

Sustainable Starters

Outreach Activity

Overview: Invite participants to begin thinking about where materials come from through an interactive activity during which participants match technologies with the bio-based starting materials from which they are made.

Goal: By thinking about where do materials come from, participants begin to think “Where could materials come from?”

ChemAttitudes Public Learning Outcomes:

- Increased interest in the field of green chemistry/chemistry
- increased understanding of the relevance of green chemistry/chemistry to their lives

ChemAttitudes Activity Format & Structure

- Interactive
- Simple to do and easy to understand
- Evoke familiar experiences

ChemAttitudes Chemistry Content

Chemistry concept	introduction to green chemistry; introduction to chemistry of materials/plastics
Connection to everyday life	chemistry of everyday objects
Applications and uses of green chemistry/chemistry	making sustainable products and technologies
Connections across other STEM topics	life science/earth science - minimizing human impact on the environment; materials science
Connections to societal issues	use of renewable vs non-renewable resources

Invention Education Framework Tenets

Context	1c. Age Appropriate and Culturally Competent Application 1e. Larger Educational Ecosystem Context
Empathy	2c. Statement of Work Across Disciplinary Boundaries 2d. Selected Approach(es) to Real World Problem Identification
Problem Solving	3a. Problem Solving 3f. Intellectual Tools and Approaches
Continuous Learning	4d. Self Directed Learning Experiences
Iteration	5f. Celebration of Historical and Modern Inventors
Sustainable Innovation	6c. Understanding Environmental Impact and Planning for Sustainability

Introduce Activity

ChemAttitudes Facilitation Techniques – Invite Participation by:

- Starting with basics
 - Engaging the whole group
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- Invite participants to look at the space around them and ask, “What are most of the materials around you made from?”
 - Answers will likely include wood and metal (furniture, doors, etc), paper (books, notebooks, etc), plastic (tech devices, most fabrics, school supplies/writing tools, etc)
 - Remark on the importance of plastics in each of our lives and the diversity of plastic products
 - *Optional* – Have participants compare and contrast some of the properties of the plastic materials directly around them/in front of them

ChemAttitudes Facilitation Techniques – Support Exploration by:

- Being flexible and attentive
 - Asking guiding questions
 - Being a good listener
 - Offering positive feedback
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- Ask “What are plastics made from?” and allow students to brainstorm/share/discuss
 - *Optional* - For higher-level groups, may also want to discuss what chemically makes something a plastic/polymer (i.e., long chains of smaller molecules bonded together in a repeating pattern)
 - Guide participants to the concept that most plastics are made from non-renewable materials (like petroleum/fossil fuels)
 - *Optional* - If time there is time, invite student feedback as to why this might be problematic for society in the long-term
 - Introduce concept of green chemistry
 - *Optional* - If there is time, invite participants to share what they think green chemistry is before defining green chemistry for the group
 - Use a definition of green chemistry that makes the most sense for the group
 - EPA definition: Green chemistry is the design of chemical products and processes that reduce and/or eliminate the generation of hazardous substances.
 - Other ways to describe: “pollution prevention at the molecular level,” “designing materials in a way that prevents them from causing harm to people and the environment”
 - Explain that one of the Principles of Green Chemistry encourages scientists to use *renewable feedstocks*, or renewable starting materials. An entire field of chemistry is devoted to *bioplastics*, plastics made from renewable biomass (biomass = materials made from living things, like plants and algae)
 - *Optional* – Ask participants for examples of renewable materials or biomass
 - Tell participants that they’ll be looking at some examples more sustainable materials that scientists have made using renewable resources

Activity

- Activity found at: https://matchthememory.com/sustainable_starters
- Half of the cards show a technology/man-made material. The other half depict renewable resource that was used as a starting material. Match the technology with the starting material from which it is made.
- Each time a correct match is made, there will be a short blurb on the technology and links to videos or articles about the materials.
- There are no limits to the number of times cards may be flipped.

ChemAttitudes Facilitation Techniques – Deepen Understanding by:

- Asking discussion questions
 - Making connections
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- Debrief together once all participants have completed the activity
 - What was surprising to you?
 - What was interesting to you?
 - Which, if any, were you familiar with?
 - Which do you think you would be able to use?
 - What other types of bio-based materials do you know about/have you used?
 - Why might a bio-based material be more desirable/sustainable than one made from a non-renewable resource?

Matching Game Key

Sustainable Starter	Product	Resources
Tapioca starch	Biodegradable plastic bag	Read how tapioca is being used to make bags in Bali!
Virus	Environmentally friendly batteries	Virus's were able to be optimized and then used to grow environmentally friendly batteries. Learn more here
Mycelium	Faux-leather	Mycellicum (root-like) structures in mushrooms are used form a leather replacement that can be used in various forms, such as in creating handbags. Learn more here
Sugar cane	LEGOs	By 2030, lego has pledged to make it's blocks out of sugarcane as a naturally sourced bios material! Watch Here!
Crustacean shells	Self-fertilizing plots	Shellworks is creating planters, along with all sorts of things from crustacean Shells. See their process here!
Seaweed	Edible straws	Loliwear creates products are both biodegradable and edible, including both cups and straws! Watch here about their edible cups