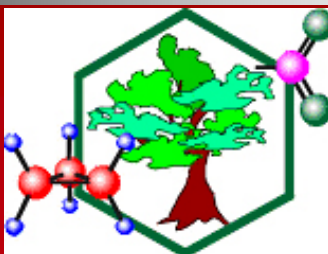


The Glowing Spiral With A Green Twist



Brandon Fultz

What is Chemiluminescence?



- A luminescence resulting from a chemical reaction as in the oxidation of luciferin in fireflies.
- Glowing Spiral?
- Ex. glow sticks



What is NOT Green Chemistry ?

- The generation of hazardous or toxic wastes.
- Using expensive materials.
- Using explosive or highly corrosive reagents.
- Demonstrations...?



Is There a Green Chemiluminescence Demo?

- Singlet Molecular Oxygen – uses of Cl_2
- Sensitized Oxalyl Chloride Chemiluminescence – uses oxalyl chloride, Dichloromethane, Rhodamine 6G
- Luminol Chemiluminescence Clock Reactions – use of cyanide salts



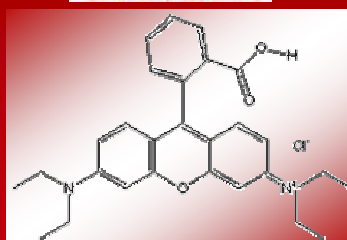
Before The Lab

- Researched many chemiluminescence reaction demos.
- Found one procedure, but it needed a little work
- The Good News: waste was all water soluble and fluorescein was 2nd dye used
- Problems: Rhodamine B, and use of a high concentration of H₂O₂.



Rhodamine B

- EC Class : Irritant, dangerous for the environment
- Pesticide, Tumorigen, Mutagen, Reproductive Effector



An Environmentally Benign Chemiluminescence Demo



- My Primary goal: to find an alternate dye to replace Rhodamine B
- Try to substitute a lower concentration of H_2O_2 for a higher one.

Methods

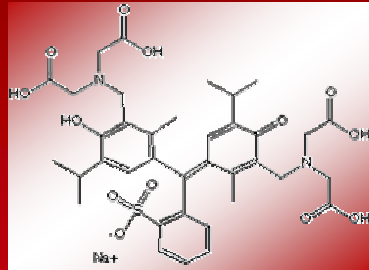


- Ran the original procedure
- Revised the procedure
- Small scale testing of dyes (41 dyes)
- Repeated new full-scale procedure





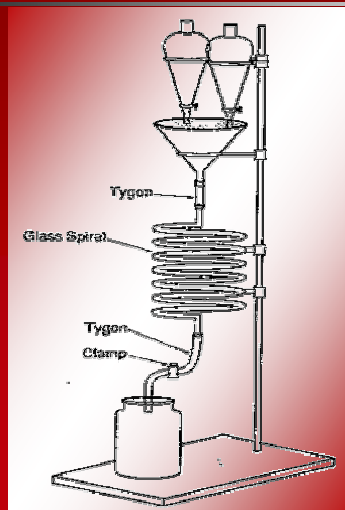
Methylthymol Blue



- ❑ NOT a Pesticide, Tumorigen, Mutagen, Reproductive Effector
- ❑ Water soluble



The Apparatus



- ❑ 2 large separatory funnels
- ❑ 1 medium funnel
- ❑ 2L waste beaker
- ❑ 2 ring stands
- ❑ 3 inch piece of tubing
- ❑ Hose clamp
- ❑ 1 glass spiral



Procedure

- Dissolve 10g of NaOH in 325ml of H₂O, 150ml of ethanol, and 50ml of 3% H₂O₂ (Solution A).
- Dissolve 0.1g of lucigenin in 500ml of distilled H₂O (Solution B).
- Dissolve 0.05g of each dye in 50ml of ethanol.

Demonstration



Summary

- Replaced Rhodamine B dye with Methylthymol blue.
- Replaced 30% H₂O₂ with 3% H₂O₂.
- Kept the same "wow" effect.



Green or not?

Comparison Parameter	Methylthymol Blue	Rhodamine B
Hazards	*	
Cost of Dye		*
Efficiency	*	*
Toxicity of byproducts	*	*
Waste disposal	*	



Acknowledgements

- Thanks to Marian College who funded my research. Additionally thanks to all of my fellow green chemistry researchers for insight and motivation. A special thanks to Dr. Carl Lecher who provided a large amount of insight and assistance throughout the project.



Questions

