Changes in abiotic dissipation rates and bound fractions of antibiotics in biochar-amended soil

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BACKGROUND/OBJECTIVES: The overapplication and misuse of antibiotics have resulted in their ubiquitous presence in various environmental systems. Biochar can removal and/or immobilization of various contaminants from water and soil. This study is based on the following purposes: (1) to examine the effects of antibiotic molecular structures and biochar properties on their abiotic dissipation in soil; (2) to explore the effects of biochars on the bound fractions of antibiotics in soil, and (3) to assess the effects of biochars on the potential risk of antibiotics.

METHOD: Nine types of biochars produced from different feedstocks at different pyrolysis temperatures were applied into an agricultural soil contaminated with manure compost containing 16 antibiotics . Extract and determination different forms of antibiotics, HPLC-MS was used to detection the targeted antibiotics.

RESULTS: In soil without biochar, the abiotic dissipation rates of antibiotics were generally TCs > SAs > QLs. In biochar-treated soils, biochars produced at 250℃ generally had a positive effect on the abiotic dissipation rates of antibiotics. The effect sizes of biochars produced at 400℃ and 600℃ for the abiotic dissipation of antibiotics were influenced by both biochar type and antibiotic molecular structure. The effects of biochar types on antibiotic bound fractions were generally SAs >TCs>QLs.Biochars generally decreased the apparent K_{app} of antibiotics in soil.

CONCLUSION/IMPLICATION: Abiotic dissipation rates of antibiotics in soil were molecular tructure-depended; Biochar produced at 250° C generally enhanced the abiotic dissipation of antibiotics; Biochar had the strongest impact on bound fractions of sulfonamides; Biochar generally reduced apparent distribution coefficients of antibiotics in soil.