RELEASE OF BURIED HEAVY METALS FROM DIFFERENT DEPTHS IN CONTAMINATED SEDIMENTS BY BIOTURBATION/ BIOIRRIGATION

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Introduction

Bioturbation/bioirrigation can remobilize previously buried heavy metals in the sediments. The remobilization of buried thallium (Tl), copper (Cu), zinc (Zn), and lead (Pb) from three different sediment depth layers (1.0-2.0 cm, 4.0-5.0 cm, 8.0-9.0 cm) was studied in a laboratory experiment with two organisms, the Tubificid and Loach. Results showed that, the highest remobilization of heavy metals occurred from the most shallow layers (1.0-2.0 cm > 4.0-5.0 cm > 8.0-9.0 cm). As concentrations of the heavy metals detected by the diffusive gradients in the thin films technique (DGT) in the sediment pore water, the bioturbation/bioirrigation redistributed the heavy metals along the depths, especially in the presence of Loach, which may be for the Loach's buried behavior providing greater channel for the circulation of heavy metals in the pore water. Remobilization of heavy metals had no significantly difference with bioturbation/bioirrigation by the two organisms in the overlying water except for the Tl and Cu, which were significantly higher in the presence of Loach than in Tubificid treatments and both lower than controls (without bioturbation/bioirrigation) in the treatments from the 1.0-2.0 cm. The bioaccumulation of the heavy metals in the Tubificid is much more than that in the Loach, with the highest bioaccumulation appeared in the buried layer 1.0-2.0 cm, because it lived in the surface sediments.

Methods

The glass containers were distributed in room temperature for a 24 h period of stabilization before introducing the organisms. A total of 39 aquaria were randomly assigned to one of three different treatments: without organism, n=15; with Tubificid, n=12; with Loach, n=12. In each treatment, there included 4 parallel units with contaminated sediment buried depths were 1.0-2.0 cm, 4.0-5.0 cm, and 8.0-9.0 cm separately. The total sediment depth was 12 cm. After the 24 h stabilization equilibrium period, 7.5×10^5 Tubificid per square meter, 9.4×10^4 Chironomid larvae per square meter, 1.5×10^2 Loach per square meter was introduced into each glass container. The system with no organism added was used as a bioturbation/bioirrigation experiment blank. Four replicates were done for each condition. At the beginning of the exposure time, followed the DGT established procedures to sampling the heavy metals in the pore water in the control units. The overlying water was sampled at days 1, 3, 5, and 7 after the addition of animals. At the end of exposure time, One unit in each treatment was followed the DGT established procedures. Tl, Cu, Pb, and Zn were determined by inductively coupled plasma mass spectrometry (ICP-MS) (7500a, Agilent Technologies Co. Ltd., America).

Results

The highest remobilization of heavy metals occurred from the most shallow layers (1.0-2.0 cm > 4.0-5.0 cm > 8.0-9.0 cm). In the sediment pore water, the bioturbation/bioirrigation redistributed the heavy metals along the depths, especially in the presence of Loach, which may be for the Loach's buried behavior providing greater channel for the circulation of heavy metals in the pore water. Remobilization of heavy metals had no significantly difference with bioturbation/bioirrigation by the two organisms in the overlying water except for the Tl and Cu, which were significantly higher in the presence of Loach than in Tubificid treatments and both lower than controls (without bioturbation/bioirrigation) in the treatments from the 1.0-

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Conclusion

In the sediment pore water, the bioturbation/bioirrigation redistributed the heavy metals along the depths, especially in the presence of Loach. The highest remobilization of heavy metals occurred from the most shallow layers (1.0-2.0 cm > 4.0-5.0 cm > 8.0-9.0 cm).