



Anaerobic microbial mobilization of iron and manganese in a ferralsol supplied with rum vinasse

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Spreading liquid organic wastes on soil enhances the risks of anaerobiosis and metal mobilization. Our aims were to identify the anaerobic processes involved in the reductions and mobilizations of Fe and Mn, with regard to the dynamic of FeIII reducers and their ability to perform other catabolic reactions. Batch incubations over periods lower than 40 d were carried out using a ferralsol supplied or not with a rum vinasse. At the initial time or after 2 and 7 d of incubations, electron donors and/or acceptors were added and incubations were carried out for 2 more days. Along the incubations, we performed characterizations of gases, organic and mineral solutes, and Fe solids, as well as enumerations of micro-organisms (N oxide reducers, fermentative bacteria, Fe reducers, SO_4^{2-} reducers). In incubations of the soil supplied with vinasse, Fe and Mn mobilization increased from the beginning to 21 d of incubation. After this date, their microbial reductions stopped, leading to their partial immobilization, their precipitations beginning early. Mössbauer analyses and electron balance calculations indicated that most of reduced metal were in solid phase. Since all carbohydrates, polyols and proteins were used in fermentations and acidogenic transformations, FeIII and MnIV reductions were a priori coupled to H_2 oxidation or the partial oxidation of butyrate, propionate, ethanol into acetate. FeIII and MnIV reductions therefore interact with all processes involved in H_2 fate. Dynamic of total anaerobes and functional microbial groups could be link to major biotransformations. However, the low density of FeIII reducers and the complex relationships between FeIII reduction and FeIII reducer dynamics suggest either indirect microbial FeIII reduction, or the microbial reduction of FeIII without energy yield.