Sediment Toxicity Tests on Aquatic Biota

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Introduction: In recent years, protecting sediment quality has been viewed as a logical and necessary extension of water quality protection. In order to establish the sediment quality criteria (SQC) for heavy metals, it is necessary to predict the toxicity of metals in aquatic sediment from chemical measurements. This requires knowledge of how sediment components moderate metal bioavailability.

Toxicity testing in aquatic marine environments presents several difficulties. High dilution capacity and mobility of ocean water masses could make it very difficult to detect the response of organisms to toxicants. For eamples, salinity and pH changes in water when inland effluents meet the estuaries, ocean. This usually causes a quick precipitation of many xenobiotics to sediments. Thus, measurement of toxicity in coastal sediment toxicity becomes a very important topic. Chemical analyses provide only measured concentrations of a given chemical in an environmental compartment and are not good predictors of the effects (e.g. acute toxicity) of chemicals to aquatic biota. Hence, bioassays have been designed to determinate the effect of potentially toxic samples to biota and are necessary to establish pollution risk in sediments.

Toxicity tests involving sediments and microphytobenthic organisms are extremely scarce and recent. . There are no standardized protocols for sediment bioassays involving microphytobenthos in the literature [1]. Traditional laboratory-based toxicity tests is the difficulty of extrapolating effects observed in the laboratory to those in the real environment. Laboratory experiments using single indicator species have served well in the past and continue to provide a mainstay for toxicology. Laboratory cultured organisms can also alter their sensitivity due to acclimation (adaptation) to different xenobiotics concentrations in the culture medium and consequently toxicity test results [2].

Most of the standart bioassays have been designed for freshwater environments (OECD, 1998) but there is a recent increase in developing standart toxicity bioassays or marine environments, some of them focused on marine microalgae (APHA-AWWA-WPCF,1989; ISO,1995; ISO 2006) [1]. The eight different categories of sediment or aquatic toxicity tests are classified, according to the microbial test involved [3].

Bioavailability is defined as the fraction of the total contaminant in the interstitial water and in the sediment particles that is available for bioaccumulation. Therefore, it can be absorbed by biota and hence can potentially cause toxic effects if present at the target site in sufficiently high concentrations. Estimating bioavailability is an important first step in evaluating the significance of chemicals sorbed into sediment. Metal bioavailability results in high concentrations of the corresponding metals in biota. This occurs through the bioconcentration, a process by which chemical matter is accumulated into biota from its surrounding environment..

Microorganisms are more sensitive to toxicants because their surface/volume ratio is quite higher and thus exposition to toxicants is more direct than in the case of multi-cellular organisms [4]. But disadvantages include that some toxicants seem to be more toxic to higher organisms than to microorganisms, as the latter lack target tissues r organs affected for tese substances [1]. When there are no results of toxicity tests with microorganisms, plants or animals available it is very difficult to derive sediment quality guidelines. *D. magna* which is one of the most widely used organisms in ecotoxicology is not a benthic organism and isolated pore water may not reflect toxicant exposure in situ and thus may not provide reliable information on the impact of pollutants in sediments [4,5]. Algae, crustaceans, insect larvae and fish are the most commonly used test species. The critical role of algae in ecosystem functioning has been demonstrated over many years through limiting-nutrient, eutrophication, and primary productivity studies [6].

Results: Environmental pollutants often do not cause damage when acting as single active substances; in combination with others, however, the same concentrations may lead to strong effects, such as decrease in species diversity, death of juvenile invertebrates, prevention of settlement, reduction of growth, reproduction, or filtration. Determining the effects of polluted sediments bound toxicants on microphytobenthic organisms is therefore a necessary step in ecological risk assessment.

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