

Chromatic Chemistry:

All You Ever Wanted to Know About Dyeing and Then Some

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HISTORY OF TIE DYE

Tie-Dye resist techniques have been practiced around the world in many forms for centuries. There are the Traditional Japanese Shibori, Indian Bandhana, and Indonesian Plangi or Tritik. Ancient examples have been found in South America as well. The end results are random patterns that are either geometric or loose and free flowing and/or combinations of everything in between.

Now a days, tie-dye describes a pattern of color made by preventing the dye from reaching some areas of the fabric while dyeing others. Folding, tying, stitching, crumpling or otherwise preparing the fabric inhibits the flow of the dye to some areas. Usually most folding, scrunching and twisting is done with the wet shirt flat on a plastic covered table. The pattern of the folds and where the colors are squirted helps to determine what the design will be. However, surprise is part of what makes tie-dye exciting and interesting.

QUICK EXPLANATION OF THE CHEMICAL PROCESSES INVOLVED IN TIE-DYEING

Fiber reactive dyes attach permanently to cellulose fibers using a covalent (electron-sharing) bond. These molecules carry a "chromophore" which absorbs varying spectra of the light, allowing only certain spectra to reflect.

Covalent bonding is one of the most basic and strongest types of chemical reactions. This reaction happens gradually over time depending on temperature and/or the pH level of the surrounding environment.

The sodium carbonate pre-soak raises the pH level of the garment or fabric to approximately 10.5. Raising the pH level of the solution that the fabric or garment is soaked in raises the level of negative hydroxide ions in the dyeing environment. The chemical bonding process uses these ions in the reaction. Pre-soaking in sodium carbonate solution is what allows the fiber reactive dyes to work at room temperature.

The reaction can also be aided with heat. Some tie-dyers have had success with using baking soda and microwaving their dyed articles. Since sodium bicarbonate (baking soda) is a weaker base than sodium carbonate, it must be accompanied by heat. Some people who are "chemically sensitive" choose to use this method.

The dye is allowed to react in a desirable host environment for up to 24 hours. After this time, the bonding sites on the cellulose should be saturated with dye molecules. Excess dye molecules that have not bonded permanently are washed away using warm water rinse and a dye-carrying detergent.

HELPFUL HINTS

- Put a small amount of [Sodium Alginate](#) thickener into dye mixture to slow down the rate that the dye spreads and to create sharper edges.
- Sprinkle pure [Procion](#) powder onto tied and pre-soaked item for different effect (super intense color. Use a salt shaker with lots of salt and some dye for a lighter application)
- Any method keeping the fabric wet is OK, needn't be a plastic bag - cover many with plastic drop cloth, wrap in plastic wrap, etc. The warmer the temperature where you lay out your tie-dyes to cure, the quicker the chemical reaction.
- Use [Water Softener](#) if you suspect you have "hard" water.
- DON'T USE HOT WATER. The dyes work best in warm water (105 degrees)
- Urea helps dye to dissolve, so dissolve the Urea in water first. Add this water to the dye powder gradually and paste it up to avoid lumps. Undissolved dye makes "explosions" of color or "freckles", so if a color is difficult to dissolve, straining through some light fabric might be necessary. Coffee filters only work if the dye is really liquid. Otherwise, they filter out too much of the dye.
- If you have trouble making a paste of the colors, a little [Calsolene Oil](#) can help because it breaks the surface tension.
- Squirt bottles are mechanically mass produced and once in awhile they leak. A couple of wraps of that very inexpensive (~.60¢) thin white stretchy plumber's tape, that is available at any hardware store, around the threads solves this problem perfectly. No tie-dyer should be without it!
- Cover your work surfaces with old newspapers or folded paper towels to absorb extra dye. Wear old clothes! After applying dye to one side, flip garment over and repeat the process. Inject the tip of the squeeze bottle into the folds for best dye penetration and less white on the final product.
- With this dye, there is always lots of "excess dye" to be washed out. Don't crowd your washing machine with too much tie-dye or the water gets too muddy and so will your tie-dyes. Delicate items like rayon and silk are better hand washed or should go into a mesh bag on a gentle cycle so the agitation doesn't shred them.

