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Akdeniz, N 2019 A systematic review of biochar use in animal waste composting Waste Management 10.1016/j.wasman.2019.03.054

Background and objective

Although there have been a few review papers that have summarized the literature regarding biochar use in composting, none of these has focused on animal waste composting. The purpose of this review paper was to critically analyze the role of biochar in animal waste composting, identify the gaps in our current knowledge, and propose future research directions. Here the effect of biochar on methane (CH₄) and nitrous oxide (N₂O) emissions are reported.

Search strategy and selection criteria

For the purpose of this review, the author conducted a systematic literature search of the Web of Science, Google Scholar, Scopus, and Science Direct databases using the keywords "biochar" and "compost" in the title, keywords, and abstract. In addition to the systematic literature search, a number of papers and books were consulted as references to explain certain basic concepts (e.g., composting, nitrification, pyrolysis) and define commonly confused terms (e.g., biochar/hydrochar/charcoal and hydrothermal carbonization/pyrolysis/torrefaction). 1. Studies that focus on the soil application of biochar with compost were excluded because these studies provided no information regarding the impact of biochar on the composting process. 2. Papers that discuss the effects of biochar on composting non-agriculture-related waste (e.g., food waste and sewage sludge) were also excluded, as the scope of the present review is animal waste composting. Articles that report the impact of biochar addition on livestock and poultry waste compost were included in the qualitative analysis.

Data and analysis

Not reported

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
Not reported	Animal waste	Biochar addition on livestock and poultry waste compost (biochar-compost)	Compost of animal waste without biochar addition	Metric: 1) CH ₄ emission; 2) N ₂ O emission; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	37.5

Results

- An anaerobic environment facilitates the emission of CH₄, whereas biochar amendment reduces the formation of anaerobic pockets within the compost pile, and consequently less CH₄ is generated. During the composting process, organic nitrogen is degraded to ammonium and nitrate, with N₂O being produced mainly via the denitrification of nitrate.
- The lower rates of N₂O emission measured from biochar-amended compost piles may be related to a decrease in the nitrogen made available for denitrification, as biochar can efficiently absorb and retain NH₃ gas and ammonium, as well as nitrate ions.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Biochar addition to animal waste composting could reduce CH₄ and N₂O emissions, but these results are uncertain due to the methodology used in this study (systematic review, no quantitative analysis).