CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38009

Project Title

How Byproducts Produced by Removal of Oxybenzone by Phytoremediation & Laccase/ABTS Beads Affect Morality of D. magna

Abstract

Objectives/Goals

1)if byproducts produced by the removal of oxybenzone using phytoremediation w/wetland plants & a biotech method using laccase/ABTS alginate beads are harmful to Daphnia magna 2)if laccase beads can remove oxy. at a higher & faster rate than wetland plants; 3)determine rate that sunscreen washes off skin to contaminate waterways

Methods/Materials

Phase 1-Using a UV Spectrophotometer, create a standard curve using 1:2 serial dilution of oxybenzone sunscreen. Use curve to determine amt. of sunscreen that washes off hand.

Phase 2-Perform 2 trials of ea: [control, leca, plant (5 species), plant & leca (5 species)] in 0.1 % oxy. solution. Test UV absorbance every 24 hrs. Make 4 combos of laccase/ABTS/buffer alginate beads and perform 2 trials of ea. in a 0.1% oxy. solution. Test UV absorbance thru time.

Phase 3-Select solutions with lowest % of oxy. from plants/beads & mix same % for controls. Place 6 Daphnia in ea. solution. Count survivors thru time.

Results

Phase 1: Standard curve is a near perfect line: r = .9969. This validates the use of UV Spec to measure the amt. of oxy. Hand w/sunscreen in water lost 62 % of sunscreen after 30 min.

Phase 2: 4 of 5 wetland plants were effective in removing oxy. from water. A one way ANOVA test = p-value of <0.0001 so I reject the null hypothesis & have high confidence that plants removed oxy. from water.Laccase beads had unreliable results. Two removed oxy. but the decrease was not significant -p-value = 0.0622. Two others had unreliable data.

Phase 3:Exposure to byproducts from plants resulted in a higher mortality rate/hr of D. magna compared to controls. The hrs. to reach 50% mortality were 27% to 76% faster than controls and to reach 100% mortality were 40% to 60% faster than controls (1 exception). Exposure to byproducts from laccase beads had mixed results. The hrs. to reach 50% mortality of D. magna w/LA & LABS beads were 15% & 72% faster than control & to reach 100% mortality,LABS were 72% faster than control but D. magna in LA survived longer than control.

Conclusions/Discussion

Byproducts produced by the removal of oxybenzone by both methods had an overall harmful effect on D. magna as evidence by the increase in the rate at which the D. magna reached the 50% and 100% mortality rate. Therefore, while we develop methods for removing toxicants from our waterways, it is critical to test that the byproducts produced are not as harmful as the toxicants.

Summary Statement

This experiment tests if the byproducts produced by two methods of removing oxybenzone from waterways (phytoremediation and alginate beads made with the enzyme laccase and a mediator ABTS) are toxic to Daphnia magna.

Help Received

Ms. Burndon and Mr. Capp and Mr. Endberg from Carlmont High who helped brainstorm ways of measuring reduction of oxybenzone in solutions and helped me understand details of some published research as well as providing access to lab supplies.