GENERAL MIXING GUIDE:

Dye Mixing Chart: 8 oz warm water + 1 T urea + 2 t dye 9 EXCEPT * = 4 t, ** = 8 t
Also if needed ¼ t water softer and/Or sodium alqinate thickener

DYEING OPTIONS

A. Single color: Soak, until saturated, both sides of fabric with only one color. down into the folds all around. No white should be showing on fabric.

B. Multicolored: 1. Stripes, Pleats, Sunbursts, Specialty designs: You may choose to make each section a different color, or you may choose to have a repeating pattern. Soak, until saturated, both sides of fabric with the same color. Inject the dye down into the folds all around. No white should be showing on fabric.

2. Spirals and Crushes: You may choose to make opposite pie wedges the same color for a symmetrical effect.

Or, you may choose to have half of the spiral one color and the other half a different color. To achieve that affect let one of the rubber bands be the dividing line and put one color on one half and a different color on the other half.

A third option is a rainbow effect where each pie wedge is a different color.

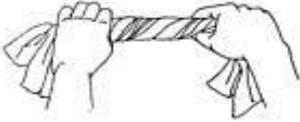
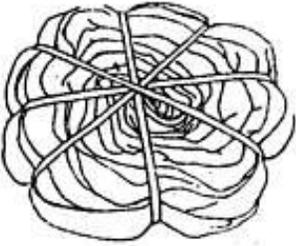
Which ever option you select remember to soak, until saturated, both sides of fabric with the same color. Inject the dye down into the folds all around. No white should be showing on fabric.

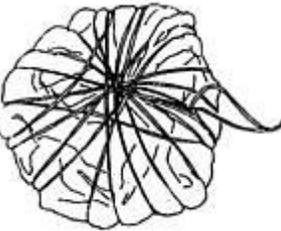
C. Use of floral marbles – cover marble with fabric and secure using rubber band, string – Choice a) dye marbles one color and rest of item a second color or b) tie the item in a traditional fold – dye the marbles one color and dye the fold to personal preference

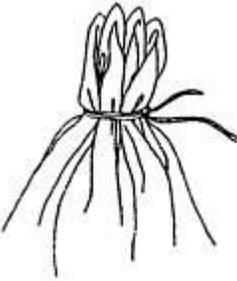
D. Specialty shapes – fold item in half, draw half of shape(half heart, square, etc.) , using a basting stitch sew along the shape, gather, and tie similar to a sunburst and dyet

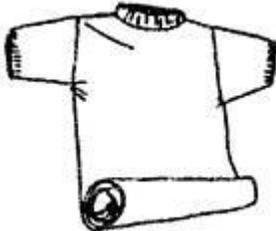
HINTS On Dyeing: Place a different color, like yellow in the center, or on the rubber band/ string dividers. This will cause colors to run together to produce colors that were not used. Example putting yellow between blue and red you will get a blending of green and orange.

FOLDING PATTERNS

<p>KNOT TYING</p>	
	<p>Hold the cloth at both ends and twist into a long rope form</p>
	<p>Tie this long rope into a knot and tighten as much as you can without damaging the cloth. Knot tying works best on long sleeves and light-weight material. You can tie as many knots as you have room for. Rubber bands or string can be tied over the knots to reinforce them as well as provide fine lines in the pattern.</p>
<p>SPIRALS</p>	
	<p>Lay your material on a flat surface. Place your thumb and a couple of fingers together on the cloth at the point which will be the center of the design. Using the weight of your fingers to hold the cloth in place, start twisting. After each twist, flatten the material with the palm of your hand to keep the folds from rising. With your other hand, bring the loose ends into the circle and continue to twist until the whole thing looks like a fat pancake.</p>
	<p>Now take rubber bands, and without disturbing the shape of the pancake slide the bands under the cloth so that they intersect at the center. Use as many as necessary to retain the circular shape, about twice the number shown in the illustration at right for most tie-dyes. If you decide to immerse, instead of squirting, just set the cloth gently in the dye bath, do not stir. For an interesting effect, prevent the cloth from submerging, either by using less water or by placing the cloth on a prop to hold it out of the dye a little. Some materials will float automatically. Then sprinkle a different color dye in powder form over the top of the cloth, being careful not to get any in the other dye solution.</p>

