

SUMMER INSTITUTE FOR ENGINEERING AND TECHNOLOGY EDUCATION

MATERIALS ENGINEERING - TEACHER MODULE 1

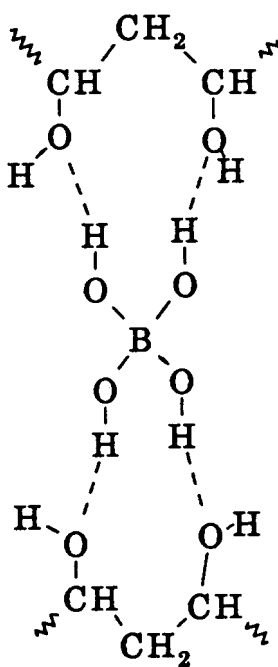
SLIME

CONCEPT

Formation of a loosely crosslinked polymer gel using hydrogen bonding.

BACKGROUND

Crosslinked polymer, water soluble polymers, polymer gels, polymer swelling.



SCIENCE PROCESS SKILLS

- Identifying
- Measuring
- Observing
- Predicting
- Experimenting
- Collecting and interpreting data
- Analyzing data

AAAS SCIENCE BENCHMARKS

- 1A The Scientific World View
- 1B Scientific Inquiry
- 4D Structure of Matter
- 4E Energy Transformations
- 12 Manipulation and Observation
- 12E Critical Response Skills
- 5E Flow of Energy and Matter

SCIENCE EDUCATION CONTENT STANDARDS (NRC)**Grades 5-8**

- Design and conduct a scientific investigation
- Use appropriate tools, techniques, and analyze data
- Construct explanations and models using evidence
- Properties of matter
- Particulate model of matter

Grades 9-12

- Identify the questions and use concepts to guide scientific investigations
- Construct and revise scientific explanations and models
- Using logic and evidence
- Recognize and analyze alternative explanations and models
- Communicate and defend a scientific argument
- Interactions of energy and matter
- Atomic structure of matter

STATE SCIENCE CURRICULUM FRAMEWORKS

Grades 5-8: 1.1.7,1.1.10,1.1.11, 1.1.12, 1.1.13, 1.1.14, 1.1.15, 1.1.16, 3.1.15, 3.1.17, 3.1.19

Grades 9-12: 1.1.20, 1.1.21, 1.1.22, 1.1.26, 1.1.27, 3.1.33, 3.1.37

MATERIALS**For 4% PVA Solution**

- 2 L beaker
- stirring hot plate
- clear plastic wrap
- PVA, 99-100% hydrolyzed (e.g., Eastman Kodak #2606)
- Distilled Water
- Thermometer

For Slime

- 4% PVA (Poly vinyl alcohol) in water
- 4% Sodium borate solution
- Paper cups

- Wood Sticks
- Food Color

PROCEDURE (WEAR GLASSES)

Prepare 4% PVA Solution in advance

1. Heat approximately 1.7 L of distilled water to 60 - 70°C (To hurry this initial heating, use water from a coffee brewer). Slowly sprinkle 80 g of PVA powder into the hot water with vigorous magnetic stirring. Add slowly so as to avoid clumping of the material.
2. Cover the beaker with plastic wrap and continue heating at 60 - 80°C for 4-6 hours or until solution clears. Do not exceed 80°C. The time for dissolution varies considerably from as little as 1 hour to as much as 6 hours.
3. The solution can be diluted while still warm to 2 L. A small amount of residual solid ("scum") does not seem to effect the performance of the slime.

Alternative Procedure

The PVA solution can also be obtained by diluting Elmer's white glue.

Creating Slime

1. Pour about 40 ml. of the 4% PVA solution into a paper cup.
2. Add about 4 ml. of the 4% sodium borate solution and stir vigorously with the wood stick.
3. Remove the "blob" from the cup and knead it. Then play with the "blob" and observe its different properties
4. Stretch the gel slowly, then try stretching quickly. Notice the different responses. Allow the gel to hang freely and note how it flows.
5. Wash hands when finished. (Students can handle slime but be sure that they do not eat it or feed it to anyone else! Also, they should wash their hands when finished!)

SOURCE

NSF-Polyed Workshop. University of Southern Mississippi, Department of Polymer Science, July 28 - 31, 1993.

REFERENCES

CASASSA, E. Z.; SARQUIS, A. M.; VANDYKE, C. H. J. *Chem. Educ.* **63**,57 (1986).

SARQUIS, A. M. *J. Chem. Educ.* **63**, 60 (1986).

OTHER RESOURCES FOR SLIME

BORGFORD, CHRISTIE L., AND SUMMER, LEE R. SUMMERLIN, *Chemical Activities: Teacher Edition*, American Chemical Society, Washington, D.C., 1988.

WOODWARD, LINDA, *Polymers All Around You!* A copy may be ordered from:

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