



LEARN TO SEE  
GREEN

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# Green Chemistry

- ❖ Green chemistry can be defined as the design of chemical products and processes that **eliminate** the generation of hazardous substances.
- ❖ We can never be completely green; we will never eliminate all hazardous substances.
- ❖ We can be “greener” but this requires changes in research, education and outreach.

# Where we are now



# Data speaks louder than words

- ❖ The teaching labs here at the University of Arizona were handling on average 550 L of liquid waste a week.
  - Removing this volume cost about \$1.80 per L
  - Total for liquid waste removal only \$990
- ❖ A recent general chemistry laboratory produced 220 L of liquid waste.
  - A new program called “chemical thinking”, which focuses on green chemistry produced 40 L
  - \$396 vs \$72

# What can green chemistry do to fix these problems?

- ❖ Creating renewable and sustainable products is key to reducing waste.
- ❖ Eliminating the dependence on fossil fuel will greatly decrease air pollution.
- ❖ Solar technology can provide a sustainable source of energy as well as reduce our need to burn fossil fuels
- ❖ Many chemical and biological processes are the cause a negative impact on the environment.
  - The acidification of water sources due to heavy metal refinement.
- ❖ Innovations in greener chemistry can also be a source of solutions.

# A starting point

## Green Chemistry Pocket Guide

### The 12 Principles of Green Chemistry

Provides a framework for learning about green chemistry and designing or improving materials, products, processes and systems.

1. Prevent waste
2. Atom Economy
3. Less Hazardous Synthesis
4. Design Benign Chemicals
5. Benign Solvents & Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis (vs. Stoichiometric)
10. Design for Degradation
11. Real-Time Analysis for Pollution Prevention
12. Inherently Benign Chemistry for Accident Prevention

[www.acs.org/greenchemistry](http://www.acs.org/greenchemistry)



## A New Kind of Chemistry!

### Green Chemistry — Sustainable Chemistry in Sync With Nature

The design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.

- Smarter
- Safer
- More Efficient
- Saves Money
- Conserves Energy
- Prevents Pollution
- Designed for Reuse or Recycle
- Enhances Chem's Public Image



*"The best way to predict the future is to create it."*  
- Peter Drucker

Green chemistry can create a better future.

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# green

- ❖ GREEN's mission is to encourage green thinking in the lab, in the classroom, and in society by educating all of the importance of seeing green.
- ❖ Our goal is to be a resource for anyone pursuing a more environmentally conscious approach to any and ever facet of life.

# The Big Three

- ❖ Education
- ❖ Outreach
- ❖ Empowerment



# Education

- ❖ Becoming a greener society requires a complete overhaul of almost every process in place today.
- ❖ This is a task that many future generations will have to tackle; we are responsible for their education.
- ❖ Less than a  $\frac{1}{4}$  of current chemistry books contain any mention of green chemistry.
- ❖ GREEN aims to become a database for teachers in all levels of education.

# Outreach

- ❖ Change in the community will have to be assisted through outreach events; complete life style changes are not easy.
- ❖ Community workshops and activities bring information and expertise that is not accessible to everyone.
- ❖ With a stronger bond to the community, GREEN can commit to delivering relevant and concise information to a wider range of people.

# Empowerment

- ❖ Our goal is for GREEN and the GREEN website to become a hub for green chemistry worldwide.
- ❖ By having a free online newsletter with articles written by green scientists from around the world.
- ❖ Creating a database open to all teachers; allowing them to produce greener and more cost efficient labs.
- ❖ Educating future generations of students through outreach and the website.

# GREEN Newsletter

- ❖ There have been 4 newsletters published through the GREEN website.
- ❖ 11 published articles with topics addressing the 12 principles.
  - ❖ With an equal distribution of research and non-research oriented topics.
- ❖ Interest has risen and there are guest articles slated to be released soon.
- ❖ A secondary newsletter has been created, focused on research and home green tips.

# Our place in this new future

- ❖ We are all responsible for the impact we have on this planet, whether it be a positive or negative one.
- ❖ The resources to make widespread change are available and the number of resources are growing.
- ❖ GREEN strives to be a new starting point for everyone and to assist all in seeing green.

# Members of GREEN

- ❖ Cliff Coss - Founder
- ❖ David Hogan - President
- ❖ Ricardo Palos-Pacheco - Vice President
- ❖ Ryan Eismin - Secretary
- ❖ Ivan Garcia - Outreach Coordinator
- ❖ Tori Hidalgo - Director
- ❖ Laurel Kegel - Director
- ❖ Cody Corbin – Director
- ❖ Juliana Gil-Loaiza - Director