Seminar

Topic：Phytoremediation of Contaminated Soil and Water

Speaker：Prof. Norman Terry

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University of California-Berkeley, USA

Date & Time：**10:00 (am) Oct. 17, 2011（Monday）**

Venue：**Meeting room 307, IPE Mansion**

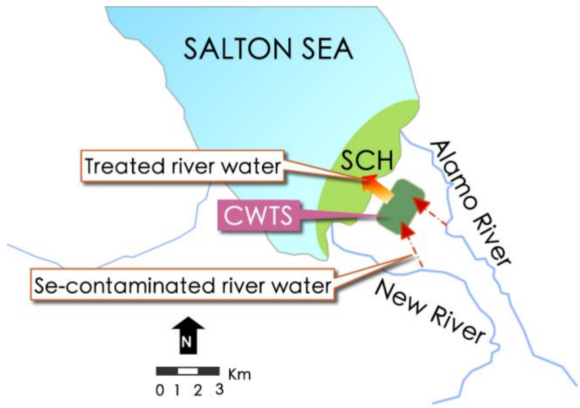
Introduction

The current research of Prof. Norman Terry is concerned with the removal of toxic trace elements from contaminated agricultural and industrial wastewater. His laboratory is unique in that it is the only university laboratory in which phytoremediation is studied from the molecular to the field level, i.e., His research includes molecular biology, microbiology, plant-microbe interactions, plant physiology and biochemistry, and physiological and field ecology. His major accomplishments include development of the use of constructed wetlands to remove selenium and toxic heavy metals from agricultural and industrial wastewater, as well as the development of genetically engineered plants for the phytoremediation of selenium-contaminated soils. He has authored over 250 research publications, submitted three patent applications (one accepted and two in review), and co-edited the book Phytoremediation of Contaminated Soil and Water, published by Lewis publishers, New York.

Abstract

Currently, we have three projects on phytoremediation: 1) to preserve the Salton Sea ecosystem (California) by developing a wetland water-treatment system for selenium (Se) removal; 2) to build bioreactors and wetland treatment systems to treat boron (B) contaminated electric utility effluents; and 3) to remediate B-contaminated mining sites in Southern California. The Salton Sea research is highlighted below.

The Salton Sea is the largest inland lake in California. It is an important bird, fish and wildlife habitat and serves as a major stop-over for migratory birds traveling the Pacific Flyway. Because of diminishing water supplies and increasing salinity, the Salton Sea ecosystem is in danger of collapse. To compensate for the loss of wetland habitat, the State of California has proposed to construct a Species Conservation Habitat (SCH). The water needed to support the SCH could come from two rivers, the New River or the Alamo River. However, these rivers contain significant levels of Se, fertilizer nutrients and other contaminants.



The presence of Se in the New and Alamo Rivers is of particular concern because it poses a potential eco-risk to the wildlife that forage in the SCH. High concentrations of Se in drainage water have been linked to mortality, developmental defects, and reproductive failure in migratory aquatic birds and in fish. Our research goal is to develop a constructed-wetland water treatment system (CWTS) to remove Se and other contaminants before the river water flows into the SCH. Surface flow wetlands have been shown to be successful in removing Se from wastewater: up to ~90% of Se from oil refinery wastewater, ~60-80% from agricultural drain water, ~20-50% for the San Diego Creek and ~50-70% for the Imperial Irrigation District. The principal mechanism of Se removal by wetlands is the microbially-mediated reduction of Se to insoluble forms (e.g., Se^0) in the anaerobic sediments. An additional pathway for Se removal is through biological (plants and microbes) volatilization. Volatilization can account for 10 to 30% of Se removal, and can go as high as ~50-60%. Using mesocosms, we tested different types of wetland design by varying plant species, sediment composition and structure, and irrigation regimes. A broad overview of these experiments shows that, with respect to plant species, cattail and saltmarsh bulrush plantings were the most efficient at removing Se. Specifically, inflow Se concentrations were reduced from 12.5 to <1.0 µg/L within 1 to 3 weeks. Increasing the depth of cattail litter in the sediments gave the best result: inflow Se of 15 µg/L was reduced to 0.1 µg/L in less than 1 week. Wet-dry cycling at 2-day intervals was more efficient than 4-day intervals or continuously irrigated. Mesocosms have proved to be a very efficient and inexpensive way of developing wetland design and have the advantage that they can be replicated.