BEHAVIOR OF CHEMICAL AND MICROBIOLOGIST PARAMETERS FROM SLUDGE INDIGESTED SUBMITTED THE TREATMENT IN A GREENHOUSE

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Abstract

This study aimed at evaluating the performance of a greenhouse in drying and hygienization of the sludge, not digested produced in Wastewater Treatment Plants by activated–sludge processes, located in Espírito Santo – Brazil. The intended standards were for Class A sludge in agreement with the Resolution 375/2006 of the Conama, which makes its utilization in the agriculture. Therefore, different methodological conditions were studied such as the form of disposing the sludge inside the greenhouse, the revolving period of the sludge and the condition of whether adding alkaline material in the sludge or not. The monitored parameters were TS, VS, pH, moisture, thermo tolerant coliform, s*almonella* sp., viable helminth ova. The great advantage of this process is its operational simplicity and the possibility of obtaining the drying and hygienization of the sludge, utilizing only the meteorological conditions, without sophisticated equipment for the elevation of temperature in the greenhouse.

Keywords: sewage sludge; management sludge; higienization sludge; drying sludge; greenhouse

Introduction

For the final disposition sludge generated in Wastewater Treatment Plants (WWTP), differentiated alternatives are adopted that include those which value the potential of its components and the ones that do not, representing only a form of final disposition without utilization or recycling of its components. In the case of the ones that value, the use in the agriculture and forestry plantations and also the forms that allow their application in a sustainable way in degraded areas are underlined (Almendro – Candel *et al.*, 2006). Among the main displayed benefits using the biossolid in agriculture, the reduced speed in the release of nitrogen; the release of phosphorus, potassium and micro nutrients essential to plants, such as zinc and iron; the improvement of the capacity retention of water in the structure of soil are highlighted (US EPA, 2000). However, the advantages of using sludge in agriculture go beyond the benefits related to its agricultural potentiality, also having the possibility of adding the decrease in the use of chemical fertilizer and consequently minimizing serious environmental and health impacts occasioned in the indiscriminate use of those products. Although the disposal of sewage sludge in agriculture areas may promote improvements in soil quality, such practice presents some restrictions to the use and should be investigated, especially those related to the presence of heavy metals, pathogenic microorganism and varied organic pollutants that might cause health and environmental risks (Renoux *et al.*, 2007). In relation to the pathogenic microorganism, Dumontet et al. (2001) cite that its presence is associated directly with the health of the local community from which

the sewage was originated and in this case, the sludge must pass through treatments that include, among others, the stabilization and hygienization to guarantee reduction of pathogens and the stability of sludge.

In Brazil, on 29 August 2006, the National Council of the Environment (CONAMA), organ linked to the Ministry of Environment, published Resolution Nº 375 which define criteria and procedures for agricultural use sewage sludge generated in sewage treatment plants and its derivative products (Brasil, 2006).

This research proposes to give support to the management of the sludge generated in the four big WWTP implanted in different cities of the Metropolitan region of the Great Vitoria, Espírito Santo, Brazil, using a greenhouse. In such case, the objective of this research was to study variation of chemical and microbiologist characteristics of the sludge produced in WWTP, when submitted to drying and hygienization in a greenhouse, with and without addition lime, disposed in different ways, aiming its utilization in agriculture.

Methods

The sludge utilized in the assessment of a greenhouse performance in drying and higienization was produced in the Wastewater Treatment Plants –Araçás, situated in the city of Vila Velha, Espírito Santo, Brazil. The Wastewater Treatment Plants (WWTP) use activated-sludge process aerobically digested and it has screening, flow meter, grit removal, biologic treatment and disinfection (treatment of the liquid phase); and digestion, thickener and dewatering (treatment of the solid phase). However, the sludge used was not submitted to disgestion, passing only the steps thickener and dewatering. The WWTP treat typically domestic sewage. The intention was to obtain material with characteristics that make its utilization in agriculture in agreement with the standard established by the Resolution 375/2006 of the Conama (Brasil, 2006). In such case, the intention is to reduce the volume, destroy the pathogenic microorganisms and reduce the odors. Therefore, different methodological conditions were studied such as the way of disposing the sludge inside the greenhouse, the revolving period of the sludge and the condition of adding alkaline material in the sludge or not (Figure 1 and Table 1).

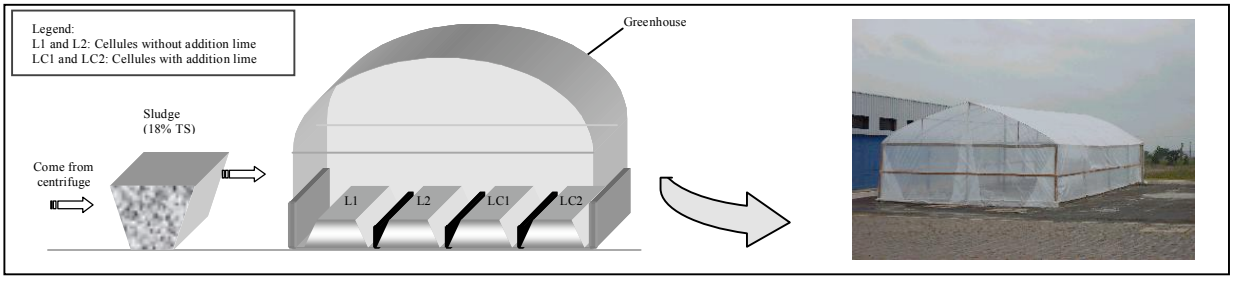


Figura1. Disposition of the sludge in the cell of the greenhouse and vision outside of the greenhouse

