



TechData Sheet

Naval Facilities Engineering Command
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QwikSed

A Bioluminescent Sediment Toxicity Test

A rapid sediment characterization tool

Introduction

The QwikSed is a rapid and cost-effective bioassay system that saves money and time for conducting contaminated sediment toxicity tests.

Contaminated marine sediments at Navy shoreside facilities pose a potential risk to ecosystems and human health that translates into a growing fiscal and regulatory burden for the Navy. Bioassays required for RI/FS investigations at hazardous waste sites and maintenance dredging are showing toxicity that may require expensive remedial actions.

Technical Description

The Navy has developed a rapid bioassay system (QwikSed) that is proving to be a valuable asset for conducting bioassays on marine sediments. The basis of detection is to measure a reduction in light from a bioluminescent dinoflagellate such as *Gonyaulax polyedra* or *Ceratocorys horrida* (Figure 1) following exposure to a toxicant. The toxic response is usually measured within 24 hours from the start of the test and can be conducted for a 4-day acute test or a 7- to 11-day chronic test. A measurable reduction or inhibition in bioluminescence is an adverse effect. The endpoint used to measure this light reduction is the IC50 (a 50% reduction in light output when compared to control cells).

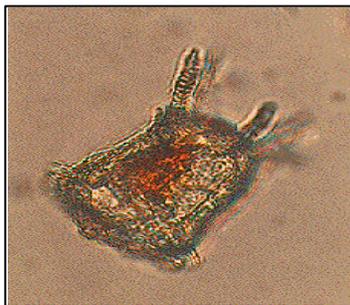


Figure 1. *Dinoflagellate Ceratocorys horrida.*

The QwikSed unit (Figure 2) has been licensed to Sealite Instruments, Inc., of Ft. Lauderdale, Florida. The cost of the QwikSed analyzer and supporting software is approximately \$15,000. The instrument includes built-in software that automatically prints the raw data and calculates the mean, standard deviation, coefficient of variation, percent of control, and the estimated IC50 (inhibition concentration of the sample or toxicant which inhibits 50% of light output from the dinoflagellate). The QwikSed unit can be connected to either a printer via a serial port on the back of the unit for direct printouts, or it can be connected to a computer for further manipulation or graphing of data using a software program such as Excel. The data from QwikSed bioassay can be correlated with more conventional toxicity tests such as amphipods and sea urchin development.

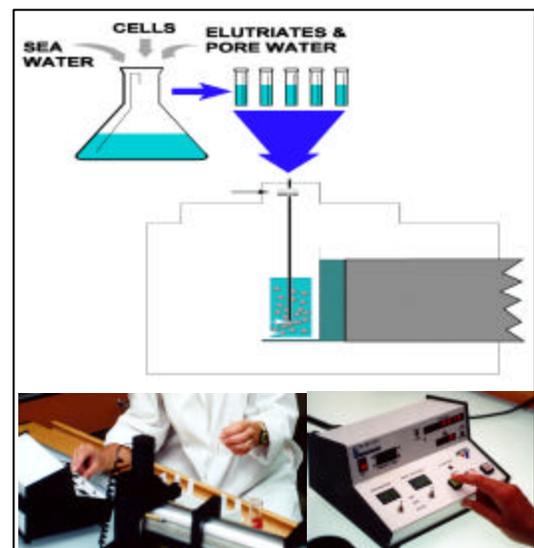


Figure 2. Schematic of toxicity test setup and the QwikSed toxicity unit.

Methodology

Seawater and the aqueous samples are mixed and distributed into cuvettes. Dino cells are added to a range of dilutions of this mixture. A few hours are required to make dilutions and pipette into cuvettes. The cells are cycled through a day-night period of 24 hours and then tested in the QwikSed system. Testing of all dilutions of the sample requires less than 1 hour to complete.

A special procedure is required to remove ammonia interference on QwikSed toxicity measurements. A protocol is available describing this procedure.

Advantages

- Faster setup and testing
- Less expensive than conventional toxicity tests
- Maintain adequate sensitivity to a range of contaminants
- Can be used by personnel with minimal training in toxicity testing

Application

QwikSed has been effective for testing the toxicity of:

- Metals
- Storm drain discharges
- Leachates of ship hull coatings
- Industrial discharges
- Marine sediments

QwikSed bioassays can evaluate both acute and sublethal chronic effects from exposure to a variety of toxicants. QwikSed can be used as a rapid sediment characterization tool before other, more expensive toxicity tests are used. QwikSed has a quick and easy initial setup and testing can be done in less than 1 hour per day. QwikSed toxicity is as sensitive or more sensitive than mysid shrimp, silverside fish, chain diatoms, and sea urchins to various inorganic and organic toxicants.

Case Study 1: Pearl Harbor, Hawaii

Bioassay screening results can show impact from contaminants measured by chemical screening tools, but can also flag effects of other contaminants, or synergistic effects from multiple contaminants. The QwikSed bioassay was deployed at two sites of the Pearl Harbor Naval Complex, Hawaii. Both sites were contaminated with heavy metals, but Bishop Point was also contaminated with polycyclic aromatic hydrocarbons (PAHs). Sediment samples from the Middle Loch site did not exhibit toxicity in either QwikSed or the sea urchin test while both tests exhibited toxicity at the Bishop

Point site (78% of all samples) (see Figure 3). Both tests were in agreement for 94% of all samples (n = 18).

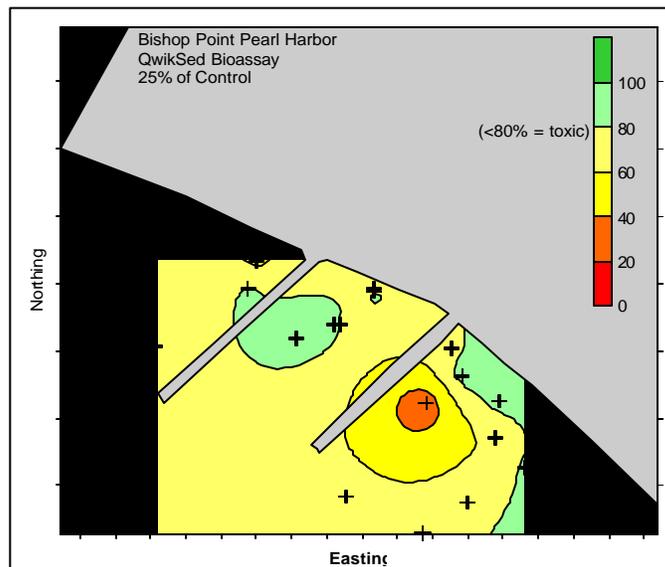


Figure 3. Delineating an area of concern using the QwikSed bioassay at Bishop Point.

Case Study 2: Alameda Harbor, California

At Alameda Harbor, toxicity in both QwikSed and the amphipods was seen in the pier areas and less in Seaplane Lagoon with an overall agreement of 92% of all samples (n = 25 samples). The worst agreement was between the amphipod and the sea urchin test (72%). QwikSed and the sea urchin displayed intermediate agreement (76%).

Cost Information

QwikSed	Amphipod
\$200 per test (24-hr turnaround)	\$1,200 per test (10-day turnaround)

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