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In Situ Control of Typical Taste and Odor Matters in River Sediments and Identification of Functional Bacteria Species

Xi-Hui Zhang (xihuizh@mail.tsinghua.edu.cn) (Tsinghua-Berkeley Shenzhen Institute, Shenzhen, China)
Qianwu Song (songqianwu@vip.163.com) and Yi Tao (tao.yi@sz.tsinghua.edu.cn) (Tsinghua University, Shenzhen, China)

Background/Objectives. Heavily contaminated river sediments are widely found in the cities of most developing countries. Large amounts of taste and odor materials produced in sediments under anaerobic conditions often influence the daily life of the residents along the rivers. This paper conducted an in situ control project in Shenzhen River located along the boundary of Hong Kong and Shenzhen in China. The main stream of Shenzhen River is 13 km long with a flow rate of 75-100 m^3/d. A site project with 11200 m^2 was implemented in Shenzhen River bed. Major performances in terms of effectiveness, sustainability and ecological safety were evaluated from 2012 to 2016.

Approach/Activities. It was found that main odor matters included acid volatile sulfide (AVS), geosmin (GEM) and 2-methylisoborneol (2-MIB); their contents reached to 3680 mg/kg, 72 mmg/kg and 264 mg/kg, respectively. TOC in sediment reached to 4.6% while its removal efficiency was just around 10%. This project demonstrated that appropriate injection at 1.68g-N/g-AVS can obtain 95% removal of AVS within two weeks. In addition, the heavy mental ions did not release to the overlying water body and the microbiological toxicity reduced substantially. However, over dosage of calcium nitrate may result in inhibition of active microorganism, which would not benefit AVS removal. Although injection of calcium nitrate can also remove both GEM and 2-MIB, its efficiency was not as good as on AVS. During AVS removal process, the sulfur in AVS was transformed into sulfate almost quantitatively, while related degradation of GEM, 2- MIB and other organics in sediments appeared to be complicated.

Results/Lessons Learned. Major microbial communities in polluted sediments in Shenzhen River belonged to seven phyla (*Planctomycetes*, *Chloroflexi*, BCR1, *Fimicutes*, *Actinobacteria*, *Acidobacteria*, and *Chlamydiae*) and three classes (*Acidobacteria*, *Thermomicrobia*, and *δ-proteobacteria*) with the ecological function of sulfate reduction and organic matter degradation. Microbial communities varied distinctly on the 7th day during remediation with nitrate. *Proteobacteria* increased distinctly in sediments, major bacteria from the taxa of *β*-, *ε*-, and *γ-protebacteria*. The ecological function of bacterial population was to reduce nitrate to nitrogen and oxidize sulfide to sulfate cooperatively at the same time, some other processes included heterotrophic denitrification, oxidization of iron and manganese and degradation of organic matter. *Thiobacillus* was the most abundant species for AVS removal followed by *Sulfurimona* belonging to *ε-proteobacteria* and *Rhodanobacter* from *β-proteobacteria*. The results on bacterial community structure and its function provide the scientific principles for engineering control of odor in sediment of Shenzhen River.