Geophysical Research Abstracts
Vol. 21, EGU2019-13360, 2019
EGU General Assembly 2019


# Consumption and alteration of different organic matter sources during remediation of a sandy acid sulfate soil

Angelika Koelbl (1), Franziska Bucka (1), Petra Marschner (2), Luke Mosley (3), Rob Fitzpatrick (3), Ingrid Kögel-Knabner (1,4)

(1) Chair of Soil Science, Technical University of Munich, 85354 Freising, Germany, (2) School of Agriculture, Food and Wine, The University of Adelaide, South Australia 5005, Australia, (3) Acid Sulfate Soils Centre, The University of Adelaide, South Australia 5064, Australia , (4) Institute for Advanced Study, Technical University of Munich, 85748 Garching, Germany

When acid sulfate soils dry, they generate large amounts of sulfuric acid due to oxidation of pyrite to form sulfuric material (pH <4). After re-saturation of these sulfuric soils and thus the re-establishment of reduced conditions, activity of sulfate reducing bacteria (SRB) can lead to a renewed formation of pyrite and pH increase. However, many SRB are heterotrophic and require sufficient available organic matter. Despite the general knowledge about positive impacts of organic carbon (OC) sources for ameliorating sulfuric soils, little is known about OC consumption and changes of OC composition of added organic substrates during the amelioration process. To investigate remediation of a sandy, OC-poor sulfuric soil (initial pH = 2.5), a short-term anoxic incubation experiment over a period of approx. 10 weeks was conducted after re-submerging under controlled laboratory conditions. We tested organic matter quantities between 50% up to 200% of the native soil OC content. Besides wheat straw, we used lactate additions to test if this selectively promotes the activity of SRB, and thus, accelerates sulfate reduction and pH neutralization. The results showed that OC additions of $\geq$ 50% of native soil OC content and pre-adjustment of pH to values $\geq$ 5.0 were sufficient to enable microbial reduction reactions to occur, which increased the pH to values $\geq$ 5.5. OC additions of $\geq$ 100% of native soil OC as wheat straw led to quicker changes of redox and pH values when compared to additions of 50% of native soil OC, and led to higher proportions of newly-formed mineral-associated OC. The addition of OC as lactate solution to promote specifically SRB resulted in highly variable pH and redox values between the replicates. This cannot be rated as reliable remediation success. However, in combination with wheat straw addition, the presence of lactate led to the quickest changes of pH and redox values and resulted in pH $\geq$ 7 and redox values $\leq$ -300mV, which was accompanied by high $CO_2$ release indicating an active microbial population. The application of 1:1 wheat straw-lactate – mixtures led to the quickest remediation success; however, OC losses due to microbial degradation and leaching losses due to high proportions of dissolved OC have to be taken into account and may require repeated OC addition, especially if this remediation approach is to be transferred to field conditions.