

Biosurfactant production and growth kinetics studies of the waste canola oil-degrading bacterium *Rhodococcus erythropolis* AQ5-07 from Antarctica

ABSTRACT

With the progressive increase in human activities in the Antarctic region, the possibility of domestic oil spillage also increases. Developing means for the removal of oils, such as canola oil, from the environment and waste "grey" water using biological approaches is therefore desirable, since the thermal process of oil degradation is expensive and ineffective. Thus, in this study an indigenous cold-adapted Antarctic soil bacterium, *Rhodococcus erythropolis* strain AQ5-07, was screened for biosurfactant production ability using the multiple approaches of blood haemolysis, surface tension, emulsification index, oil spreading, drop collapse and "MATH" assay for cellular hydrophobicity. The growth kinetics of the bacterium containing different canola oil concentration was studied. The strain showed β -haemolysis on blood agar with a high emulsification index and low surface tension value of 91.5% and 25.14 mN/m, respectively. Of the models tested, the Haldane model provided the best description of the growth kinetics, although several models were similar in performance. Parameters obtained from the modelling were the maximum specific growth rate (q_{max}), concentration of substrate at the half maximum specific growth rate, K_s % (v/v) and the inhibition constant K_i % (v/v), with values of 0.142 h⁻¹, 7.743% (v/v) and 0.399% (v/v), respectively. These biological coefficients are useful in predicting growth conditions for batch studies, and also relevant to "in field" bioremediation strategies where the concentration of oil might need to be diluted to non-toxic levels prior to remediation. Biosurfactants can also have application in enhanced oil recovery (EOR) under different environmental conditions.

Keyword: Antarctica; Biosurfactants; Canola oil; Kinetics; Haldane; Modelling; *Rhodococcus erythropolis* AQ5-07