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磺胺甲噁唑对猪粪堆肥过程中堆料性质与酶活性的影响

Effect of sulfamethoxazole on properties and enzymes activities during composting

关键词: [堆肥](#) [磺胺甲噁唑](#) [酶活性](#) [基本性质](#)

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摘要: 以猪粪、小麦秸秆为材料, 研究了磺胺甲噁唑 (SMZ) 对高温堆肥过程中理化性质 (温度、pH值、 E_4/E_6) 和酶活性 (纤维素酶、磷酸酶、脲酶、多酚氧化酶) 的影响. 结果表明: SMZ对堆肥理化性质的影响与其浓度有关. 高浓度 ($95 \text{ mg} \cdot \text{kg}^{-1}$) SMZ会对微生物活性产生显著抑制作用, 表现出堆肥温度难以达到无害化标准, 堆料pH值较低 (<9.0). 但高浓度 ($95 \text{ mg} \cdot \text{kg}^{-1}$) SMZ能激活多酚氧化酶活性, 且水提浸液 E_4/E_6 值较低. 在堆肥过程中, SMZ对纤维素酶和脲酶活性呈现出“抑制-激活-抑制”的作用, $50 \text{ mg} \cdot \text{kg}^{-1}$ 的SMZ对纤维素酶产生不同程度的激活作用. 相比之下, 脲酶活性对SMZ的敏感性比纤维素酶更敏感, $5 \text{ mg} \cdot \text{kg}^{-1}$ 的SMZ即能显著抑制脲酶活性, 中浓度 ($50 \text{ mg} \cdot \text{kg}^{-1}$)的SMZ对碱性磷酸酶活性产生了显著的抑制作用. 综上, SMZ通过影响酶活性而影响堆肥过程的物质转化. 此外, SMZ浓度越大, 种子发芽指数越低. 当 $\text{SMZ} \geq 50 \text{ mg} \cdot \text{kg}^{-1}$ 时, 堆肥难以腐熟而对植物毒性较大.

Abstract: Effects of addition of SMZ to a composting material, which was made of pig manure and wheat straw during aerobic fermentation in thermophilic aerobic state, were studied in this paper. The changes of cellulose, urease, alkaline phosphatase and polyphenol oxidase activities, and composting temperatures, pH and humic acid E_4/E_6 of composting materials were determined. Results showed that the influence of added SMZ on physical and chemical properties of compost related to its concentrations. High concentration ($95 \text{ mg} \cdot \text{kg}^{-1}$) of SMZ had significant inhibitory effect on microorganism activity, resulting in the compost temperature hardly met the national standards. In addition, it was difficult for the degradation of protein composition with the lower pH (<9.0). However, high concentration ($95 \text{ mg} \cdot \text{kg}^{-1}$) of SMZ could activate the activity of polyphenol oxidase, and thus promote the condensation of humus and aromatization, making E_4/E_6 value lower than CK. The effects of SMZ on cellulose and urease activity were mainly presented as "inhibition-activation-inhibition" trend with composting period. $50 \text{ mg} \cdot \text{kg}^{-1}$ of SMZ had activation impact on cellulose activities to different extents. In contrast, urease activity was more sensitive to SMZ than cellulose activity. $5.0 \text{ mg} \cdot \text{kg}^{-1}$ of SMZ could significantly inhibit urease activity, while $50 \text{ mg} \cdot \text{kg}^{-1}$ of SMZ had significant inhibitory effect on the activity of alkaline phosphatase. To sum up, SMZ had impacts on the transformation of substance by affecting enzymes activities. In addition, the germination index of seed was declined with the rising of the SMZ concentration. When the spiked concentration of SMZ was over $50 \text{ mg} \cdot \text{kg}^{-1}$ in compost, the compost was hardly thoroughly decomposed and resulted in bigger phytotoxicity.

Key words: [compost](#) [sulfamethoxazole](#) [enzyme activities](#) [physicochemical properties](#)

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