Heavy Metal Inhibition towards Diesel Biodegradation by Antarctic Marine Bacteria

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The study of pollution in Antarctica helps us to understand the extent of human impact on the southern polar continent. The presence of heavy metals in Antarctica is an emerging issue as human influence becomes more discernible over the years. Bioremediation possibilities in these parts are very limited due to its unique climatic conditions. In the present study, diesel degradation was observed in the presence of 1 ppm of nine selected heavy metals: - Ag, Al, As, Cd, Co, Cr, Ni, Pb and Zn using marine bacteria consortium from Antarctica. Diesel degradation was inhibited in the order of increasing inhibition Cr> Al> As> Zn> Pb> Ag> Cd> Ni> Co, which was analysed using gravimetry analysis. Degradation was the highest in Cr (43.71%) and lowest in Co at 22.76%. Bacterial growth was the highest in Zn at OD600 0.556 and lowest in Ag at OD600 0.151 in the order of Zn>Pb>Cr>Cd>Al>As>Ni>Co>Ag. ANOVA analysis of the growth obtained P values of control and all nine heavy metals. This work serves as a pilot study in collecting data to analyse and gather more data for inhibition concentration of heavy metals for the Antarctic marine bacteria.

References

Zakaria, N.N., A.F.A. Roslee, C. Gomez-Fuentes, A. Zulkharnain, M. Abdulrasheed, S. Sabri, N. Ramirez-Moreno, N. Calisto-Ulloa, and S.A. Ahmad, Kinetic studies of marine psychrotolerant microorganisms capable of degrading diesel in the presence of heavy metals. Revista Mexicana de Ingenieria Química, 19, 375-1388, 2020.

Zakaria, N.N., A.F.A. Roslee, A. Zulkharnain, C. Gomez-Fuentes, , M. Abdulrasheed, S. Sabri, N. Calisto-Ulloa, and S.A. Ahmad, Bacterial growth and diesel biodegradation in the presence of As, Cu and Pb by Antarctic marine bacteria. Malaysian Journal of Biochemistry and Mololecular Biology, 22,1-7, 2020.