Marbling Paper with Oil Paints

Classroom Fun

Concepts

- Density
- Solubility
- Surface tension
- Organic chemistry

Background

Artists' oil paints contain inorganic pigments mixed into an organic linseed oil binder. Linseed oil (an ester of glycerol with linoleic, oleic, and linolenic fatty acids) "dries" by creating crosslinks between molecules. These crosslinks are formed when the double bonds in the organic fatty acids open up and reconnect with adjacent molecules. This forms a film or skin that seals in the inorganic pigments, many of which are toxic. Light is needed for this slow polymerization reaction to occur. The thinner the layer of linseed oil, the faster the oil paint dries because the crosslinks occur more quickly.

In addition, this exercise demonstrates how diluting the oil pigments with thinner produces mixtures with varying surface tensions. The action of surface tension will be seen as the different colors are placed on the water. The actions of surface tension, density differences, and solubilities produce unique color patterns on paper.

Materials

Oil paints, various colors
Turpenoid®, mineral spirits
Water, tap
Dropper bottles, 60-mL
Foil pan, disposable
Newspapers
Paper for marbling (8.5″ × 14″)
Paper towels
Pipets, thin-stem, one for each color

Safety Precautions

The solvents used in this activity are flammable. Do not use near open flame. Many oil paints are toxic. This activity should only be conducted in a room with adequate ventilation or the odors may become offensive or dangerous. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Follow all laboratory safety guidelines. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Prepare the diluted oil paints by squeezing a 3–4 cm portion of paint from a tube into a dropping bottle.
2. Add thinner to nearly fill the bottle. Screw the top onto the bottle and shake to dissolve the pigment. Test the mixture by placing a few drops in a pan of water. If it spreads too much, add more pigment; if it does not spread, add more solvent. (This is NOT an exact science—the variations are part of the charm.)
3. Cut the paper to fit the size of the pans used. *Tip:* An 8″ × 8″ disposable pan works well.
4. Place layers of newspapers around the work area. Fill the shallow trays with at least one inch of water.
5. Use the dropper (or pipet) to float the oil paints onto the surface of the water. The water should be covered with a very *thin* film of paints. *Note:* The most common error is to place too much pigment on the surface creating a thick pigment layer.
6. Fold up about an inch of the paper to make a handle when dipping paper, leaving the paper about 7″ × 7″.
7. Hold the paper by the handle and touch the paper to the marbled surface in a rolling motion to minimize the formation of air bubbles. The bubbles will produce white spots on the paper. A quick, smooth motion will produce nice results with minimal problems.

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8. Use the handle to lift the paper off the surface of the water immediately.
9. A second paper may sometimes be floated in the same pan without adding more pigment producing another marbled paper with lighter colors and a more delicate pattern.
10. Place the marbled paper on paper towels to dry.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The excess diluted pigments should be transferred to a glass bottle with a vinyl backed screw cap for storage. The oily water remaining in the pans should be blotted thoroughly with paper towel before the remaining water is poured down the drain. Do not wash the pan with soap! Allow the pan to air dry and save it for future marbling. The paper soaked with diluted oils should be bagged and closed to minimize odors in the room. It may then be disposed of according to Flinn Suggested Disposal Method #26a.

Tips

- To produce additional marbled papers, repeat the process. If different colors are desired, the surface of the water may be cleaned by using a piece of newspaper or paper towel to pick up the remaining colors. Do not empty the water out of the pan and start over.
- If a thin film of pigment was used, the marbled paper will be dry to the touch within an hour. However, because of the nature of the oil paints, they may not be completely dry for several days. After the marbled paper has dried, it can be folded and used for stationery or used as a picture.
- When paper gets wet, it wrinkles. To smooth the marbled paper, allow it to dry a week or more. Sandwich the marbled paper between two clean sheets of paper. Iron the paper on a flat, heat resistant surface.
- An extension of this activity is marbling fabric. Generally, natural fibers like cotton or silk work better than synthetics.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation
Content Standards: Grades 5–8
Content Standard B: Physical Science, properties and changes of properties in matter
Content Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter

Reference

This activity was adapted from a presentation by Maria A. Haluska at the 1996 BCCE.

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Marbling Paper with Oil Paints* activity, presented by Steve Long, is available in *Classroom Fun*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Marbling Paper with Oil Paints* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP1523	Bottle, Dropping, Glass, Square
AP8450	Bottle, French, Square-Style

Consult your *Flinn Scientific Catalog/Reference Manual* for current price