Green Chemistry: The Science of Solutions

March 22, 2016
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MISSION AND VISION

Located in Wilmington, MA co-founded by Dr. Amy Cannon and Dr. John Warner

Beyond Benign is dedicated to providing future and current scientists, educators and citizens with the tools to teach and learn about green chemistry in order to create a sustainable future.

Beyond Benign’s vision is to revolutionize the way chemistry is taught to better prepare students to engage with their world while connecting chemistry, human health and the environment.

www.beyondbenign.org
Beyond Benign Programs

K-12

- Curriculum Development and Teacher Training
  - Green Chemistry
  - Green Math & Engineering
  - Biotechnology
  - On-line Courses
  - Professional Development Workshops
  - K-12 and Community Outreach
  - College Student Fellows program

College/University

- The Green Chemistry Commitment
- Curriculum Development and Training
  - Technical Training
  - Green Chemistry training for workers
  - Green Chemistry tools
Green Chemistry

The design of chemical products or processes that reduce or eliminate the use and/or generation of hazardous substances.
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- Opportunities for high school classrooms
  - Increase safety
  - Cheaper materials
  - Real world context
WELCOME

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Why Green Chemistry

- Green Chemistry inherently minimizes the impacts of science on the environment.
- It is a sustainable approach to chemistry.
- The relationship between Green Chemistry and the environment provides a uniquely positive, solutions-based starting point for encouraging younger students, who are greatly interested in the environment, to consider positive contributions they can make in any scientific field.
High School Chemistry

Is just the right place to start

No opinion have been formed yet

We build the habits from the beginning

With Greener practice.
How to integrate Green Chemistry in a High school lab program

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<th>Sample traditional Lab list</th>
<th>Greener (adjusted) Labs</th>
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<td>Solubility curves</td>
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Traditional Stock room

Chemicals filed in order of reactivity and oxidative ability
Green Stock room

Common household products
PolyLactic Acid

PLA is a corn based product that can be used (recycled) to make a cleaning agent.

Cut the cups into small pieces (excluding) the Green part.

Compostable cold cups are made from plants grown in the USA. Even though they are as light and strong as plastic, they fully biodegrade when composted.
Nitinol

BEFORE

PUT IT IN COLD WATER—BEND IT INTO CRAZY SHAPES
PUT IN HOT WATER—IT POPS BACK STRAIGHT AGAIN!

AFTER
Copper (II) Chloride system

$\text{CuCl}_2 \text{(s)} \rightarrow \text{Cu}^{+2} \text{(aq)} + 2\text{Cl}^- \text{(aq)} + \text{Heat}$

Green  Blue
Starch Iodine Complex

Iodine + Starch $\rightarrow$ Starch-Iodine complex
Brown Colorless Blue Black

Control
Cold
Hot

Have Students determine whether the Reaction is Exothermic or Endothermic
Black Tea solution

With Ammonia  Control  With Vinegar

Tea $\leftrightarrow$ Tea + H$^+$ Complex
Factors affecting Rates of reactions

Alka Seltzer, Water, Food Coloring

Ground up Alka Seltzer

Whole Tabs

Surface Area
Upcoming opportunities with Beyond Benign
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• Online courses (Intro & Advanced) (more info)
• 3-Day Summer Institute at Beyond Benign, Date TBD (more info)
Downloads, Feedback, and Questions

To complete a brief questionnaire about this webinar, and to generate your certificate of attendance, visit:


To Download Resources:

http://bit.ly/BeyondResources