



Biotic and abiotic factors of soil organic matter mineralization: Experiment and structural modeling

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Soil organic matter (SOM) mineralization is affected by various abiotic and biotic factors, as well as the input of exogenous organic substances. Our previous studies have shown that SOM mineralization in flooded rice paddies is lower than that in adjacent upland soils in subtropical agro-ecosystems. However, the main factors contributing to the differences in SOM mineralization remain unclear. To compare the effects of biotic and abiotic factors on SOM mineralization between upland and paddy soils, we incubated upland and paddy (flooded) soils with three low molecular weight organic substances (LMWOS, i.e. glucose, acetic acid, or oxalic acid) for 30 days under field conditions. Generally, the average CO₂ efflux from upland soil was higher than that in paddy soil with the same LMWOS addition. Peroxidase activity was higher in paddy than in upland soil in the first 10 d of incubation. The total content of phospholipid fatty acids (PLFAs) in paddy soil was 2–5 times higher than that of upland soil. Redundancy analyses indicated that microbial community composition was influenced mainly by redox potential (Eh) in paddy soil. Structural equation modeling revealed that, among abiotic factors, temperature exerted indirect effects on SOM mineralization by influencing biotic factors in both soils; Eh has a positive and direct effect on SOM mineralization in paddy soil. In terms of biotic factors, SOM mineralization in upland soil was mainly regulated by the quantity of bacteria. In paddy soil, SOM mineralization was largely influenced by the ratio of fungal to bacterial PLFAs and peroxidase activity.