

Lesson #4: Clothing Inventory

Stage 1 – Desired Results	
Established Goals:	
GLO A 1. Examine mental models and their influence on guiding decisions about how to TAKE resources, MAKE material goods from those resources and deal with the WASTE.	
GLOB B 2. Explain relationships between lifestyle choices and individual/social health	
Understandings: Students will understand that... 1. Consumers make decisions about sustainability through their purchases	Essential Questions: SLO B3, B5: What are the relationships between personal habits, lifestyle choices, and sustainability and what actions (local/global) can be taken to improve those relationships?
Knowledge: SLO B5: Identify actions that promote a sustainable environment, society and economy (locally/globally) SLO B3: Identify factors that affect health and explain the relationships of personal habits, lifestyle choices, and human health (individual/social) C-30-5-22 Describe the process of polymerization and identify important natural and synthetic polymers	Skills: SLO B5: Demonstrate actions that promote a sustainable environment, society and economy (locally/globally)
Stage 2- Assessment Evidence	
Knowledge: Students report on a particular product or documented sweatshop activity OR steps that can be used to minimize/eliminate sweatshop activity. Students can describe the process of polymerization and identify important natural and synthetic polymers.	Skills: checklist of self-reported behaviour to change toward more sustainable purchasing and using of clothing
Materials Required	
Clothing samples - each one labeled with fibre type(s) and country of origin HANDOUT: Personal Clothing Inventory (Note that if students are not familiar with the term eco-footprint you may want to change the wording on the worksheet. The website for them to complete their eco-footprint on-line is http://www.earthday.net/footprint/index.asp#) HANDOUT: Sustainability Issues-Clothing Theory and Conclusion of the Demo: Polymerization: From Milk to Plastic Guest Speaker Materials for DEMO: Polymerization: From Milk to Plastic (500 mL 2% milk, 60 mL vinegar, 1 100 mL beaker, 2 1L beakers, 1 spoon, 1 strainer, aluminum foil, thermometer, hot plate (or Bunsen burner, stand, matches) (Source: Polymerization: From Milk to Plastic. (n.d.) Manitoba CRYSTAL website: Retrieved August 27, 2007 from http://www.umanitoba.ca/outreach/crystal/resources%20for%20teachers/Polymerization%20-%20Christy%20Boettcher%20&.doc)	
Stage 3 – Learning Plan	
<ol style="list-style-type: none"> 1. Handout: Personal Clothing Inventory. DIRECT students to complete the clothing inventory. 2. Handout: Sustainability Issues-Clothing 3. Enter the results into a spreadsheet and do some statistical analysis on them (simple percentages) Be careful not to embarrass or point out specific students. You might even want to keep the clothing inventory results private and deal only with large group data. 4. Guest speaker: Clothing the African Way 5. DISCUSS the implications of sweatshops (see Wikipedia http://en.wikipedia.org/wiki/Sweatshop for a decent history on them as well as some views from PROponents of sweatshops). We should also consider the transport that clothing undergoes in the stages of its production and distribution. 	

6. Nau is a clothing company who claims to be dedicated to sustainability. Have students use the website and describe the mental model that nau uses to guide the company

https://www.nau.com/homepage/index.jsp#/productdesign/our_stores&3

especially the design philosophy at

https://www.nau.com/homepage/index.jsp#/productdesign/driven_by_design&3

7. To help students with the second chart, it might be useful to enhance their background knowledge with an example. You could examine two websites that show different perspectives on the same clothing company. For example for Levi Strauss Jeans these two sites will prove the point of perspectives of the company itself and the actual facts. Note that wikipedia is not always a trustworthy source so you may want to check the claims.

<http://www.levistrauss.com/Citizenship/>

<http://en.wikipedia.org/wiki/Levi%27s>

8. DEMO: Polymerization: From Milk to Plastic. Relate this to buttons on shirts of course. This is a discrepant event intended to show that chemistry is a useful tool for understanding how products are made.

Cross-Curricular

Biology – nature of proteins

Extension Learning Activities

Clothing is a factor that plays a role in the eco-footprint calculations in which you learn how many planets it would take to sustain you with your current lifestyle and habits.

Complete it on-line at

<http://www.earthday.net/footprint/index.asp#>

If you wish to incorporate the topic of portrayals of the human body in advertising, jean companies are also good starting points. Some of the pictures on the websites do not even have a pair of jeans included in the pictures! See your nearest English teacher to discuss the interdisciplinary connections that could be made!!

Sustainability Issues -Clothing

Now determine what issues might be raised by each of the following actions in the clothing industry. Summarize in the chart below. Researching some of the companies that your clothing comes from might be a good starting point. Add more actions as you learn more about the clothing industry.

Action in Clothing Industry	Sustainability Issues Raised by the Action	Actions that can be taken to address the sustainability issue
a) using synthetic fibers in clothing rather than natural		
b) producing clothing far away from where it is sold		
c) producing clothing using “sweatshop” labor		
d)		

Polymerization: From Milk to Plastic

Thanks to Christy Boettcher Tanya Rehaluk

(Source: Polymerization: From Milk to Plastic. (n.d.) Manitoba CRYSTAL website: Retrieved August 27, 2007 from <http://www.umanitoba.ca/outreach/crystal/resources%20for%20teachers/Polymerization%20-%20Christy%20Boettcher%20&.doc>)

(didn't include the following in my thesis)

Introduction:

This discrepant event demonstrates the formation of an organic polymeric substance.

