Scientific Paper:

Science of the Total Environment (2019)

Successful control of phosphorus release from sediments using oxygen nano-bubble-modified minerals

Pingping Yu[1,2], Jingfu Wang[1], Jingan Chen[1], Jianyang Guo[1], Haiquan Yang[1], Quan Chen[1,3]
[1]State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, PR China
[2]College of Resource and Environmental Engineering, Guizhou University, Guiyang, PR China
[3]University of Chinese Academy of Sciences, Beijing, PR China

Abstract:

Due to the limited aeration capacity of current aeration techniques at the sediment-water interface (SWI), we developed a specialized aeration material aimed at the SWI, known as oxygen nano-bubble-modified minerals (ONBMMs). Furthermore, we simulated its aeration efficiency at the SWI and the control effects of internal phosphorous (P) release under anaerobic conditions during 20 days. High resolution diffusive gradients in thin films (DGT) and Planar luminescent optode (PO) technologies were used to measure the temporal variation of reactive P, reactive Fe (II) and dissolved oxygen (DO) of the SWI. These results show that ONBMMs can effectively increase the content of DO at the SWI and decrease the release flux of internal P from sediments. The use of ONBMMs reduced 97.9 % of the soluble reactive P concentration of the overlaying water and reduced the release flux of DGT-P from sediments by 78.9 %. Inhibition of reductive dissolution of Fe-P from sediments was the primary principle that effectively inhibited the input of internal P by ONBMMs. Therefore, ONBMMs are potentially promising technology for the treatment of internal P pollution in eutrophic lakes.

Keywords: Oxygen nano-bubble-modified minerals, phosphorus, sediment-water interface, diffusive gradients in thin films, planar luminescent optode technology