

Biodegradation and toxicity of byproducts from the treatment of landfill leachate with hydrotalcite

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ABSTRACT

Despite the toxic potential of landfill leachate, some researchers have suggested its use as fertilizer. However, high leachate concentrations can have negative impacts on the environment. Hydrotalcite has been used for the adsorption and purification of effluents. In this study, leachate in its raw and treated (sludge and leachate) forms was subjected to physicochemical, microbiological, toxicity, and biodegradability analyses. Treatment with hydrotalcite produced good results regarding the removal of conductivity (51%), turbidity (58%), biochemical oxygen demand in 5 d (95%), boron (40%), ammonia (35%), chemical oxygen demand (43%), color (70%), total coliforms, and *Escherichia coli*, but did not remove sodium or chloride and led to an increase in pH. Treatment led to a 21.63% decrease in toxicity to *Artemia* sp. and a 42% decrease in toxicity to *Lactuca sativa* seeds. The raw and treated leachate in the soil inhibited the germination and development of *L. sativa* by 12% and 5%, respectively, in comparison with the control. Landfill leachate at a concentration of 50 m³/ha initially potentiated bacterial growth and inhibited fungal growth. The microbiota stabilized after 84 d, except in the high concentration trials, in which the inhibition of fungal growth continued. The analyses of the landfill leachate at a concentration of 200 m³/ha revealed that repeated fertilization could make the soil unviable for planting. The raw leachate at the two concentrations tested was toxic to *Daphnia similis*. The sludge at a concentration of 2.5% stimulated the growth of *L. sativa* and increased its biomass by 42% in comparison with the control, with no negative impact on the soil microbiota or toxicity to *D. similis*. The biodegradation test showed that the inoculum increased the average daily efficiency of the process. Despite the efficient biodegradation (50% in 24 h), the toxic potential of the leachate was not eliminated. Moreover, respirometry proved not to be an effective method for the determination of the biodegradation of the sludge, since the system is influenced by the chemical characteristics of hydrotalcite.

Keywords: Landfill leachate; Hydrotalcite; Landfill leachate toxicity

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