

Joke Juice

Purpose

Illustrate the effect of cross-linking on a polymer.

Materials

- Guar gum
- Borax, sodium tetraborate decahydrate, $\text{Na}_2\text{B}_4\text{O}_7 \cdot \text{H}_2\text{O}$
- Red food coloring
- Glass stirring rod
- Empty glass juice bottle (~300 mL)
- Distilled water
- 100-mL graduated cylinder
- 100-mL beaker
- Electronic balance

Safety

- Read the SDS sheets for all chemicals before using them.
- Wear safety glasses and gloves.
- Remove the original label from the juice bottle and clearly label the container to ensure it is not mistaken as drinkable juice.

Procedure

1. Prepare 25 mL of a saturated solution of sodium borate by mixing borax with water until no more dissolves. (solubility ~1 g / 16 mL H_2O)
2. Add 100 mL of distilled water into the empty glass juice container.
3. Add 3 drops of red food coloring.
4. Add 0.6 g of guar gum and stir until dissolved.
5. While swirling the liquid in the bottle, slowly add 5 mL of the saturated borax solution prepared in step 1.
6. Cap the juice bottle.

Results

- The addition of sodium borate to an aqueous suspension of guar gum produces a cross-linked gel.
- The resulting cross-linked polymer forms a red gel that looks like juice.

Follow-up Teaching Notes

- The juice bottle can be opened and quickly shaken forward and back causing the gel to partially leave the bottle walls and then quickly snap back.

Connections

- Polymers, cross-linking.

Extension

- Borax solution and Elmer's glue is an example of cross-linking where varying the amount of borax solution produces the effect of slime or Silly Putty.
- Nylon demonstration kit (available from Ward's distributors) is another great example of a polymer synthesis.

Disposal/Clean-up

- The natural polymer can be disposed of in the garbage.