

A BAG OF SLIME^{®1}

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Slime[®], a product of the Mattel Toy Corporation, was originally marketed in 1978 and was available through most of 1979. The properties of Slime[®] as a non-Newtonian fluid were noted by Jearl Walker in 1978(1). Slime[®] was described by Dr. Maki Papavasiliou(2), of the Mattel Materials Laboratory, as a reversible cross-linking gel made from Guar gum, a vegetable gum used as a protective colloid, stabilizer, and thickening agent for foods, cosmetics, and lotions. The cross-linking is accomplished by the addition of borax, Na₂B₄O₇·10H₂O (sodium tetraborate decahydrate). Based on information from Papavasiliou, the author was able to work out a formulation for a guar gum based Slime[®] in 1979(3).

In 1981, David Weill demonstrated that Slime[®]-type material could be made from polyvinyl alcohol, a substance used as a thickener, stabilizer, and binder in cosmetics, paper cloth, films, cements and mortars, instead of guar gum(4). Since that time, Slime[®] has become a popular demonstration and activity in chemistry and science classes, workshops, and related workshop publications(5-9). The use of polyvinyl alcohol in place of guar gum has been preferred since solutions can be prepared in advance and weighing of materials is not required at the time of use.

Upon drying, polyvinyl alcohol solutions leave a thin plastic film that is finding use in packaging materials. This film, if left in the environment will break down rather than persist as some plastics do, thus requiring no clean-up. One of the applications of polyvinyl alcohol has been in laundry bags designed for use in areas such as hospitals where clothing and bedding may be contaminated with infectious material(10). Such materials are placed in polyvinyl alcohol bags, and then sent to the laundry where the bag and its contents are placed in a washing machine without anyone coming in contact with the contaminated clothing and bedding. In the wash, the bag dissolves and the materials are cleaned and disinfected.

In experimenting with polyvinyl alcohol bags it is found that the polyvinyl alcohol dissolves in warm water and does not decompose. As a result, these polyvinyl alcohol bags provide a novel method of preparing Slime[®], without having to prepare polyvinyl alcohol solutions in advance, along with demonstrating the use of a degradable plastic.

PROCEDURE

1. Materials needed:

- 100 mL beaker or paper cup (5 ounce)
- graduated cylinder, 25 mL
- stirring rod
- water, room temperature or warmed to 60°C (hot tap water is adequate for this procedure)
- Polyvinyl alcohol laundry bag, warm water soluble² or cold water soluble³, cut into squares 20 cm x 20 cm (approximately 8 in by 8 in)
- Borax (sodium tetraborate decahydrate), Na₂B₄O₇·10H₂O, 4% solution, by weight, in water. (Note: the solubility of sodium tetraborate in water is 6.3 g per 100 mL water.(11))
- Food color to color the Slime[®] (optional)
- Plastic bag to store the Slime[®] (zip-lock type or bag with twist tie)

2. Safety Precautions:

Wear safety goggles or glasses at all times in the laboratory.

There are no hazards associated with the polyvinyl alcohol.

Sodium borate (borax) is toxic by ingestion. Take care that this material is not placed in the mouth.

This procedure may utilize hot water at about 60°C for the hot water soluble bags. Hot tap water is sufficient for this procedure. Water should be dispensed in small quantities and care should be taken to keep the water temperature from becoming elevated to minimize the possibility of burns. To eliminate hot water, and any sources of scalds or burns, use cold water soluble bags.

Take care to keep the chemicals and the Slime[®] away from clothes or cloth covered furniture as it may produce permanent stains.

The Slime[®] will get dirty from handling and may become moldy after several days. When this occurs, the Slime[®] should be discarded (see below).

3. Disposal:

Dispose of any Slime[®] in the trash. Do not put it down the drain as it will clog the drain.

4. Experimental Procedure:

If warm water soluble bags are used for this procedure, use hot tap water or heat water to a temperature of 60°C. If cold water soluble bags are used, use tap water at room temperature or slightly warmed.

Measure 25 mL of water into a beaker or paper cup. Add a piece of a polyvinyl alcohol bag approximately 20 cm x 20 cm (this is a mass of approximately 1.4 g). Stir well to dissolve and disperse the polymer.

If desired, one or two drops of food color can be added to the polyvinyl alcohol solution. Stir the mixture.

Measure 5 mL of 4% borax solution. Pour the borax solution into the cup of polyvinyl alcohol and stir well. Remove the material from the cup and knead it in your hand. The material will become firm and lose some of its stickiness.

Test the properties of the “Slime[®]”:

- a) Pull the Slime[®] slowly. What happens?
- b) Pull the Slime[®] hard. What happens?
- c) Roll a piece of Slime[®] into a ball and drop it. What happens?
- d) Place a small piece of Slime[®] on the table top. Hit it with your hand. What happens?
- e) Write your name on a piece of paper with a felt-tip pen. Place the Slime[®] on your name, then lift it up. Did anything happen? Can you explain why? Repeat this procedure with different brands of felt-tip pens.

Store the Slime[®] in a plastic bag.

Literature Cited

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Footnotes

¹Slime[®] is a registered trademark of Mattel, Inc., Hawthorne, CA 90250

²Warm water soluble polyvinyl alcohol bags, 26" x 33", 1 Mil thickness, are available in cases of 100 bags, Stock number 19-1-05, from Associated Bag Company, 400 West Boden Street, Milwaukee, WI 53207-7120, telephone (800) 926-6100, or from Educational Innovations, Inc., 362 Main avenue, Norwalk, CT 06851, telephone 203-229-0730. Other companies selling plastic bags may also carry the water soluble polyvinyl alcohol bags.

³Cold water soluble polyvinyl alcohol bags, 26" x 33", sold under the name of Melt-A-Way[®], order number 1-342, are distributed by M.D. Industries, Inc., P.O. Box 1355, 3100 Dundee Road, Suite 308, Northbrook, IL 60065-1355. Telephone (800) 421-8370. M.D. Industries is a distributor and does not sell directly to consumers, they will only refer you to companies selling the bags. To obtain cold water soluble bags, you must ask one of the sources listed in footnote 2 to special order them for you.