to have high canola oil-degrading ability. Physico-cultural conditions influencing its activity were studied using one-factor-at-a-time (OFAT) and statistical optimisation approaches. Considerable degradation (78.60%) of 3% oil was achieved by this bacterium when incubated with 1.0 g/L ammonium sulphate, 0.3 g/L yeast extract, pH 7.5 and 10% inoculum at 10°C over a 72-h incubation period. Optimisation of the medium conditions using response surface methodology (RSM) resulted in a 9.01% increase in oil degradation (87.61%) when supplemented with 3.5% canola oil, 1.05 g/L ammonium sulphate, 0.28g/L yeast extract, pH 7.5 and 10% inoculum at 12.5°C over the same incubation period. The bacterium was able to tolerate an oil concentration of up to 4.0%, after which decreased bacterial growth and oil degradation were observed. Conclusions: These features make this strain worthy of examination for practical bioremediation of lipid-rich contaminated sites. This is the first report of any waste catering oil degradation by bacteria originating from Antarctica.

Keyword: Antarctica; Biodegradation; Bioremediation; Canola oil; Cold-adapted *Rhodococcus*; One-factor-at-a-time; Removal of oils; Response surface methodology; *Rhodococcus*; Waste canola oil; Wastewater using