Quantitative and qualitative aspects of compost obtained from residues of the biodiesel production with mineral addition

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Introduction

The word energy crisis has created the necessity of finding alternative sources of energy which could gradually substitute the use of fossil fuel. These alternatives can also contribute to reduce the CO_2 emissions, helping in this way to control the increase of the greenhouse effect Thus, biocombustible is obtained from the mixture of 95 % of vegetal oils like the extracted from the seeds of castor oil plant and 5 % of alcohol anhydrous obtained from the sugar cane. In the production of raw materials of biodiesel are generated large amounts of wastes.

The agro-industrial residues can cause serious environmental pollution problems if are not used in a proper way. However, when are used in the soil as organic amendments can contribute to improve its properties by increasing both nutrients and cation exchange capacity and thus the fertility of soil and productivity of cultures. The mineral enrichment of organic compost can produce quantitative and qualitative changes in the humic substances (HS) of compost (Lima et al., 2005). Usually, the enrichment technics of compost are focused only in the reduction of N-losses the ammonia form (Sanchez-Monedero et al, 2001). However, there is little information about its influence on the humic substances formation and in their characteristics in relation with the cation exchange capacity.

The quality of the compost depends on the initial composition and proportions of the starting materials. This can be evaluated not only by the production of humic substance (HS) expressed by the humification index but also by other chemical and biological indices such as the C/N ratio, the germination index and the reactivity of the HS, as the CEC of the compost (Roig et al., 1988). Thus, the aim of this study is to evaluate quantitative and qualitative aspects of composts obtained from the residues of the production of biodiesel with mineral addition.

Materials and Methods

Eight different composts were obtained through the mixture of the following materials: sugar cane bagasse (SCB), ashes of sugar cane bagasse (ASCB), poultry manure (PM), filter cake (FC) and castor oil plant cake (*Ricinus communis*, L.) (MR). The treatments were prepared by mixing the materials in the following combinations: a) SC: SCB + ASCB + PM; b) UR: SCB + ASCB + PM + mineral fertilisers NPK, where N: urea; c) AS: SCB + ASCB + PM + mineral fertilisers NPK, where N: ammonium sulphate; d) SM: SCB + ASCB + PM + serpentinite and micaxist powdered rocks; e) PR: SCB + FC; f) FC: SCB + FC; g) M+G: SCB + MR + gneiss powdered rocks; and h) M-G: SCB + MR. The treatments were sampled at 120 days after starting composting. It was measured their pH, C, N, germination index (IG), CEC and estimated the humification organic matter (HOM). The humic organic substance (HOM) was determinated by the following equation:

HOM= 100-(% ashes – % humidity - (% LOM - % ashes of theLOM))

Where HOM: means humic organic substance and LOM: light organic matter.

Results and Discussion

The HOM content showed high correlation with the sum of C of HA and the FA (r= 0,94**). The C content of HA + FA was used to calculate the value of the C of HOM in relation to the total C, which was called C of the HOM relative. Thus, figure 1 shows the effect of the treatment of composts on the dynamics of decomposition of OM with respect to the C of the HOM relative. The SM compost showed the highest C of MOH relative content, reflecting the large loss of OM of this compost in the CO_2 form, remaining in the compost a lower ratio of not humified OM, whereas in SA compost there was the greatest level of OM not humified, in relation to the other composts.

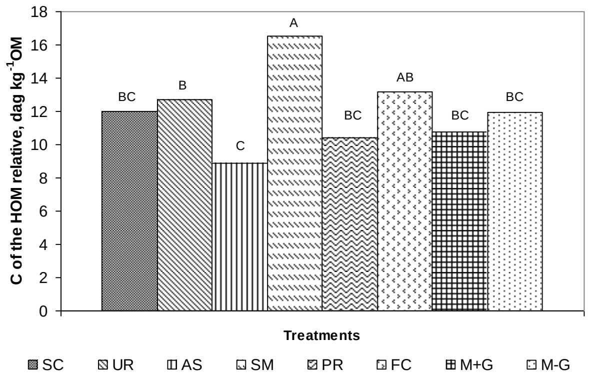

Figure 1. Carbon of the humic organic matter relative (C of the HOM relative - HA + FA in function at the total carbon) of the composts obtains from different materials and mineral enrichments.

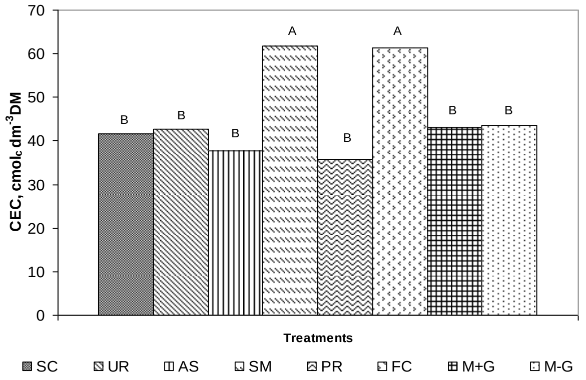

Figure 2. Exchange capacity of the composts obtained from different materials and mineral enrichments.

The SM and FC composts presented the greatest CEC values (Fig. 2), whereas the other composts had lower values and they did not show any significant differences. The positive correlation between the CEC and the HOM of r= 0.52** is raised up to r= 0.93**, when treatment SM was excluded indicating that this compost is different because showed greater CEC for the same amount of total carbon (CEC:Ct). Although the CEC:Ct ratio was relatively low for FC compost, the high HOM content caused the raise of the CEC, whereas, although SM compost had lower MOH content, presented higher CEC due higher negative density load. Moreover, the influence of pH must be considered on the CEC of the HS.

Conclusions

- The mineral enrichment causes quantitative and qualitative changes in the humic organic substance of the composts, making possible the manipulation of the quality of composts during its accomplishment, by means of mineral enrichment;
- The composts prepared with filter cake (FC), and a base of castor oil plant (M+G and M-G) showed greater humic organic substance content, whereas composts SM and PR, had lower. However, the raised acidity of the composts prepared with castor oil plant (M+G and M-G) achieved an end product with low CEC:Ct ratio.
- The SM and FC composts showed higher CEC, whereas the others composts had lower and similar values of CEC.

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