CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
S0823

Project Title
Alginate: The Nontoxic, Biodegradable Tool for the Firefighting Arsenal

Abstract

Objectives/Goals
The ingredients of many common fire retardants and suppressants have both immediate and long-term negative effects on ecological communities. Common active ingredients include toxic chemicals that bio-magnify in food chains or nitrates and phosphates that can cause eutrophication in nearby water sources. The purpose of this project is to determine if a viscous spray made with alginate, a natural, biodegradable compound produced in the cell walls of brown algae, is an effective fire-retardant alternative based on its ability to prevent combustion and burning.

Methods/Materials
Each trial tested three 3.0g hay pellets with varying levels of alginate exposure [a dry, unsprayed hay pellet (control, pellet A), a hay pellet sprayed 5 times with 0.5% alginate (pellet B), and a hay pellet sprayed 5 times with water (second control, pellet C)]. Each hay pellet was exposed to a Bunsen burner flame at a distance of 5cm from the side of the pellet to the tip of the Bunsen burner, for 15 seconds. Then, pellets B and C were allowed to dry, and all the pellets were weighed to determine the percent mass left after burning. Forty-seven trials were conducted, each involving three pellets, for a total of 141 tested pellets.

Results
Pellet A, the control, burned the most, with a mean of 45.9% mass burned. Pellet B, the alginate pellet, burned the least, with a mean of 16.0% mass burned. Pellet C, the water pellet, burned more than pellet B but less than pellet A, with a mean of 32.5% mass burned.

Conclusions/Discussion
The gel-like properties of viscous alginate solution prevented burning and combustion consistently better than water. The standard deviation of the mass of burned pellet B was 0.185 while the standard deviation of mass of burned pellet C was 0.355 and for Pellet A was 0.507. This implied that hay pellets sprayed with alginate were much less flammable than those sprayed with an equal volume of water. This finding is significant based on the z test, which suggested an extremely low p-value of <0.00003. These results indicate that alginate could possibly be used as an alternative, more environmentally friendly fire retardant. More studies are necessary to further explore the fire suppressant/extinguisher potential of alginate.

Summary Statement
This project tested the novel idea of using alginate - a natural chemical produced in brown algae - as a nontoxic fire retardant and results suggest that a coating of alginate solution reduces flammability more than a coating of water.

Help Received
Used lab equipment at Canyon Crest Academy and used fire under the supervision of Ms. Slijk; Funding from an Intel Research Grant awarded by COSMOS