EGU24-18070, updated on 25 Jul 2024
https://doi.org/10.5194/egusphere-egu24-18070
EGU General Assembly 2024

Stability of microbial necromass in soil is controlled by necromass chemical composition

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Reversing the trend of decreasing soil carbon stocks is important to help mitigate current environmental challenges. Improving knowledge on the mechanisms that control the stabilisation and persistence of soil organic carbon will provide a foundation to tackle the issue. This includes the mechanisms controlling the stability of organomineral associations, considered to be the most persistent pool of soil carbon. Uncertainties remain in how the composition of carbon involved in mineral associations can control the persistence of this soil organic carbon (SOC) pool.

With the mineral associated pool being dominated by soil carbon derived from microbial necromass, composition of microbes and their cell components will have a significant impact on organomineral stability. This study aims to investigate whether differences in cell wall composition between fungi, gram-positive and gram-negative bacteria, contribute to contrasting stability of the organominerals synthesised using necromass of these microbial groups.

Organominerals composed of ferrihydrite and montmorillonite minerals and three types of necromass were synthesised and tested for their stability. This was done using chemical washes that bring about desorption (NaOH) and oxidation (NaOCl) of the necromass C. Solid fraction C and N were measured before and after chemical wash treatments to determine the extent of organic carbon (OC) destabilisation, and Fourier transform infrared (FTIR) spectroscopy was used to semi-quantitatively assess changes in OC functional groups before and after destabilisation.

Results indicate that organominerals containing fungal necromass have greater stability compared to organominerals containing gram-positive and gram-negative bacterial necromass. The most stable fraction within organominerals was C rich and did not comprise N-containing necromass components. The results imply that necromass derived from soil fungi could enhance the persistence of the mineral-associated pool of SOC.