Effects of Heavy Metals on Antarctic Bacterial Community Growth Kinetics in Degrading Waste Canola Oil

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The presence of heavy metals from anthropogenic activities and natural sources from the Antarctic environment significantly affect the microbial growth and biodegradation of hydrocarbon process. The effects of different types of metal were studied through kinetics modelling and allowed for the predictions of behaviour of bacterial community in degrading waste canola oil (WCO) through kinetics parameters obtained. One ppm of heavy metals including Cd, Cr, Al, Zn, Ni, As, Co, Ag and Pb were tested by introducing them to the Antarctic bacterial community known as BS14 in the minimal salt media with 1% of waste oil. The degradation of WCO was analysed through gravimetric analysis, while the bacterial growth was evaluated using a spectrophotometer at 600 nm of wavelength. Then, the data on bacterial growth were regressed using linear and non-linear kinetics equations. Generally, the bacterial growth was inhibited in increasing order of Ag > Al > Cd > control > As> Zn> Pb > Ni> Cr> Co, while the oil reduction by bacterial community was inhibited in the order of Ag > Zn> Cr> Ni> Al> Cd> As> control > Co > Pb. High R^2 value and low value of statistical error in the non-linear regression model showed the best-fit of bacterial growth to the model. Ni exhibited the highest value at 0.8421 and low value at 0.3058, respectively for R^2 and sy.x with a high value of growth rate, which was at 0.0113 h^{-1}. However, in the linear regression model, the best-fitted data to the model was Co with 0.9082 value of R^2 and 0.01510 h^{-1} of growth rate. These results showed that Antarctic bacterial community (BS14) was able to tolerate some heavy metals as well as induce the biodegradation of WCO such as Co and Pb. The data on bacterial growth for seven days indicated that the linear regression model was found more suitable model to determine the predicted growth rate on Antarctic bacterial community in the presence of heavy metals. This mathematical modelling result can help in predicting the bacteria performance for the application of bioremediation processes.

References

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