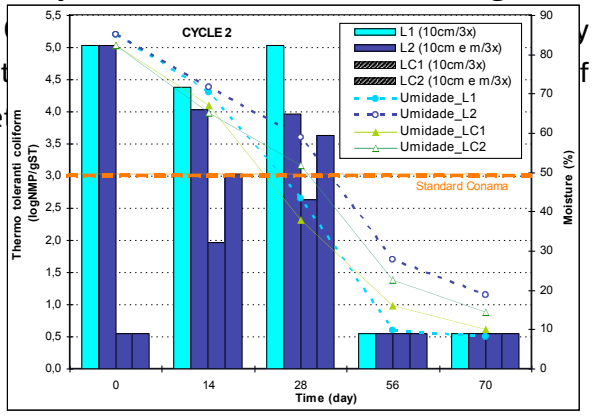
Tabela 1. Methodology conditions utilized in the investigation for three cycles

Cycle	Disposition sludge in the cell	Revolving period sludge	Cycle temp
Cycle 1	First 14 days – sludge dispersed with 10 cm height (L1, L2, LC1 e LC2). After 14° day – sludge form of the pile with 50 cm height (L1, L2, LC1 e LC2).	Firsts 14 days – three times per week. After 14° day – one time per week.	12/12/2007 a 20/02/2007
Cycle 2	First 14 days – sludge dispersed with 10 cm height (L1, L2, LC1 e LC2). After 14° day – sludge dispersed with 10 cm height (L1 e LC1) and sludge form of the pile with 50 cm height (L2, LC2).	During all cycle – three times per week.	12/03/2008 a 25/05/2008

The monitored parameters were TS, VS, pH, moisture (7 and 7 days), thermo tolerant coliform, *Salmonella* sp., viable helminth ova (15 and 15 days). Besides these parameters, the temperature inside and outside of the greenhouse were monitored and initial test was performed for checking what the quantity of hydrated lime is necessary so that the pH meets the Conama's requirement.

Results and discussion

Based on the obtained results it was possible to confirm that the utilization of the greenhouse was satisfactory for the appraised conditions, producing a Class A material, in conformity to the standard used, except for virus that was not monitored. The temperature inside of the greenhouse reached values above 50°C. The averages of the moisture in the cell sludge with and without lime were similar, with the same tendency of the decline. In LC1 and LC2 (sludge with lime) it was evidenced that pH was maintained above 12 for 2 hours and at least 11,5 without addition of more alkali by an additional of 22 hours, in agreement with Resolution 375/06. In the case of the sludge without lime the pH maintained next to 5.5 in the tree cycles. The undigested sludge showed values of VS/TS (volatile solids and totals solids) next to 78% and when lime was added this relation turned to be 65%. The addition of the alkaline material was significative in the elimination of monitored microorganisms (thermo tolerant coliform and *Salmonella* sp.) but still in the digested sludge without additional lime in the 28° day of the experiment the concentrations of these microorganisms were despicable when compared to standards of the Conama. However, the density of viable helminth ova in the sludge used in the study was always inferior to the standard of the
metals. Parameters of agronomical interest showed int
view. Figure 2 shows the assessment of several parame



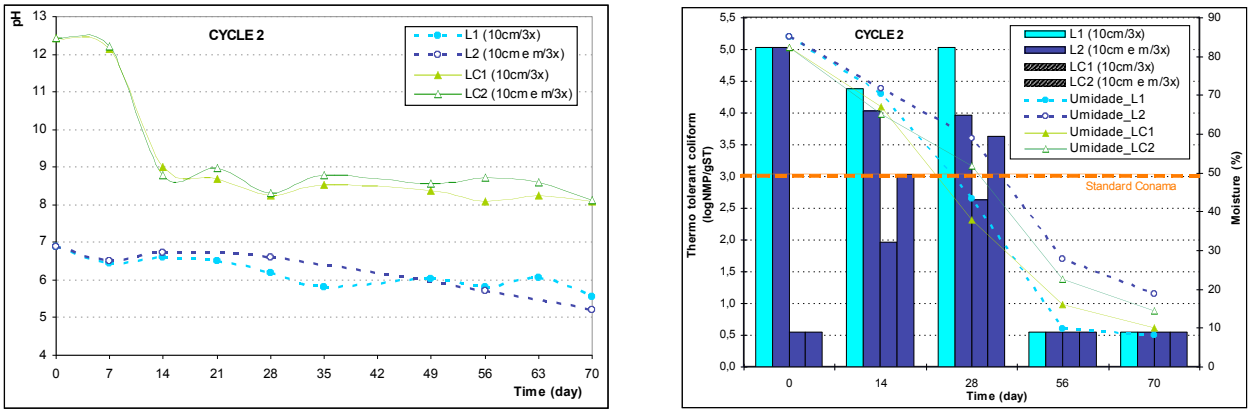


Figure 2. Behavior of pH, moisture and thermo tolerant coliform versus moisture in the different cycles

Conclusions

Based on the obtained results it was possible to confirm that the utilization of the greenhouse was satisfactory for the appraised conditions, producing a Class A material, in conformity with the standard used.

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