BIODEGRADATION KINETICS OF GASOLINE IN A MICROBIAL SOIL COMMUNITY ANALYZED BY CONDUCTIVITY

Montagnolli, R. N. [1], Lopes, P. R. M. [2], Cruz, J. M. [1], Claro, E. M. T. [1], Quiterio, G. M. [1], Bidoia E. D. [1]

[1]UNESP - Universidade Estadual Paulista – Campus de Rio Claro (Avenida 24-A, 1515, Jardim Bela Vista – 13506-900 - Rio Claro – SP) [2]UNESP - Universidade Estadual Paulista – Campus de Dracena (Rodovia Comandante João Ribeiro de Barros km 651 – 17900-000 – Dracena – SP)

Microorganisms can be great tools for removing pollutants in soil, water and sediments due to their numerous advantages over other processes. Cleaning environments with hydrocarbons during bioremediation should explore the ability of microorganisms, as well as understand how the process takes place in different petroleum compounds. This work studied the biodegradation of gasoline by presenting a new biodegradation detection methodology via electrical conductivity. The biodegradation monitoring with this new technique measured the saturation of CO_2 in a 0.2 M KOH solution in an airtight simulated atmosphere. Based on a calibration curve it was possible to transform the values of conductivity (mS) to CO_2 concentration (µmol). According to the reaction stoichiometry, 0.2 M KOH generates 0.1 M K2CO3. CO_2 production data was used in mathematical modelling to further describe the biodegradation process. Each type of respirometry (cumulative and weekly) used a different model. We assumed a correlation between the population dynamics of microorganisms and weekly CO_2 production in order to fit the data set obtained in respirometry. The rapid emergence of a peak output of 613.56 ± 3.2 µmol CO_2/week shows that the soil microbiota was able to quickly degrade the hydrocarbon substrate in the early days. However, after peak production, there was a drop to values close to the control assays. The decrease in CO_2 production rate occurs long before the other tests the control. Two important parameters were generated via data fitting: maximum value of expected biodegradation (Bmax) and estimated time to the maximum amount provided for biodegradation (BmaxT). It was possible to predict the maximum amount of CO_2 that would be produced and the final time of biodegradation for each bioprocess. According to Bmax values, there is an overall CO_2 production expected for systems containing gasoline (2572.25 µmol of CO_2) in about 49 days, which is 24% higher than the basal control respirometry (595.96 µmol of CO_2). Using the new CO_2 detection methodology enables experiments with greater efficiency and less risk of results interference by variations in experimental protocols. Kinetic models were able to predict the behavior of perfluorinated pollutants in real petrochemical industry spills scenarios.

Palavras-chaves: bioremediation, petrochemicals, respirometry

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