

TITLE: APPLICATION OF THE FORD-WALFORD MATHEMATICAL MODEL IN THE DEGRADATION OF SEWAGE SLUDGE IN SOIL

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ABSTRACT:

The use of sewage sludge in agriculture presents well-founded benefits, such as improvement of soil physical characteristics and increase in the organic matter concentration. However, there is a growing concern with the environment and the potential impacts on the soil biota caused by this agriculture use. One way to verify the possible impacts of using this residue is to evaluate the microbial activity in the soil that received the sludge, as well as the biodegradation rate of the sludge in the soil. This is possible by using the Bartha method of respirometry that evaluate the residue biodegradation in the soil and CO₂ production due to microbial activity in the same soil. Considering the asymptotic behavior of CO₂ production, which tends to stabilize with time, the results of the experiments were applied to a mathematical model in order to determine the indicative value of the limiting capacity of CO₂ production, using the Ford-Walford method. Therefore, a linear adjustment of the Exponential Asymptotic Model was performed from that estimation with the purpose to understand the microbial activity in the soil as well as analyze the behavior of CO₂ production. In this work, the respirometric activity was monitored in the soil that received sewage sludge application in two concentrations, 1.6 and 16 g/Kg⁻¹, being 1.6 g/Kg⁻¹ calculated from the nitrogen content recommended for corn crops and the nitrogen contents in sewage sludge, according to CONAMA nº 375/2006. In this study, it was also possible to evaluate the behavior of the model experimental data versus the model theoretical data, which allows predictions, such as the estimation of the time that takes to reach the limit value that CO₂ production stabilizes.

Keywords: Agriculture; Biodegradation; Sewage sludge; Mathematical modeling.

Development Agency: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)