Remobilization mechanism of sediments phosphorus under microbial activity in a polluted river, South China

*Rui Li[1], Jianyao Chen[1], Lei Gao[1]

1. Sun yat-sen Univ.

Reductive dissolution of iron (Fe) oxyhydroxides is considered as a key factor of phosphorus (P) endogenous release from sediments in water body. However, the cycling of sulfur (S) can decouple the phosphorus-iron relationship. In this study, the vertical profile of labile-S, Fe, and P concentrations in sediments were measured using the DGT technique in the Danshui River (Huizhou, China) to investigate the remobilization and release characteristics of P in heavily polluted river. Sediment and water samples were collected in January, July, and November, respectively, to explore the controlling factor of P release mechanic. Sediments of the Danshui River showed higher P accumulation and release risk than the Xizhi River. The labile-P concentration in the surface sediment interstitial water increased sharply with depth and reached a maximum in the sub-surface layer (1-2 cm). The highest concentration of labile-P in sediment interstitial water was occurred in the Danshui River in July. The increase of temperature accelerated the mineralization and decomposition of organic matter in the sediments and promoted the reductive dissolution of iron oxyhydroxides. In addition, a strong sulfate reduction was observed in the surface sediments of Danshui River in July, which consumed dissolved ferrous ions and promoted the transformation of P from the solid phase to the liquid phase. We found that the community composition of sulfate-reducing bacteria was different between Xizhi River and Danshui River. The abundance of Desulfomicrobium had a significantly positive correlation ($r=0.631$, $p<0.05$) with labile-S in sediments, and it played an important role in sulfate reduction.

Keywords: DGT technology, phosphorus endogenous release, iron oxyhydroxides, sulfate reduction

