



Turnover and influencing factors of low molecular weight dissolved organic N in a paddy soil under long-term fertilisation practices

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Dissolved organic nitrogen (DON) is a significant nitrogen (N) pool in most soils and is considered to be important for N cycling. Increasing evidence suggests that not only amino acids but also small peptides are potential direct nutrient sources for both soil microorganisms and plants. However, current understanding of turnover and underlying mechanisms of those low molecular weight DON (LMW DON) compounds in soils remains incomplete. In this study, we aimed to investigate mineralization of LMW DON compounds in a paddy soil from different depths under different N fertilisation practices; and to test the linkages between soil characteristics and LMW DON turnover. To accomplish this, we collected soils from different depths (i.e., 0-10, 10-20, 20-30 and 30-40 cm) in a paddy field under long-term different fertilisation practices (i.e., control without fertiliser, chemical fertiliser and organic fertiliser alone and their combination) in southern China. We measured soil physiochemical properties and abundance and structure of soil microbial communities after long-term fertilisation management. In ^{14}C mineralization assay (7 days at 22 °C), we used the amino acid L-alanine and its peptide tri-L-alanine as model L-enantiomer substrates to investigate the rates of LMW DON mineralisation in paddy soils. Overall, a double first-order kinetic model conformed very well to the experimental data of amino acid and peptide mineralization. For both form of LMW DON, the pool sizes of both catabolic and anabolic processes were significantly affected by N fertiliser, soil depth, and their interaction ($P < 0.0001$), thus contributing to pronounced differences in microbial C use efficiency among treatments. However, microbial uptake rates of peptide but not amino acid were significantly affected by N fertiliser, soil depth, and their interaction (all $P < 0.05$). Results of canonical correspondence analysis suggest that microbial C use efficiency of both LMW DON was positively correlated with soil pH, while microbial uptake rates were predominately associated with other soil biochemistry properties (e.g. soil and microbial C and N indices).