

# Soy Foam: Insulation

## Objective:

Identify reasons to choose soy foam insulation over traditional synthetic insulation.

## Keywords:

- Insulation
- Heat transfer
- Soy foam

## 21<sup>st</sup> Century Skills Represented:

- Environmental Literacy
- Problem Solving
- Creativity and Innovation
- Critical Thinking
- Communication and Collaboration
- Information Literacy

## National Science Education Standards:

- Physical Science: Matter & its Interactions
- Earth & Space Sciences: Earth & Human Activity
- Engineering Technology & Applications of Science: Engineering Design; Links Among Engineering, Technology, Science & Society

feedstocks	processes	uses
Crops – oil from soybeans	Chemical conversion	Foam

## Background

How do the ingredients in spray foam work? What is “green” insulation?

Soy-based foam, developed from soy polyols, is used in a lot of products: wind-turbine blades, wake surfboards and military drones used for target practice. Some foam has fire retardants added for use in home insulation, furniture and mattresses. The automotive industry uses foam in seats and headliners.

Different foam formulas produce different densities and uses. When a soy-based polyol is combined with isocyanate, a polyurethane resin system, soy foam is created. One company in Spencerville, Ohio, makes 9 miles of foam a month in “buns” that are 200 feet long and weigh 6,000 pounds each.

What is the appeal? The earth-friendly properties of soy allow manufacturers to reduce their environmental footprint while producing great products.

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## Materials

### *Materials for class demonstration:*

- 2 tablespoons of A component – soy polyol
- 2 tablespoons of B component - isocyanate
- Large glass container (beaker, glass, etc.)
- Stirring stick
- Rubber gloves
- Goggles

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## ***Pre-Lab Preparation***

1. Hold a class discussion on the following questions:
  - a. What is insulation?
  - b. Why is insulation used?
  - c. What are some different types of insulation?
  - d. How do the differing types of insulation effect heat transfer?

## ***Lab Procedures***

1. Provide a demonstration for the class.
  - a. Pour component A into a large glass container.
  - b. Pour component B into the same glass container as component A.
  - c. Immediately stir so that component A and B are mixed thoroughly.
2. While student are observing the reaction have them record questions that come to their mind:
  - a. What gas is given off?
  - b. What is in component A and B?
3. Have students work with a partner and research answers to at least one questions.
4. Hold a class discussion on students' questions and answers.

## ***Post-Lab Discussion/Questions***

1. Have the students list and describe possible uses of the foam product.
2. Hold a class discussion on the uses they came up with. Try to categorize their uses during the discussion (i.e. home repair, new construction, theatre, etc.).
3. Hold a class discussion over the following questions:
  - a. What are the similarities between soy foam insulation and synthetic insulation?
  - b. What are the differences between soy foam insulation and synthetic insulation?
  - c. Why should we use soy foam insulation instead of synthetic insulation?

## ***Expansion Ideas***

- Develop marketing strategies for using soy foam.
- Explore the home insulation market. Do a cost comparison of soy foam and other types of insulation.
- Test and rate product claims for reliability and performance.
- Conduct a heat loss experiment between different types of insulation.

## ***Evaluation of Learning***

- Create a list of reasons for using soy foam.
- Create a Venn diagram comparing soy foam and other foams.

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## Resources

- Videos
  - [Growing Ohio's Economy: Poly-Green Technologies](#) from YouTube by The Ohio State University-OARDC
  - [Ford Soy Foam](#) from YouTube by Ford Motor Company
  - [SoyFoam Seating Technology Thanks to Ford, Lear, MI Soybean and United Soybean Board](#) from YouTube by Michigan Farm Bureau
  - [Spray Foam Insulation](#) from BioFoam Insulation
  - [Spray Foam Insulation](#) from Spray Foam Energy Solutions
- Websites and Articles
  - [Soy Plastics: Versatile and Cost Effective](#) from United Soybean Board
  - [BiOH polyols for foam and polyurethane manufacturing](#) from Cargill
  - [BioFlex Hybrid Foam](#) from Flexible Foam Products, Inc.
  - [Norwalk Furniture Incorporates 10% Soy Based Foam](#) by Furniture World Magazine
  - [Head's Up: Ford Increases Soy Content in Foam, Adds Head Restraint as Newest Component for Sustainable Material](#) by Ford Motor Company
  - [OARDC Helps Mansfield Company Produce 'Green' Polyurethane Foam, Jobs](#) by Mauricio Espinoza, The Ohio State University-Extension

## Contacts

- EMEGA Biocomposites, Lancaster, OH: <http://www.emegabuild.com/>
- Green Insulation Technologies, LLC, Garrettsville, OH: <http://www.greeninsulationtechnologies.com/>
- Norwalk Furniture, Norwalk, OH: <http://www.norwalkfurniture.com/>
- Flexible Foam Products, Inc., Spencerville, OH: <http://flexiblefoam.com/>
- Poly-Green Technologies, Mansfield, OH
- Ohio Soybean Council, Columbus, OH: <http://www.soyohio.org>