

# 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

<b>Context</b>	<b>1c.</b> Age Appropriate and Culturally Competent Application <b>1e.</b> Larger Educational Ecosystem Context
<b>Empathy</b>	<b>2c.</b> Statement of Work Across Disciplinary Boundaries <b>2d.</b> Selected Approach(es) to Real World Problem Identification
<b>Problem Solving</b>	<b>3a.</b> Problem Solving <b>3f.</b> Intellectual Tools and Approaches
<b>Continuous Learning</b>	<b>4d.</b> Self Directed Learning Experiences
<b>Iteration</b>	<b>5f.</b> Celebration of Historical and Modern Inventors
<b>Sustainable Innovation</b>	<b>6c.</b> 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](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
<b>Tapioca starch</b>	Biodegradable plastic bag	<b>Read how</b> tapioca is being used to make bags in Bali!
<b>Virus</b>	Environmentally friendly batteries	Viruses were able to be optimized and then used to grow environmentally friendly batteries. <b>Learn more here</b>
<b>Mycelium</b>	Faux-leather	Mycelium (root-like) structures in mushrooms are used form a leather replacement that can be used in various forms, such as in creating handbags. <b>Learn more here</b>
<b>Sugar cane</b>	LEGOs	By 2030, Lego has pledged to make its blocks out of sugarcane as a naturally sourced bio material! <b>Watch Here!</b>
<b>Crustacean shells</b>	Self-fertilizing plots	Shellworks is creating planters, along with all sorts of things from crustacean Shells. <b>See their process here!</b>
<b>Seaweed</b>	Edible straws	Loliwear creates products are both biodegradable and edible, including both cups and straws! <b>Watch here about their edible cups</b>