Scientific Paper:

J. Lake Sci. (2019) 31 (1), 65 - 71

Experimental study on the oxygenation efficiency of nano-bubble modified mineral particles at the sediment-water interface in lakes

Pingping Yu[1,2], Jingfu Wang[2], Jingan Chen[2], Yao Zhang[3], Quan Chen[2,4], Yaoting Lu[2,4]
[1]College of Resource and Environmental Engineering, Guizhou Univeristy, PR China
[2]State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, PR China
[3]College of Geography and Environmental Sciences, Guizhou Normal University, PR China
[4]University of Chinese Academy of Sciences, Beijing, PR China

Abstract:

Seasonal hypoxia that enhancing the release of phosphorus from sediment in summer and exacerbating the water eutrophication is a big challenge for deep-water lakes (reservoirs) in southwest China. Increasing the oxygen level of the sediment-water interface (SWI) during summer anoxic periods is the key to reduce the internal phosphorus release. The existing deep water oxygenation technology has limited efficiency due to lacking pertinence to the SWI. In recent years, the nano-bubbles provide great potential for the development of a new oxygenation technology, which have advantages of good stability, high oxygen mass transfer rate and low environmental risk. In this study, the natural minerals, i.e. white mica, sericite, diatomite and zeolite, were modified by nano-bubbles to develop a new oxygenation technology. Simulation experiments were conducted to assess the efficiency of the newly established oxygenation technology by using planar luminescent optode technology. Our results showed that the nano-bubbles modified mineral particles obviously increased the oxygen concentrations of the SWI. The duration of continuous oxygenation for white mica, sericite and zeolite can be over 7 days, while maximum dissolved oxygen concentration at the SWI was more than 4.0 mg/L. The modified diatomite had no ability to increase oxygen level of the SWI. Minerals with fine grain size have the stronger oxygenation efficiency and the longer oxygenation duration. The nano-bubbles modified mineral technology provides new technical support for the precise oxygenation of SWI and effective control of sediment pollution in lakes.

Keywords: Nano-bubbles, natural minerals, oxygenation of the sediment-water interface, planar luminescent optode technology