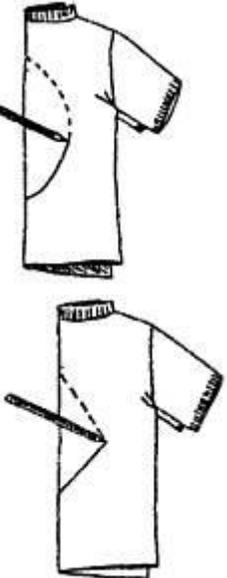
ELECTRIC BUNCHING	
	<p>Gather cloth together in small bunches until it is shaped like a ball. Try to expose as much of the cloth to the surface as possible. This effect works best on thin materials.</p>
	<p>Wrap the string or rubber bands loosely around the ball in as many directions necessary to retain the ball shape, and set gently in the dye bath. Do not stir. Just turn over once in a while.</p>

ROSETTES	
	<p>A Rosette is many little circles, touching or overlapping each other. Using a pencil or your mind's eye, make a few dots on the cloth in any pattern. Each dot will be the center of a small circle.</p>
	<p>With the thumb and forefinger pick up dot after dot and transfer to the other hand.</p>
	<p>Wrap string or rubber bands several times around the base of all the circles which have been gathered together. Continue to wrap to the tip and back, making sure your ties are very tight.</p>

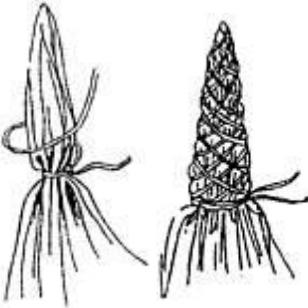
STRIPES	
	<p>Roll the cloth very loosely, forming a long tube. The stripes will be at right angles to the tube.</p>

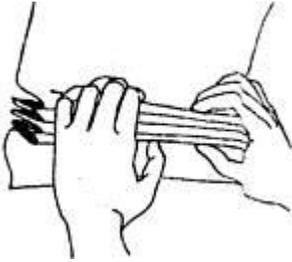
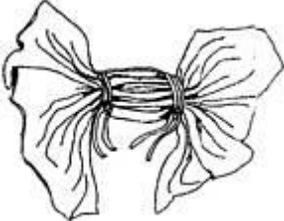
DIAMONDS OVALS SQUARES	
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	<p>Fold the cloth once along an imaginary line which will run through the intended form. See possibilities below. Try hearts too.</p>
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	<p>Draw half of the intended design with a pencil or with your mind's eye, starting and ending on the crease.</p>
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	<p>Form pleats, starting at one end of your line. Try to keep that line in the center between your hands while pleating until you come to the end of your line.</p>
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CIRCLES	
	<p>The circle design is relatively simple to create, yet it is easily one of the most dramatic. Just pick up the cloth with thumb and forefinger at the point you choose to be the center of the circle.</p>
	<p>With the other hand, try to arrange fairly neat and evenly spaced pleats around the central axis like a closed umbrella. Smooth the cloth down, and hold tightly at the base. Now let go of the top.</p>
	<p>With string or rubber bands, tie a strong anchor-knot around the base. Continue wrapping to the tip and back again and secure at the base. Make sure the ties are very tight. VARIATIONS: 1) Tie only part of the circle. 2) Tie at one inch intervals. 3) Poke the center or tip down inside the rest of the circle before tying.</p>

