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Enrichment characteristic and source identification of colloid-bound ammonium and phosphorus in groundwater systems of Jianghan Plain, China.

CAIXIANG ZHANG
China University of Geosciences (Wuhan)

High levels of colloid− bound ammonium (C-NH_4^+) and phosphorus (C-P) have been proved to exist in groundwater systems, which can pose a potential threat on human health and ecosystems. However, field-scale studies of their enrichment characteristics remain limited. In this study, high levels of C-NH_4^+ (up to 19.7 mg/L) and C-P (up to 3.28 mg/L) were found in groundwater systems of Jianghan Plain, China. Among them, C-NH_4^+ was mainly distributed in small molecular weight fraction (1-10 kDa), while C-P was mainly distributed in large and medium molecular weight fraction (10 kDa -0.45 μm). The release of C-NH_4^+ (up to 105 mg/kg) and C-P (up to 652 mg/kg) from sediments could be a main source of colloids in groundwater. Moreover, correlation and principal component analysis (PCA) results indicated another source of anthropogenic input for C-$NH_4^+$and C-P. Importantly, the enrichment of C-NH_4^+ was mainly regulated by colloidal Fe/Mn (C-Fe/Mn), whereas that of C-P was coupling controlled with C-Fe/Mn and dissolved organic matter. Fluorescence excitation-emission matrices with parallel factor analysis (EEM-PARAFAC) results revealed the terrestrial humic-like and tryptophan-like components of different colloidal fractions. Large and medium molecular weight C-P (10 kDa-0.45 μm) regulated by terrestrial humic-like dissolved organic matter (DOM) could form complex colloids through surface active sites (DOM-P binary complexes). Small molecular weight C-P (1-10 kDa) was closely related to the degradation or the release of internal proteinaceous substances (e.g., tryptophan) by microorganisms. This study provides new insights into the enrichment of C-NH_4^+/P in groundwater systems.

