COMPOSTING SEWAGE SLUDGE WITH BIOCHAR AND ZEOLITE: EFFECTs ON COMPOSTING PROCESS, SOIL AND SUNFLOWER GROWTH

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Abstract

Composting is a promising process for transforming and stabilizing sewage sludge (SS) into a valuable resource[1]. Biochar and zeolite can be used as bulking agents for composting[2]. However, their effect on the composting process, compost quality and soil-plant system upon compost application to soil have not been tested extensively. The aim of this study was to evaluate the effect of biochar and zeolite, as bulking agents, on the composting process and compost quality from SS mixed with pruning residues. Then, compost was tested in a pot experiment to evaluate its effect on soil fertility and sunflower (*Helianthus annuus* L.) growth. Compost with biochar (CB) as bulking agent experienced temperatures and CO_2 emissions higher than those experienced by mixtures with zeolite (CZ) or only pruning residues (CC). Total organic carbon (TOC) and nitrogen (TN) were the highest in CC followed by CB and then by CZ, whereas total phosphorus (P) was the highest in CB. Thus, biochar as bulking agent, revealed a good potential to improve the quality of compost and its sanitization. Soil TN and available P were increased by CC followed by CB and then by CZ. TOC was not significantly affected by compost addition whereas extractable organic C showed the highest concentration in soil+CC and the lowest in soil+CB and soil+CZ. Such a pattern was ascribed to the ability of biochar and zeolite to absorb low weight organic substrates. This reflected also on microbial biomass C which increased only in soil+CC. Finally, CB and CZ addition to soil improved plant growth by 26% compared to control and, particularly, increased root biomass by 85%, thus allowing plants assimilate more N and, only in the case of CB, also more P in the shoots compared to plants grown in soil not amended. Results showed that biochar, more than zeolite, is very effective as a bulking agent for composting and contributes to producing a compost able to improve soil fertility and plant growth.

[1] Kumar V., Chopra A.K., Kumar A., “A review on sewage sludge (Biosolids) a resource for sustainable agriculture”. Archives of Agriculture and Environmental Science 2(4), 340-347 (2017).

[2] Muscarella S.M., Badalucco L., Laudicina V.A., Wang Z., Mannina G., “Chapter 6 -Wastewater treatment sludge composting”. In Mannina G., Pandey A., Sirohi R. (Eds.), Current Developments in Biotechnology and Bioengineering, 115–136 (2023).