Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2021.26744

214 (2021) 402–412
February

Different forms of phosphorous transformation and release prediction with environment factor in sediments from Lake Dongting, China

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Received 7 June 2020; Accepted 22 October 2020

ABSTRACT

Lake Dongting is the largest freshwater lake of China. Because of eutrophication, it has become a hot topic of water environmental protection in China. Although the input of exogenous phosphorus (P) is controlled, the release of endogenous P can maintain eutrophication for an extended time. This study explored the relationship between different environmental factors and the release of endogenous P in sediments through a large-scale field investigation. The migration of endogenous P from sediment to the overlying water layer follows a three-phase cycle process, in which iron and aluminum phosphorus (Fe/Al–P), calcium phosphorus (Ca–P), and TP transformation will occur. Fe/Al–P is the most important source of phosphorus release. The content of total P in Lake Dongting shows the following gradient East Dongting Lake > West Dongting Lake > South Dongting Lake. The contents of Fe/Al–P in East Dongting Lake were highest, which may represent a risk of P release. Therefore, canonical variate analysis showed that the effect relationship of phosphorus release followed ORP > pH > *T* > depth > conductivity ≈ TDS. Among these, ORP was the most important driving factor, as it affects the conversion of Fe^{3+}–P and Fe^{2+}–P. Finally, a model to predict P release was developed and the P release rate (Ri) was Ri = 0.472 + 0.085[*T*] + 0.029[TDS] + 0.058 [Cond.] – 0.207[ORP] – 0.134[DO] – 0.047[Depth]. These results have important guiding significance for the selection and implementation of P control technologies.

Keywords: Sediment; Phosphorus transformation; Phosphorus release; Release prediction; Environmental factor; Lake Dongting

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