PLEATS	
	<p>Lay cloth on flat surface. Place thumbs of both hands together firmly on the cloth. Position fingers about an inch or two in front of your thumbs, and pinch the fabric to raise a fold. Continue to pinch up more pleats until you reach the end of the cloth. You can change directions as often as you want by gathering more material in one hand than in the other.</p>
	<p>Be careful not to lose any pleats. Loop rubber bands or string very tightly around all the pleats several times and knot. You can use as many ties as you want. This useful technique is also employed in tying ovals, squares, diamonds or any shape you can imagine which has symmetry.</p>

Comparison of Dying Techniques:

Type	Material to be dyed	Dyes Used	Mixing of Dyes	Fabric Preparation	Dying Technique
Traditional Tie Dye	100% natural fiber – 100% cotton, 100% silk, etc	Procion Dye	<ul style="list-style-type: none"> ▫ 8 oz. cup of warm water (not hot, body temperature) ▫ 2 to 8 teaspoons of Procion dye <i>Some colors are noted with *</i> <i>On the Procion dye page (Colors with no * = 2 teaspoons)</i> <i>(One * = 4 teaspoons)</i> <i>(Two ** = 8 teaspoons)</i> ▫ 1 tablespoon Urea (dissolve in hot water first). ▫ 1/4 teaspoon water softener (if needed) ▫ Sodium Alginate Thickener <i>(A little to slow spreading, and control color, if desired)</i> 	<p>Pre-wash in hot water with a phosphate free detergent and dry on HOT dryer cycle</p> <p>Item must be soaked in 20% sodium carbonate solution (1 cup Na₂CO₃ in 1 gallon hot water) for 15-20 minutes before dying</p>	<p>Some prefer to soak then tie into a pattern and some prefer to tie and then soak</p> <p>A third alternative is to soak, dry, and then fold and dye</p> <p>Apply dye – as many colors as you want.</p> <p>Put fabric(still tied) in a plastic bag and let sit for at least 4 hours.</p> <p>Remove from bag and rinse off excess dye, untie and continue to rinse until water runs fairly clear.</p> <p>Watch in hot water using phosphate free detergent. Dry on HOT dryer cycle</p>
Silk in Microwave	100% Silk	Procion Dyes	Same as for Traditional Tie Dye	<p>Pre-wash in hot water with a phosphate free detergent and dry on HOT dryer cycle</p> <p>Item is soaked in vinegar for 15-20 minutes before dying</p>	<p>Fold and dye as in Traditional Tie Dye</p> <p>Place in Ziploc bag and microwave on HIGH for 2 minutes. Keep a close eye and when bag inflates stop and open to let out pent up steam.</p> <p>*Careful! Steam will burn you if it comes in contact with your skin!</p> <p>Rinse and wash as in Traditional Tie Dye.</p>

Type	Material to be dyed	Dyes Used	Mixing of Dyes	Fabric Preparation	Dying Technique
Shibori	100% silk or cotton	Procion dyes	To about ½ tsp dye add about ½ tsp of water to make a paste. Once the dye is dissolved, add about ½ cup. of water.	<p>Pre-wash in hot water and a mild detergent (Joy, Ivory, Dawn, etc.) Detergent needs to be phosphate free.</p> <p>Dry on the hot dryer cycle.</p> <p>Fabric should be soaked in ¼ cup sodium carbonate in 1 qt of hot water for 5 minutes.</p>	<p>Wring item & arrange over Shibori pole.</p> <p>Tightly wrap dental floss around the pole & item, pleating often.</p> <p>Use a foam brush to dip into a color & apply to the fabric.</p> <p>Dry over-night, or in the sun. If in the sun, turn often to give even exposure.</p> <p>Untie or cut floss, sliding off pole.</p> <p>Rinse and wash as in Traditional Tie Dye</p>
Marbling Paper	Any paper, although cardstock yields very nice results. You can make your own decorative paper for cards, scrapbook pages, gift bags, etc.	Food coloring	None	None	<p>Fill tray with shaving cream.</p> <p>Dot shaving cream with different colors of food dye and swirl into a pattern.</p> <p>Gently place paper on top and tap down so all areas of the paper come in contact with the shaving cream/food color mixture.</p> <p>Peel up and scrap off excess shaving cream</p> <p>Air dry</p>

