Modelling the effect of heavy metal on the growth rate of an SDS-degrading pseudomonas sp. strain DRY15 from antarctic soil

ABSTRACT

The SDS-degrading bacterium Pseudomonas sp. strain DRY15 was strongly inhibited by heavy metals especially mercury. Growth of the SDS-degrading bacterium at various concentrations of mercury shows a sigmoidal pattern with lag periods ranging from 7 to 10 h. As the concentration of mercury was increased, the overall growth was inhibited with 1.0 g/L causing an almost cessation of bacterial growth. The modified Gompertz model was utilized to obtain growth rates at different concentrations of mercury. The growth rates obtained from the modified Gompertz model was then modelled according to the modified Han-Levenspiel, Wang, Liu, modified Andrews, the Amor and Shukor models. Out of the five models, only the Shukor, Wang, modified Han-Levenspiel and the Liu models were able to fit the curve, whilst the modified Andrews and Amor models were unable to fit the curves. The best model was Shukor based on the lowest values for RMSE and AICc, highest adjusted correlation coefficient (adR2) and values of AF and BF closest to unity. The parameters obtained from the Shukor model, which are Sm, max and n which represent critical heavy metal ion concentration (mg/L), maximum growth rate (h-1) and empirical constant values were 6.0 (95%, confidence interval from 5.87 to 6.14), 0.09 (95%, confidence interval of 0.086 to 0.096) and 4.2 (95%, confidence interval from 3.1 to 5.2), respectively.