Geophysical Research Abstracts
Vol. 20, EGU2018-5947, 2018
EGU General Assembly 2018

Interactions between microbial residues and minerals - potential mechanisms for SOM stabilisation

Anja Miltner, Jan Achtenhagen, Mariam Karagulyan, Michael Schweigert, and Matthias Kästner
UFZ - Helmholtz Centre for Environmental Research, Department of Environmental Biotechnology, Leipzig, Germany
(anja.miltner@ufz.de)

A substantial contribution of microbial residues as a source for SOM is increasingly accepted. However, the question remains how this microbial-derived carbon is stabilised in soil. We hypothesise that, similar to what is postulated for SOM in general, organo-mineral interactions are also important for the stabilisation of microbial-derived residues. In this study, we investigated the fate of different types of microbial residues in soil, and how the residues interact with minerals present. In addition to setting up a mass balance in an incubation experiment with ^{13}C-labelled bacterial and fungal biomass, we analysed the effect of bacterial cells and cell residues on the wettability of minerals, and we performed experiments to test the effect of Fe and Al oxyhydroxides on the mineralisation of bacterial residues. Our results show that a significant portion of microbial biomass-derived C remains in soil after extended incubation. The percentage remaining in soil differs between bacteria and fungi. Mineralisation of bacterial cells and cell residues was significantly reduced in the presence of Fe and Al oxyhydroxides, but reductive dissolution of the Fe oxyhydroxide alleviated this stabilisation, further substantiating the decisive role of these mineral phases in stabilisation of microbial residues, presumably by incrustation. We could also demonstrate that bacterial biomass residues significantly reduce the wettability of mineral particles. The resulting wettability depends on the surface coverage by bacterial residues and on the wettability of the residues which is strain-specific, but also depends on stress experienced by the bacteria, e.g. drought stress. Reduced wettability of soil particles may result in hydrophobic domains where water is excluded and microbial activity is thus substantially reduced. In summary, we could identify two potential stabilisation mechanisms for microbial residues in soil; these are (1) sorption to and incrustation into soil minerals, in particular soil oxyhydroxides and (2) the formation of hydrophobic domains with reduced microbial activity and thus mineralisation of the microbial residues. As a consequence, microbial residues have a larger persistence in soil and thus contribute more to SOM than expected based on their chemical composition. They therefore need to be considered in modelling SOM formation and turnover.