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Heavy Metals Transportation Between Sediment and Water Underdifferent Hydrodynamic Conditions

HEAVY METALS TRANSPORTATION BETWEEN SEDIMENT AND WATER UNDER DIFFERENT HYDRODYNAMIC CONDITIONS

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The release of heavy metals in sediments could influence the water quality in shallow lakes. One of the most impotent factors causing the transportation of heavy metals is hydrodynamic condition. Nowadays, heavy metals in waters are widely studied by many scientists allover the world, but most of the researches focus on the heavy metals in static water instead of dynamic water.

In this study, three hydrodynamic ecotype flumes were applied to simulate transportation of this kind in surface sediments from the Zhushan Bay, Taihu Lake, under different hydrodynamic conditions (4.0 cm/s, 12.7 cm/s, 20.2 cm/s). Figure 1 shows the schematic diagram of the experimental set. Samples of sediment, pore water and overlying water in flumes were collected at 0d, 1d, 3d, 5d, 7d, 11d, 15d, and then treated properly. At the same time, physical indexes such as temperature, dissolved oxygen and oxidation-reduction potential was measured. Inductively coupled plasma-mass spectrometry (ICP-MS) was used to measure the contents of heavy metals (Cu, Co, Ni) in these samples during the experiment period.

Results show that the hydrodynamic condition has great influence on the release of heavy metals in sediment. More heavy metals transport from the sediment into water when flow velocity in the flume is higher. Meantime, different heavy metals have different abilities of release. Cu is the most easily released heavy metal from sediment in the three ones, whose maximum release rates are respectively 15.8%, 16.2%, 22.4% in three hydrodynamic conditions. Ni is the second with the maximum release rates of 12.9%, 13.8%, 21.9%. The last one is Co, and the maximum release rates are 11.5%, 12.4%, 13.4% separately. Correspondingly, the largest content of the three heavy metals is Cu in overlying water, followed by Ni and Co. The ranges of the heavy metal content in three flumes are respectively 1.83~29.81, 1.49~38.37, 2.11~102.55 μg/L for Cu, 1.41~23.66, 1.10~24.55, 1.37~79.40 μg/L for Ni, and 0.12~2.93, 0.09~3.87, 0.14~11.58 μg/L for Co. However, the ranges of the heavy metal content in pore water are lower, which are respectively 1.39~2.98, 1.30~2.87, 1.34~2.72 μg/L for Cu, 7.20~21.26, 8.15~16.67, 8.07~13.24 μg/L for Ni, 0.79~1.95, 0.84~2.45, 0.90~2.31 μg/L for Co. Meanwhile, the contents of the three heavy metals have similar trends in different mediums. The contents decrease gently in surface sediments but ascend in overlying water. Besides, they are first increase and then decrease gradually in pore water. The results indicate that the dominant transportation of the heavy metals in the three mediums is from sediment into pore water and overlying water, while the transportation is not obvious between overlying water and pore water. Statistic analysis revealed that the degrees of transportation of the heavy metals in three mediums are different influenced by hydrodynamic conditions. The medium that can be greatly influenced by hydrodynamic condition is sediment, followed by overlying water and pore water for Cu and Ni. While overlying water is

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the most easily influenced medium for Co by hydrodynamic condition, followed by sediment and pore water. It is hoped that our finding will provide evidence for further studies of the transportation of heavy metals in shallow lakes.

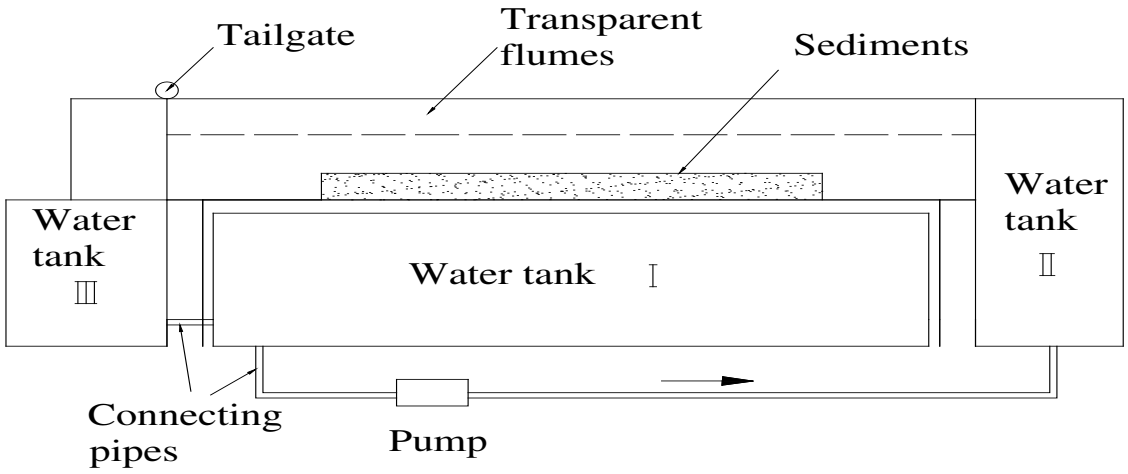

Figure 1 Experimental set