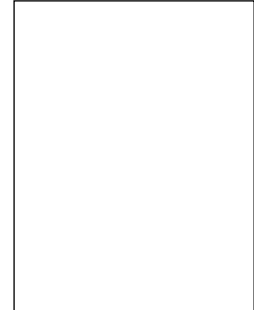


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Potential Benefits from Biochar Application for Agricultural Use: A Review

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ABSTRACT

Soil degradation and pesticide pollution are two major problems in the agricultural ecosystem. The application of biochar is a promising method because it has been proved to be highly effective in increasing crop yield and enhancing pesticide degradation in many previous studies. Here, we review the potential benefits of biochar in improving the efficiency of fertilizer usage by increasing the availability of nutrients and soil fertility through enhanced nutrient retention and release. Its promoting effect in pesticide chemical degradation and biodegradation is also investigated. The main properties of biochar are: high surface area with many functional groups, high cation exchange capacity, and high stability. The influencing factors (*e.g.*, feedstock, pyrolysis temperature and application rate) and mechanisms for nutrient retention by biochar are discussed. As certain differences exist in the conditions between laboratory experiments and field trials, further studies should be focused on the long-term dynamic function of biochar.

Key Words: pollution; nutrient; biochar; chemical degradation; biodegradation

INTRODUCTION

The application of fertilizer (*e.g.*, nitrogen (N), phosphorus (P), and potassium (K)) and pesticide in agricultural soil as a way to improve crop yields has become increasingly intensive. For instance, fertilizer consumption in China accounts for 90% of the global fertilizer consumption (Pan *et al.*, 2017). The annual increase in pesticide consumption is estimated to be equivalent to 61%, 55% and 10% of the total amount of Cambodia, Laos, and Vietnam respectively (Schreinemachers *et al.*, 2015). Under intensive application, leaching losses of fertilizer and pesticide may occur, which can lead to the deterioration of soil fertility and to environmental pollution. Moreover, nutrient leaching from agricultural soils can reduce soil fertility, increase the costs of farming, accelerate soil acidification, and reduce crop yields (Laird *et al.*, 2010). Pesticide has the tendency for long-range transport and trans-boundary dispersion, and its capacity to bioaccumulate in the food chain can pose a great threat to human health and the global environment (Kuranchie-Mensah *et al.*, 2011).

On the one hand, in order to satisfy the large food demand in some countries, people urgently need to

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