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中文题名	泥沙颗粒吸附重金属铜离子后表面形貌及结构特征研究
英文题名	Research on the Sediment Morphology and Structure Characteristics of Heavy Metal Copper Ions Adsorbed
中文关键词	细颗粒泥沙;形貌与结构;泥沙吸附;重金属铜离子
英文关键词	fine sediment;morphology and structure;sediment adsorption;copper ions
中文文摘	天然水体中的泥沙颗粒具有复杂的表面形貌，水体中的各种污染物质容易与其发生吸附-解吸作用，并随着泥沙颗粒的输移而迁移转化。污染物质被泥沙颗粒吸附后，一方面改变了水体中污染物浓度及污染物在泥沙颗粒表面的分布规律，以至影响水质模型的各种参数；另一方面，泥沙吸附污染物质后，其表面形貌也随之发生改变，使得自身的力学运动特性发生变化。泥沙颗粒对于污染物的吸附总量过去已有广泛地研究，但污染物被泥沙颗粒吸附后泥沙颗粒表面形貌的变化及污染物质在其表面的分布特性还缺乏研究，而这是研究泥沙颗粒与污染物质相互作用关系的基础。细颗粒泥沙的表面形貌及泥沙吸附重金属铜离子后的形貌改变是本论文研究的重点。研究手段主要包括电镜实验和吸附实验两个方面，其中电镜实验是通过拍摄干净泥沙和污染泥沙颗粒的外形轮廓和表面形貌，获得泥沙颗粒的形貌结构和表面特征；吸附-脱附实验是得到大量污染泥沙的研究样本。研究方法则采用统计方法与傅立叶形状分析方法，对各类泥沙形貌进行表述，定量分析天然沙、干净泥沙与污染泥沙的差异。通过上述研究表明：（1）泥沙颗粒的表面形貌十分复杂，基于傅立叶形状分析方法而建立的“数学泥沙”平台具有空间分析的能力，通过该平台可以提取、计算和分析泥沙颗粒的表面信息，是研究泥沙颗粒与污染物质相互作用关系的基础；（2）重金属铜离子被泥沙颗粒吸附后，颗粒表面有铜离子的聚积、其孔隙结构被铜离子所填充，颗粒的形貌和结构发生改变，包括表面积、总孔体积和孔径分布等结构特征，这些变化又将对泥沙运动产生影响；（3）通过 X 射线显微分析技术所提供的铜离子吸附后在泥沙颗粒表面的分布结果显示：铜离子的吸附点位主要位于泥沙颗粒的边脊和凹谷区域，这些区域的吸附能力与其表面的曲率有较好的相关关系。
外文文摘	The sediment particles in natural water have a complex surface morphology. Contaminants in water during transportation have been transformed with the sediment in the adsorption/desorption process. In the adsorption process, the concentration and distribution of contaminants on sediment particle surfaces changes, and parameters of water quality model are also influenced. On the other hand, the mechanisms of sedimentation are influenced because the sediment morphology changes. Research on sediments and pollutants in water emphasize the adsorption amount, but sediment particle morphology and the location of contaminants on the particle surface are the real foundation of sediment adsorption research. These factors have not been closely studied. This dissertation focuses on sediment morphology and especially morphology changes after copper ions are adsorbed. The field-emission scanning electron microscope (FESEM) is utilized to determine the surface structure and characteristic sediment particle morphology. The adsorption/desorption test is applied then to provide the samples for experiment. The description and quantitative analysis of natural, clean and polluted sand are then analyzed using statistical and Fourier Shape Analysis (FSA).The results of the research indicate that: (1) “Mathematical Sand”, built by FSA, can present sediment morphology and has excellent spatial analysis ability. It provides the sediment surface data and as the basis for calculation and analysis. Therefore, Mathematical Sand becomes a platform for sediment adsorption research. (2) As a result of sediment copper ion adsorption, copper ions accumulate on sediment surfaces and fill the pore structure. The sediment morphology and structure, including the surface area, total pore volume, and pore diameter distribution, undergo significant changes. Those changes impact sediment transportation. (3) X-ray microanalysis technology shows that the copper ions are adsorbed easily in the ridges and valleys of particle surfaces. The adsorption capacity of those morphology characteristics shows a good correlation with the surface curvature.

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