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Straw biochar alters mass distribution and microbial community structure across particle-size fractions of paddy soil

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Soil aggregates and microorganisms play an important role in soil functions, and biochar is known to exert a strong influence on them. However, how soil physical structure and microbial communities could be altered by a single biochar soil amendment in the long-term scale under field condition had been not yet clearly understood. In this research, we chose the plots of paddy soil located at Yixing City, Jiangsu Province of China, which had been treated with straw biochar from May, 2009. Bulk soil samples of control and biochar-amended plots were collected at rice harvest in October, 2015. Then each sample was fractionated using wet sieving to macroaggregates (2000-250μm), microaggregates (250-53μm), coarse silt (53-20μm), fine silt (20-2μm) and clay particle (<2μm). We measured microbial communities via high-throughput sequencing (Illumina Miseq), enzyme activities and basic physicochemical properties. More macroaggregates and microaggregates were formed with the decrease in silt fraction under biochar treatment over control. Biochar treatment also increased the content of organic carbon in each fraction with coarser face of aggregates, and most enzyme activities increased in silt fraction after biochar amendment. Further, biochar treatment and different particle size of aggregates had interactions on organic carbon content, C-degrading related enzyme activities, bacterial abundance and Shannon index of microbial communities. What's more, soil microbial communities were separated by different particle size of aggregates and biochar treatment. In conclude, after biochar amendment for 6 years, the content of soil organic carbon was increased with higher organic carbon stability. Also, biochar treatment promoted soil microbial activity, while biochar amendment and particle size of aggregates shifted the microbial communities.