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DGT-based Measurement of Phosphorus in Sediment Microzones and Rhizospheres

Shengrui Wang, Zhihao Wu

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This book focuses on the development of DGT (diffusive gradients in thin films) and the related techniques for measuring and investigating the geochemical process and P transfer across the sediment/water or sediment/root interface in lakes. A series of DGT techniques such as new types of probes, test methods in sediment or the rhizosphere, DIFS (DGT induced fluxes in sediments and soils) model for kinetic P exchange, CID (computer imaging densitometry) for S(-II), and microchelex gel/LA-ICP-MS (laser ablation inductively coupled plasma mass spectrometry) have been developed.

The corresponding chapters on the theory and methodology of DGT, the “internal P loading” or P transfer across sediment/root in two lakes, provide insights into the research method and conclusions, including the P release mechanism, the quantification of “internal P loading”, kinetic P exchange in DGT/sediment interface, Fe- or S(-II)-microniches at submillimeter scales in sediments for the prediction of P release, and DGT as a surrogate for the prediction of P uptake by roots.

It also offers new perspectives in the fields of P analysis and P process in micro-interfaces in lakes using DGT techniques. The P remobilization from Fe-bound P, the coupled Fe-S(-II)-P geochemical reaction and algae biomass breakdown causing P release, are elucidated using DGT methods in sediment layers. DGT parameters and curves for time or distance derived from DIFS can be used to assess kinetic P release in the sediment microzone. CID and LA-ICP-MS methods deliver Fe- and S(-II) images at submillimeter scales, which can be used for the quantification of flux related to microniche peaks and the prediction of P release from Fe-microniche or Fe-S(-II)-P geochemical reactions. DGT measurements in-situ in rhizosphere or rhizonbox can give C_E (effective concentration) and C_{DGT} values for the prediction of P accumulated in plant tissues.

This book provides a valuable reference resource for senior graduate students, lecturers and researchers in the fields of the geochemical process of eutrophic elements in lakes, lake eutrophication mechanism and environmental analysis.

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