

Phosphorus speciation in surface sediments of a Chinese hypertrophic lake: insights from fractionation and solution ^{31}P NMR

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Phosphorus (P) species in surface sediments from a shallow hypertrophic lake, Lake Dianchi, China, were investigated by P fractionation and ^{31}P nuclear magnetic resonance (NMR) spectroscopy during a regional algal bloom, and their potential contributions to the overlying water were also evaluated. Labile fractions of P extracted by NH_4Cl , bicarbonate dithionite and NaOH ranged from 340.6 to 1725.8 mg kg^{-1} , accounting for 20.5%-67.2% of total P. A two-step extraction method refinement of P recovery was performed before ^{31}P NMR analysis. Recovery rates of sedimentary TP and organic P by combining EDTA pretreatment and NaOH or mixed reagents ranged from 31.8% to 69.3% and from 19.8% to 51.7%. ^{31}P NMR Results showed that ortho-P and monoester-P were the most abundant P components in the sediment extractable P of sediments, followed by diester-P and pyro-P. Spatial distribution of the sum of ortho-P, diester-P and pyro-P detected by ^{31}P NMR corresponded well with the labile P concentration determined by fractionation. Both exhibited a significant positive correlation with total P in the water column, suggesting that internal loading may be an important source of P to the lake ecosystem. The release of labile P fractions fueled algal bloom, and the decay of organic matter following bloom events consumed oxygen and elevated pH value, thus this codependence might lead to a vicious cycle. Transformation mechanisms of various P species remain ambiguous and are worthy of further investigation.

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