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Bioavailability and toxicity of trace metals (Cd, Cr, Cu, Ni, and Zn) in sediment cores from the Shima River, South China

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1 **Bioavailability and toxicity of trace metals (Cd, Cr, Cu, Ni, and Zn) in sediment**
2 **cores from the Shima River, South China**

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7 **Abstract:** Five sediment cores (S1–S5) were collected from the Shima River to determine the
8 bioavailability of trace metals (Cd, Cr, Cu, Ni, and Zn) using the modified European Community
9 Bureau of Reference (BCR) procedure. The toxic effects of polluted sediment were assessed using
10 the LUMISTox[®] bioassay with *Vibrio fischeri* and chemical models such as the toxicity unit (TU)
11 of each metal, sum of all TUs (\sum TU), and toxic risk index (TRI). The results showed that Cd, Ni,
12 and Zn were present mainly in the acid-soluble and residual fractions, and the residual fraction of
13 Cr accounted for the majority of the metal content (44%), while Cu was present mainly in the
14 reducible and residual fractions. Cd had a mean enrichment factor (EF) of 15.1 and was
15 considered to be severely enriched, while there was a minor enrichment of Cr and moderately
16 severe enrichment of Zn, Cu, and Ni. From the LUMISTox[®] bioassay, an acute TU (TU_a) value
17 exceeding 0.4 was found at the upper and middle reach sites and was considered to represent
18 slightly acute toxicity, whereas little acute toxicity was found at the lower reach site. The
19 acid-soluble fraction of trace metals was the geochemical fraction mainly responsible for the acute
20 toxicity of the sediment, and acid-soluble Zn and Ni were identified as important contributors to
21 sediment toxicity.

22 **Keywords:** Riverine sediment; trace metal; geochemical fraction; toxic effects; *Vibrio fischeri*.

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