

Activity 2 – Crosslinking: Polymers to Plastics

Based on "Polymers & Molecular Models: Petretec Industry Example" Beyond Benign 2017 Web. 2 May 2018. <https://www.beyondbenign.org/lessons/polymers-molecular-models-petretec-industry-example/>

Materials:

- Safety Glasses
- Gloves
- 100 mL Guar Gum Solution
- 0.5 mL Borax Solution
- 100 mL of Skim Milk
- 50 mL of Vinegar
- 3 Large Beakers (~200 mL)
- 2 Graduated Cylinders
- 1 Metal Pan
- 1 Small Beaker (~10 mL)
- 1 Disposable Syringe
- 2 Stir Rods
- 1 Hot Plate
- 1 Stopwatch

Instructions:

1. Record your prediction below for whether casein or guar gum will make the stronger (harder to deform) plastic when crosslinked: _____

2. Why do you predict this will be the case? _____

3. Predict whether the casein or guar gum will make a more durable (harder to break) plastic when crosslinked: _____

4. Why do you predict this will be the case? _____

Casein-based plastic:

Take a pair of gloves and safety glasses and put them on. Do not remove them until you leave the lab area. Form groups of 3-4, then have one person from your group collect the materials listed above.

1. Add 100 mL of skim milk to a 200 mL beaker.
2. Cover your hot plate with aluminum foil.
3. Place your metal pan on your hot plate, then place the beaker on the pan.
4. Fill the pan with water to just below the level of the milk.
5. Begin heating your milk at high heat with constant stirring.
6. Record your observations of the milk.
7. When the milk begins to simmer, record the time, lower the heat to medium-high and slowly add 10 mL of vinegar to the milk.
8. Record your observations of the milk/vinegar solution.
9. After 1 minute, add an additional 10 mL of vinegar to the solution and record your observations.
10. Continue adding 10 mL of vinegar and making observations until no further changes occur.
11. Turn off the heat, remove the beaker and allow your casein product to cool.
12. When cool, pour the liquid portion of the product down the drain, and measure and record the properties of your solid casein plastic.

Vinegar Added	Observation
0 mL	
10 mL	
20 mL	
__ mL	
__ mL	
__ mL	

Record the properties of the casein plastic: _____

Guar gum-based plastic:

1. Add 100 mL of the guar gum solution to a 200 mL beaker.
2. Place the beaker into your pan of warm water and set the heat to medium.
3. While constantly stirring, SLOWLY add 0.5 mL of the borax solution to the guar gum solution using a syringe.
4. Record your observations of the changes that occur as you add the borax.
5. Pour out the liquid portion of your product and examine the properties of your guar gum-based plastic.

Observations when adding borax to guar gum: _____

Properties of the guar gum plastic: _____
