Cadmium Toxicity in the Macrophytic Alga Chara australis R.Br: Role of Reactive Oxygen Species (ROS)

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BACKGROUND

Cadmium (Cd) is toxic to plants and animals. It arises from natural weathering, agriculture, manufacturing, mining, and municipal wastes[1]. Chara are macroalgae that grow primarily in freshwater, anchored in the sediment by rhizoids. (Figures 1 & 2) Previous studies show that Chara can translocate Cd from the water or sediment to the shoot[2]. They grow to significant biomass in dense mats and can accumulate various solutes to significant concentrations and would be good at removing contaminants, a process known as phytoremediation.

Reactive Oxygen Species (ROS), such as peroxides and hydroxyl radicals, arise in organisms as a response to stress, such as chemical pollutants or physical damage. (Figure 3)

HYPOTHESIS

We predict ROS are produced in response to heavy metal stress.

VARIABLES

- Duration after stress
- Dimethyl sulfoxide (DMSO) vs. ethanol
- Mass, age, health of Chara
- Presence of microorganisms

WORKS CITIED

3. Cleveland Clinic Center for Medical Art & Photography © 2010
4. Image provided by James Kern
5. Image by Charles D. Winters

PREVIOUS RESULTS

- Showed no increase in ROS during 24 hour incubation, but a decrease (Figure 5)
- Cadmium appears to cause ROS to decrease over time
- Use fluorescent compound DCHF-DA (Dichlorodihydroflurorescin diacetate) to indirectly measure ROS production in Chara

METHODS

1. Incubation

2. Extraction

3. Analysis

RESULTS

CONCLUSIONS

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Nos significant difference at 10 minute exposure to 2 ppm Cd
- Further experimentation required for refining results with statistical significance
- Based on the results, samples stressed with Cd have higher fluorescence readings, indicative of increased ROS production, compared to blanks and controls.