Effects of montmorillonite and goethite on phosphorous cycle driven by fungi in artificial soil

MU SU[1] SHIMEI WANG[1] ZHEN LI[1]

[1]College of Resources and Environmental Sciences, Nanjing Agricultural University, China
Corresponding email: lizhen@njau.edu.cn

Abstract

Phosphorus (P) in soil shows low bioavailability since inevitable adsorption and precipitation with clay minerals and other ions. Phosphate-solubilizing fungi (PSF) are ubiquitous in soils and possess potential to activate inorganic P through physical and biochemical mechanisms. Whether the interactions between PSF and clay mineral affect the transformation of P in soil remains unclear. These knowledge gaps critically limit our understanding and management for P application in different types of soil. We carried out a artificial soil incubation experiment based on quartz (Q) texture. Montmorillonite (Mt), goethite (Gt), *Aspergillus niger* (*A. niger*) and apatite were applied to investigate their interaction and the influence on P transformation. The available P released from apatite in the control treatment (Q+*A. niger*) reached 370.4 $mg \cdot kg^{-1}$. However, the P concentration were only ~24 and 79 $mg \cdot kg^{-1}$ accompanying with increased pH under the influences of Mt and Gt respectively. Additionally, the P decreased significantly with the raising content of both Mt and Gt. Clay minerals inhibited the dissolution of apatite via regulating the pH, which might result from their adsorption properties for organic acids secreted by fungi as well as available P. Moreover, both Mt and Gt promoted the respiration of *A. niger*. However, the number of fungi was decreased after the addition of Mt and Gt, especially for Gt addition. SEM-EDS results showed that the mycelium was coated by Mt tightly, while the Gt was adsorbed on mycelium surface. This may inhibite the available metabolite secreted by fungi which was used to dissolve apatite, such as organic acids. The clay minerals in soil might inhibit microbial growth and play a significant roal in affecting the activation of insoluble phosphate via acting on microbial metabolites.