

堆肥反应器中硫磺对牛粪好氧堆肥的保氮效果研究

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Nitrogen conservation by adding sulfur to dairy manure in compost bioreactors

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摘要

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摘要 利用堆肥反应器严格控制堆肥条件, 以牛粪和蘑菇渣为原料进行好氧堆肥, 在堆肥过程中添加硫磺粉, 研究硫磺对堆肥温度、pH、氮素转化、硫素转化和保氮效果的影响。结果表明, 堆肥中添加0.5%硫磺粉(T1)对堆肥温度没有显著影响, 高温期($\geq 50^\circ\text{C}$)维持5.5 d; 而添加1.0%硫磺粉(T2)能快速升温, 但堆肥高温期维持时间4.6 d。添加不同量的硫磺粉均能显著降低堆肥pH, 与CK比较差异显著。添加硫磺粉能大幅度增加铵态氮含量, 至堆肥结束时, T1和T2处理铵态氮含量分别是CK处理的15倍和24倍, 差异极显著; 还增加了堆肥有效硫含量, 至堆肥结束T1和T2有效硫含量分别较堆肥初始增加35.7%和77.1%。整个堆肥过程总氮(TN)含量呈增加的趋势, 堆肥结束时CK、T1和T2处理的TN含量分别达15.8、16.5和16.9 g/kg, T1和T2分别比CK处理增加4.4%和7.0%。说明在牛粪好氧堆肥中添加0.5%或1.0%硫磺粉, 均可起到一定的保氮作用, 可大幅度提高堆肥铵态氮和有效硫的含量, 改善了堆肥养分品质; 而且添加1.0%硫磺粉效果好于0.5%硫磺粉。但是添加1.0%硫磺粉缩短了堆肥高温期, 降低了种子发芽指数, 不利于堆肥的无害化进程。

关键词: 硫磺 牛粪 好氧堆肥 保氮效果 堆肥反应器

Abstract: By utilizing compost bioreactors with dairy manure and mushroom residues as feedstocks under controlled aerobic conditions, nitrogen and sulfur transformation, compost temperature and nitrogen conservation were studied over a 21 day composting process by adding sulfur. In this experiment, sulfur was added at rates of: 0 (non-amended control, CK), 0.5% (T1, on weight basis), 1.0% (T2) with three replicates. Compared to the CK, the addition of sulfur at a rate of 0.5% (T1) has no significant effects on compost temperature, and the thermophilic period (temperatures greater than 50°C) is about 5.5 days, while, compost temperature is increased under the addition of sulfur at a rate of 1.0%, and thermophilic period is about 4.6 days. pH of compost is significantly decreased under the additions of sulfur, while ammonium nitrogen ($\text{NH}_4^+\text{-N}$) content is significant increased. For example, at the end of this experiment, $\text{NH}_4^+\text{-N}$ contents of T1 and T2 are 15 and 24 times more than that of the CK, respectively. The extractable sulfur content is also significantly increased, and at the end of the experiment, extractable sulfur contents of T1 and T2 are increased by 35.7% and 77.1% compared to their initial values at the beginning of the composting. Slowly increased trend in total nitrogen content is observed during this comcomposting process. The total nitrogen contents are 16.5 g/kg for T1, 16.9 g/kg for T2 and 15.8 g/kg for CK, with increases by 4.4% for T1 and 7.0% for T2. These results suggest that the additions of sulfur (0.5% or 1%) to the compost can significantly increase $\text{NH}_4^+\text{-N}$ and extractable sulfur contents, and enhance nitrogen conservation, thus improving the quality of compost. Compare with the addition of sulfur (0.5%), effect of the addition (1%) is better, however, the thermophilic period is shorter and germination index is reduced, which are disadvantages for the harmless process of composting.

Keywords: sulfur dairy manure aerobic composting nitrogen conservation compost bioreactors

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