Biochar enhanced the nitrifying and denitrifying bacterial communities during the composting of poultry manure and rice straw

ABSTRACT

Biochar has proven to be a feasible additive for mitigating nitrogen loss during the composting process. This study aims to evaluate the influence of biochar addition on bacterial community and physicochemical properties changes, including ammonium (NH_4^+), nitrite (NO_2^-) and nitrate (NO_3^-) contents during the composting of poultry manure. The composting was carried out by adding 20% (w/w) of biochar into the mixture of poultry manure and rice straw with a ratio of 2:1, and the same treatment without biochar was prepared as a control. The finished product of control compost recorded the high contents of NO_2^- and NO_3^- (366 mg/kg and 600 mg/kg) with reduced the total NH_4^+ content to 10 mg/kg. Meanwhile, biochar compost recorded a higher amount of total NH_4^+ content (110 mg/kg) with low NO_2^- and NO_3^- (161 mg/kg and 137 mg/kg) content in the final composting material. The principal component analysis showed that the dynamics of dominant genera related to Halomonas, Pusillimonas, and Pseudofulvimonas, all of which were known as nitrifying and denitrifying bacteria, was significantly correlated with the dynamic of NO_2^- and NO_3^- content throughout the composting process. The genera related to Pusillimonas, and Pseudofulvimonas appeared as the dominant communities as the NO_2^- and NO_3^- increased. In contrast, as the NO_2^- and NO_3^- concentration decreased, the Halomonas genus were notably enriched in biochar compost. This study revealed the bacterial community shifts corresponded with the change of physicochemical properties, which provides essential information for a better understanding of monitoring and improving the composting process.

Keyword: Composting; Biochar; Nitrogen compounds; Nitrification; Denitrification; Bacterial community