Polymer Activity from the: POLYMER AMBASSADORS

Painting with Latex

Grades: 3-5 and 6-8 and 9-12

Science Standards: Content Standard B: Physical Science; Content Standard G: History and Nature of Science; and Integration with Fine Arts

Concept: If you have purchased a T-shirt or a sweatshirt recently with a rubberized material on the front you may have wondered how that material was originally applied. Many sports-related pieces of clothing such as numerals or team names and mascots are applied using colored and flexible elastomeric materials. This activity is designed to simulate how that process of applying colored elastomers can be duplicated in the classroom.

Materials:

Liquid latex	Stiff paint brushes	Popsicle sticks (for stirring)
Tempera paint colors	9-oz clear polystyrene cups	Vinegar in spray bottles
Safety goggles	Paper towels	Plastic sheeting
Fine point Magic Marker	Optional Latex gloves	Cloth or fabric to paint

Safety:

1. As liquid latex contains ammonia as a stabilizing agent, safety goggles should be worn in this activity to minimize any eye contact with the ammonia. Contact lenses should also not be worn for the same reason. Use copious amounts of water to flush any ammonia that may come into contact with the eyes.
2. A small portion of people are allergic to latex. Do not do this activity if you have allergies to latex or proteins
3. Avoid contact of liquid latex with eyes, hair, body, and clothing. When the latex solution sets, it forms rubber. This material is extremely durable and is difficult to remove from unwanted materials. Old clothes or protective garments should be worn. Place long hair in ponytails and remove and store jewelry, watches, etc.
4. Although vinegar is considered relatively safe, avoid contact with the eyes and flush with water if contact with the eyes occurs.
5. Tightly cap latex containers when not in use to minimize ammonia vapors.
6. Paint brushes can be cleaned in soapy water.

Procedure:

1. Prior to the activity, place protective plastic sheeting on work tables. Students are usually directed to wear old clothing on this day because it may get messy.
2. If the colors have not already been added to the liquid latex, this should be done.
    (a). Fill a small plastic cup (i.e. - 9-oz polystyrene cup) about half full of liquid latex.
    (b). To the cup add liquid tempera coloring and mix with a Popsicle stick until the shade you desire is achieved. Discard the Popsicle sticks.
3. We will be applying colored liquid latex to a size 3X Tyvek® Lab coat. You may wish to sketch your name or a design with a fine point black magic marker prior to actually applying the colored liquid latex.
4. Paint your Lab coat lightly with the colored liquid latex. If you were using cloth fabric, you should gently scrub the paint into the cloth. The liquid latex because of its thickness is sometimes difficult to apply with a normal paint brush. For this reason I prefer the stiffer brushes. Return the brush to the same cup.
5. Pick another colored liquid latex if desired and repeat the painting procedure.
6. After your masterpiece is finalized, the latex should be set. There are two methods:
    (a). Air-dry the material or garment overnight.

(b). Spray the painted areas with vinegar. Dip in water and allow to dry.

Explanation:

So what exactly is happening here? Latex is an elastomeric material that occurs naturally in the rubber tree. Its chemical composition includes many tiny particles or globules of this latex suspended in water in the natural state. When this sap is collected from the rubber tree, ammonia is added as a sort of preservative and a stabilizing agent. This keeps the latex from clumping and coagulating before it is used in an activity like "Painting with Elastomers".

After painting the latex on the fabric it must be set so it will adhere to the fabric. We do this by adding a weak acid (like the vinegar we used) to the latex material. Vinegar is sometimes called acetic acid. When it is added to the latex, it reacts with the ammonia. The acidic vinegar neutralizes or destroys the activity of the ammonia and in so doing allows the latex to coagulate as rubber. After all of the ammonia has been neutralized you may notice the characteristic ammonia smell is gone. Of course other acids (such as citric acid) could be used to achieve the same neutralizing effect. In a pinch even a carbonated soft drink such as Coca-Cola¨ or Pepsi-Cola¨(which contain phosphoric acid) could be used as the setting agent.

In eliminating the characteristic ammonia smell, you might possibly notice another entirely different smell. That smell would be sulfur as sulfur compounds are normally added to your latex. It should be remembered that the colors used in our latex will intensify (get darker)as the latex ages.

Extensions and History Link:

1. Waterproof Coaster:

A waterproof coaster can be made by taking a piece of cotton cloth fabric and cut it into a circle. Apply the liquid latex to both sides of the fabric and set the latex to the fabric as discussed in the procedure section above. After the latex has dried, test the coaster by placing water on the coaster to see if it sheds water.

2. Rubber soled shoes:

Polymer clothing had its infancy in 1868 when the Candee Manufacturing Company of New Haven, Connecticut created a type of canvas shoe with rubber soles they dubbed as "croquet sandals". Because they made no noise when people wore them, they became forever known as "sneakers". Even prior to this, approximately 400 years ago Spanish explorers in Central and South America noticed that the native Indians had protective shoes and clothing. Indians coated their feet with rubber in what must have been the original "sneakers". They also had rubber-coated fabric they wore when it rained to keep dry..

References:

"Chain Gang - The Chemistry of Polymers", Terrific Science Press, Miami University Middletown, 1995

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