CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35493

Project Title

Testing the Adhesive and Toxic Properties of Bioremediated Oil

Abstract

Objectives/Goals

My objective was to test which of 3 types of bioremediation agents,each with different mode of action and listed on NCP(Nat.Contingency Plan)NA(Nutrient Additive)MC(Microbial)EA(Enzyme Additive)performed best in reducing toxic & adhesive qualities of oil.

Methods/Materials

I performed 2 toxicity and 1 adhesive test. Adhesion Test: simulated a diving pelican used 'Dunk/Withdrawal' method, primary duck feathers trimmed to 7.62cm(10 per test).Feathers vertically dunked into 4/10gal.aerated river water aquariums(3 bio/1control),40ml oil,40ml bio.agent sprayed 4" above oil,feathers held 3 sec.,withdrawn,then hung vert.for 48hrs. Calculated total adhesion weight using analytical balance.Toxicity Test#1 VOC(volital organic compounds)& PAH(poly aromatic hydrocarbons):Duplicated same aquarium set up,application of bio.agent and oil,tested levels with miniRae3000 meter while measuring test parameters: temp,TDS,pH,DO at the following times: 3:30,5:30,8:30,12:30,17:30, 23:30,31:30,40:30,45:30,60:30 Toxicity Test#2 LC50 bioassay testing water column toxicity: Modified version EPA's LC50(Daphnia Magna)testing water column depths. Top:water-oil interface,Middle, Bottom:benthic layer.Duplicated same aquarium set up,application of bio.agent and oil over 48hrs.Extracted water each section placing samples in 40ml aerated beakers adding 6 adult Daphnia per beaker. Observed/recorded number dead/alive during: 1hr, 12hr, 24hr, 48hr.

Results

Toxicity Test #1: EA showed significant reduction. NA reduced(noted slight crude smell when applied) MC reduced but to lesser degree. Toxicity Test #2:Oil remained floating after application of all products in LC50 bioassy with no notable absorption of toxicity in water column thus eliminating secondary impact to aquatic life and benthic layer. Adhesion Test: Adhesion properties were significantly reduced when compared to control with EA agent showing greatest reduction in oil's adhesion.

Conclusions/Discussion

While bioremediation agents are typically overlooked as a 'First Response' tool in oil spills, I feel there is merit to using them in place of dispersants due to their immediate ability to reduce the oils toxic and adhesive properties and better protect waterfowl,other aquatic life and ecosystems.

Summary Statement

My project was testing to see if a bioremediation agent would be an effective 'First Response' tool in the event of an oil spill where waterfowl and predictably other aquatic life and ecosystems would be affected.

Help Received

HS Biology & Chemistry teachers reviewed project allowed use of lab equipment, GeoTech Engineering allowed me to use their VOC and PAH meters, Watson Bros. Balances allowed me to use analytical scale, Mr. Morrison donated the oil, Mom drove me, supported studies, purchased materials

Preliminary