SCIENTIFIC PROGRAM

Asia-Pacific Biofilms 2022

October 18-23, 2022 | Guangzhou, China

Crude oil degrading microbial biofilms: a synthesis

Madushika Perera[1]* & Gamini Seneviratne[2]

1Department of Agricultural Technology, Faculty of Technology, University of Colombo, Sri Lanka, and 2National Institute of Fundamental Studies, Kandy, Sri Lanka (*email: madushika@bmb.cmb.ac.lk)

Abstract: Biofilms are promising biological systems in which, the increased metabolic activity allows them to thrive in adverse environments. Crude oil is a complex mixture of hydrocarbons which forms a hydrophobic layer on water. Microbial biofilms play a major role in degradation of crude oil in the environment, by forming biofilm structures on oil-water interface, which degrade the oil. Even though themicrobial degradation of crude oil has been studied over decades in laboratory scale experiments, the dependency of the initial concentration of crude oil and the experimental temperature on the rate of degradation has not been properly addressed. Therefore, in this study, the influence of the independent variables, temperature and initial crude oil concentration, on crude oil biodegradation rate was investigated. Data were collected through a literature survey (34 observations in 21 publications) and analysed using SPSS statistical package and MATLAB software. According to the regression analysis, the dependence of the rate of biodegradation of crude oil on its concentration showed a positive 2nd order polynomial relationship ($P < 0.01$), while temperature did not display relationships ($P > 0.01$) with the degradation rate. The effect of the interaction of two independent variables on the rate of degradation was investigated using multiple regression analysis. The predicted model explained ~40% of the observed data ($R2 = 0.37$; $P = 0.003$). The response surface of the model was plotted. According to the response surface, rate of degradation of crude oil is increased with temperature increase. This clearly shows that in tropical region, crude oil degradation rate is higher than that in the temperate region. However, there is a control of the crude oil concentration in water on the degradation rate with respect to temperature. The highest rates of degradation are observed when the initial crude oil concentration is around 1%. In conclusion, it seems that there is a potential of optimizing crude oil degradation by manipulating crude oil concentration in natural settings.

Keywords: Biofilm, Crude oil, Degradation, Temperature