Adaption of marine anammox bacteria to iron-manganese-sepiolite as a heterogeneous Fenton-like catalyst

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Abstract

The combination of the Fenton-like reaction and marine anammox bacteria (MAB) is promising for the simultaneous removal of low-biodegradable organic matter and nitrogen compound from landfill leachate. Iron-manganese-sepiolite (IMS) was developed as a cost-effective Fenton-like catalyst for the treatment of low-biodegradable organic matter. In this study, we mixed MAB biomass (1g wet weight) with IMS and investigated anammox activity by batch test. A specific rate of anammox was calculated at 0.63 ± 0.07 g-N·g^{-1} protein·day^{-1} which was comparable to the control test of MAB biomass without addition of the sepiolite. Long term effect of IMS on MAB was tested by mixing the sepiolite with MAB and packing into a sealed up-flow glass column. The column was continuously fed with a synthetic leachate including ammonium (30 mg NH_4-N·L^{-1}) and nitrite (40 mg NO_2-N·L^{-1}). Anammox activity was confirmed after 10 days of the operation. Nitrogen removal efficiency (NRE) reached 83.9 ± 0.9 % at a nitrogen loading rate (NLR) of 1.4 kg-N·m^{-3}·day^{-1} on day 155. A next-generation sequencing analysis revealed that the predominance of MAB was closely related to "*Candidatus Scalindua* spp.". These findings suggest the adaption of MAB to IMS and reveal a potential combination of Fenton-like reaction and anammox for simultaneous removal of low-biodegradable organic matter and nitrogen compound.