研究报告

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太湖内源营养盐负荷状况及其对上覆水水质的影响

Status of internal nutrient loads and their effects on overlying water quality in Taihu Lake

关键词：太湖 营养盐 扩散通量 内源 孔隙水 上覆水 水质

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摘要：以太湖沉积物-上覆水界面为研究对象,于2013年夏季采集46个样点的沉积物柱状样,分析表层沉积物孔隙水中营养盐(正磷酸盐、氨氮、硝氮)的浓度空间分布,估算表层沉积物中磷、氮的扩散通量,明确营养盐在沉积物-水界面的分布规律,以探明内源营养盐负荷对太湖上覆水的污染贡献,并为沉积物-水界面氮磷的转移过程理论补充证据.结果表明:太湖西北部区域的表层沉积物孔隙水中正磷酸盐和硝氮浓度较高,分别达到1.11 mg·L^{-1}和1.25 mg·L^{-1}以上;大部分湖区的氨氮浓度超过2 mg·L^{-1}.全湖区范围内,从表层沉积物的上覆水到孔隙水,氨氮含量呈现升高趋势而硝氮含量呈现降低趋势.北部3个湖湾区的沉积物营养盐扩散通量最高,正磷酸盐为2.69~4.60 mg·m^{-2}·d^{-1},氨氮为17.8~45.7 mg·m^{-2}·d^{-1},而湖岸河口区是沉积物硝氮内源释放显著的区域.沉积物向上覆水释放正磷酸盐和氨氮的年内源污染负荷分别为64.6 t·a^{-1}和1756 t·a^{-1};而上覆水向沉积物汇入硝氮的年负荷为1102 t·a^{-1}.氨氮的内源污染负荷与外源污染负荷之比高达18.7%,氨氮、总磷和总氮内源污染为上覆水贡献的浓度分别为0.361、0.013和0.134 mg·L^{-1},表明自由扩散带来的内源负荷会使太湖水中营养盐污染恶化,需引起重视.

Abstract: The sediment-water interface of Taihu Lake (Taihu) was studied with sediment cores sampled at 46 sampling points in Taihu in the summer of 2013 to analysis the spatial distribution of nutrient concentrations (PO_4^{3-}-P, NH_4^+-N, NO_3^--N) in pore water of surface sediment, to estimate nutrient diffusion fluxes from surface sediment, and to determine the nutrient spatial distribution rules at sediment-water interface, aiming at clarifying the contribution of internal nutrient loads to the nutrient pollution in the overlying water of Taihu and adding evidence to the phosphorus and nitrogen transfer theory at sediment-water interface. The results show that concentrations of PO_4^{3-}-P and NO_3^--N were high in the northwest of Taihu and were more than 1.11 mg·L^{-1}and 1.25 mg·L^{-1}, respectively; concentrations of NH_4^+-N were over 2 mg·L^{-1} in most of area in Taihu. In the whole Taihu area, from the overlying water around sediment down to the pore water in sediment, there was an increasing trend in NH_4^+-N concentration, together with a decreasing trend in NO_3^--N concentration. The nutrient diffusion fluxes of surface sediment were the largest in the three bay area in north Taihu, with PO_4^{3-}-P of 2.69~4.60 mg·m^{-2}·d^{-1} and NH_4^+-N of 17.8~45.7 mg·m^{-2}·d^{-1}, while the nitrate nitrogen release from surface sediment was obvious in the estuary around Taihu. as the nutrient release from surface sediment to overlying water, The annual internal nutrient loads of PO_4^{3-}-P and NH_4^+-N in Taihu were 64.6 t·a^{-1}and 1756 t·a^{-1}, respectively. while the annual internal nitrate nitrogen load was -1102 t·a^{-1}, with surface sediment serving as the NO_3^--N pool of overlying water. The ratio of internal to external pollution load was as high as 18.7% for NH_4^+-N, and the overlying water contributed to internal pollution were 0.361 mg·L^{-1} for ammonia nitrogen, 0.013 mg·L^{-1} for total phosphorus and 0.134 mg·L^{-1} for total nitrogen, indicating that the internal loads of nutrient by free diffusion from surface sediment can deteriorate the pollution in Taihu that need attention.

Key words: Taihu Lake nutrient diffusion fluxes internal source pore water overlying water water quality

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