Curricular Objectives

Senior 3 Chemistry:

C 30–5–22: Describe the process of polymerization and identify important natural and synthetic polymers.

Previous Student Knowledge:

- The basis behind chemical reactions, where atoms are rearranged to form new combinations of molecules.
- Know the difference between an acid, a base and a neutral substance and how to determine the pH of a solution.
- Know the application of thermal energy in reactions.
- Understand the nature of a protein.

Materials

- 500ml 2% milk
- 60ml vinegar
- 1 100 ml beaker
- 2 1L beakers
- 1 spoon
- 1 strainer
- Aluminum foil
- Thermometer
- Hot plate or Bunsen burner and stand
- Matches if using a Bunsen burner

Procedure

1. Hold up a button and ask the students to identify it.
2. Ask the students what do they think the button is made out of. (plastic) Do they know what is the common base material of plastic? (petroleum)
3. Hold up the beaker of milk and ask if they think the button and milk are related. They will be unable to answer or say no. Then ask if they know what are the components of milk. The teacher will get various answers such as water, calcium, fat and protein. Doesn't sound like petroleum is a part of it, does it?
4. Tell the students that we are going to try and make some plastic anyway.
5. Turn on the Bunsen burner or hotplate.
6. Place beaker of milk over heat. Stir constantly.
7. Place thermometer into the milk. Heat milk until it reaches 37°C.
8. Remove from heat and immediately add vinegar, stirring constantly. Here, the teacher should ask the students what they think will happen when the vinegar is added.
9. The solution will rapidly separate into curds suspended in a clear yellow liquid.
10. Strain the solution through the strainer into the empty 1L beaker. Hold up the beaker for the students to see the clear liquid.
11. Scoop the curd onto a large piece of aluminum foil and press out into a thin layer. Pass the aluminum foil around the class.
12. Tell the students that this can be dried overnight. The experiment should have been done previously so that the teacher can now pass around dried pieces of the pressed curd. Ask them to try and break it. Pass around the button with the dried curd and ask them to see if they can observe any similarities between the button and dried curd.
13. Ask the students to remember what we said was in milk. A big component of milk is protein, which is called casein. When we added the acid, we caused the protein in the milk to coagulate and form a polymer, which is a big chain of protein or other substance of high molecular weight. The addition of heat helped to speed up the reaction. This process is called polymerization. A plastic is a polymer, as it is a long chain of molecules with high molecular weight.
14. Tell the students that what we have seen is the creation of casein plastic, which is a natural plastic. We have come to associate plastic as synthetic, with petroleum-based products dominating the market. However, this experiment shows the type of natural plastics used before the discovery of synthetic plastics. Hold up the button to the students and tell them that this was just one of the many things that casein plastic was used for.
15. To give them a little something extra to think about, mention that cheese is made in a very similar way, using a different acid.

Theory

Milk is a colloid, which is defined as a suspension of large molecules—such as proteins—in a solution such as water. Essentially, milk is a suspension of protein globules in water.

Polymerization is the process of forming a polymer by combining small molecules or monomers into long chains. The resulting compound is of high molecular weight. Polymerization can be used to make some useful materials in the manufacturing field. Plastics are well-known polymers. Most plastics are synthetic and made from oil and natural gas, but some plastics are found in nature. 80% of 2% cow's milk is made up of the polymer casein, a protein. This protein can go through polymerization to create a natural plastic, as the casein molecules are associated together in long chains. Proteins are generally unstable and are prone to unfolding, which changes the natural state of the protein. This process is called denaturing. The addition of acid, in this case vinegar, causes the casein protein to unfold and rearrange into the long chains of a polymer. The process then causes the casein to precipitate out of the milk, leaving a clear watery substance behind. The casein can then be formed into various shapes before drying. In our experiment, thermal energy in the form of heat was applied to speed the process and cause a more complete separation.

Casein was once used to manufacture buttons, as it was a hard, strong substance and did not dissolve in water. However, due to the costs of the raw materials, as demand for product increased, a cheaper, petroleum-based plastic replaced the casein. Old buttons lying around the house could be casein-based. Casein plastic is still used in manufacturing today to aid glue in book binding as well as serving as a glaze for paper.

Conclusion

This is a unique discrepant event for an introduction to polymers and polymerization in a Senior 3 chemistry class. The experiment is quite safe, with the only safety consideration being the use of a Bunsen burner or hot plate. The teacher should take the opportunity to use proper safety precautions when using the Bunsen burner or hot plate, as students take cues from passive observation. They are much more likely to be lax with safety procedures if the teacher disregards them.

The event will create disequilibrium for the students, as they have been taught to expect plastic to be a synthetic, petroleum-based product. It will be difficult for them to associate the ingredients of milk and other natural plastics in the same category as a button or a computer. They may even experience an odd sensation as they realize that they “ingest” plastic-producing products daily. Since cheese is made in a very similar way, and if they have ever heard the rumor that Kraft Singles or Cheez Whiz are one step away from being plastic, it's somewhat true! The demonstration is an excellent example of the process of polymerization and will help the students to identify synthetic and natural polymers.

References

Klipfel, J., Mauch, J. (2005). *Milk Magic*. Retrieved October 2, 2006 from the California State University website: www.csun.edu/scied/4-discrpeant-event/milk_magic/index.html.

Oxford English Dictionary. (n.d.) [Electronic version]. Retrieved October 10, 2006 from <http://dictionary.oed.com.proxy2.lib.umanitoba.ca/entrance.dtl>.