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Interactions of bacteria with soil components and potentials in biosorption and remediation of toxic metal-contaminated soils

D acteria, phyllosilicates, and iron oxides are widely distributed in soils and sediments. They are the most reactive and finest ${f D}$ colloidal components in these systems. Bacteria are commonly found together with phyllosilicate minerals or oxides to form various composites and complexes which alter soil physicochemical properties and further affect their metal-binding behaviors. Research done over the past decades has greatly improved our understanding with respect to the mechanisms of the interfacial reactions between bacteria and clay minerals, impacts of clay minerals on bacterial activity, biosorption and modeling of metals on bacteria-mineral composites. More studies from molecular level are needed in order to enhance the ability of bacteria and their association with soil components to remediate toxic metals-contaminated soils. The focus of future investigations should be on the mechanisms by which metals are sorbed and bound by bacterial cell surfaces and bacteria-soil/mineral composites. Atomic force microscopy, X-ray absorption spectroscopy, and nano secondary ion mass spectrometry are promising techniques which can provide information about the dynamic morphology and elemental distributions of mineral-bacteria interactions, the number and type of near-neighbors for the metals of interest together with estimates of bond distances. Another research imperative is to isolate bacteria from a variety of contaminated soils and associated environments and elucidate the mechanisms of their tolerance to toxic metals. Molecular biotechnologies, notably DNA recombinant technology for bacterial surface display can yield highly sorptive bacteria. The impact of these bacteria on the binding and distribution of toxic metals at the interface of the bacteria-soil compo-site/solution interface is worthwhile investigating. Equally important is the association of heavy metal-resistant bacteria with hyperaccumulator plants and its potential in remediating toxic metal-polluted soils.

Biography

Qiaoyun Huang is a Changjiang Scholar Professor, Distinguished Young Scholar of NSFC, Professor of Environmental Microbiology at Faculty of Resources and Environment, Vice Director of State Key Laboratory of Agricultural Microbiology, Huazhong Agricultural University, China. His research focuses on the interfacial processes of soil mineral-organic matter-microorganism interactions and environmental impacts. He has published more than 140 referred SCI papers. He is currently the Vice Chairman of Commission 2.5 of International Union of Soil Sciences and the executive member of the International Advisory Committee of International Society for Environmental Biogeochemistry. He was the Chairman of the 4th International Symposium on Interactions of Soil Minerals with Organic Matter and Microorganisms and the 21st International Symposium on Environmental Biogeochemistry. He serves as the editorial member for several international journals such as Applied Soil Ecology, Journal of Soils & Sediments, Frontier in Microbiology and Geomicrobiology Journal.

qyhuang@mail.hzau.edu.cn

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