Type	Material to be dyed	Dyes Used	Mixing of Dyes	Fabric Preparation	Dying Technique
Marbling Fabric	100% cotton, rayon, silk or other natural fiber	Procion dyes	<p>Dissolve the dye powders (2 tsps for colors without *, 4 tsps for colors with *, 8 tsps for colors with **) in a small amount of warm water, stirring into a smooth paste.</p> <p>Stir in ½ cup of lukewarm water. For reds and colors containing red filter the dye solution through a coffee filter to remove difficult to dissolve particles.</p> <p>Add ½ cup shaving cream to the filtered dye solution, then pour into the squeeze bottle.</p>	Same as for Traditional Tie-Dye	<p>Prepare the Marbling Tray</p> <p>Dilute about half a can of shaving cream with a cup of water in a large mixing bottle.</p> <p>Whisk the mixture until well blended and thick and creamy.</p> <p>Pour mixture into the tray until about an inch deep</p> <p>Squirt the dye/shaving cream mixture over the shaving cream/water mixture in the tray in any pattern you wish.</p> <p>Use a comb, chopstick, or any tool to swirl and spread the dye into any pattern desired.</p> <p>Place fabric to sit on surface of the dye/shaving cream for 5 minutes.</p> <p>Remove by lifting carefully.</p> <p>Place on a flat surface shaving cream side up and allow to sit for 2 to 24 hours.</p> <p>Rinse and wash as in Traditional Tie Dye.</p>

LAB- TRADITIONAL TIE DYE

INTRODUCTION

Fiber active dyes were developed in 1956. Unlike Rit or other similar dyes which are adsorbed onto the fabric, the chlorine in the Procion dyes are actually covalently bonded to the cellulose fiber.

The dye is a very high quality dye that does not fade, even after years of wear (except in bleach or heavily chlorinated pools). It works through a chemical reaction that bonds the dye to the fabric.

First the fabric is washed in hot water and a mild phosphate free detergent (*Joy*, *Ivory*, *Dawn*, etc.) and dried on the hot dryer cycle. This removes sizing additives from the fabric and preshrinks the fabric. Then the fabric is soaked in a 20% solution of sodium carbonate. This roughens the fiber and makes it start to break down. The dye, which is mixed with urea is applied to the fabric. The urea increases the solubility of the dyes and brightens the colors. The fabric is wrapped in plastic, and left to sit for 8 to 24 hours so the reactive bonding can take place. The fabric is thoroughly rinsed in cool water and then washed in a mild, phosphate free detergent and hot water and dried on the hot dryer cycle. The dye is now permanently part of the fiber of the fabric.

The dye is very intense at full strength. It can also be mixed at half-strength (add twice as much water) or quarter-strength (add four times as much water). The colors will be still be bright, but less intense.

The dye should last two or three weeks after being mixed, especially if kept in a container that blocks out light and kept cool. It will stain your hands and any porous surfaces but usually rinses easily off of plastic, rubber gloves.

The dye works on natural fibers (cotton, rayon, silk). You can dye part polyester fabrics, but they will be lighter because the synthetic fibers won't take the dye. You can dye 100% cotton boys and men's underwear shirts like Fruit-of-the-Loom, Hanes, or BVD. Socks that are 80% cotton can be dyed. Fabrics with stain-repellent do not dye well.

Purpose

To observe the reaction of a fiber reactive dye on fabric.

To make tie dyed T-shirts.

SAFETY

Wear goggles and aprons.

Wear gloves when handling activator (sodium carbonate) and dyes.

The dyes can cause an allergic reaction in the dry fonn, be careful not to inhale when mixing. It is best to work in a well-ventilated area and wear a dust mask if working with dyes often.

Turquoise dye contains sodium sulfate which can cause cancer if inhaled repeatedly.

The dyes are not harmful in liquid form, but store them in clearly marked bottles and away from food items.

MATERIALS

Fiber reactive dyes - 8 Thsp. of dye per Liter of solution	Dropper bottles for dyes	
Newspaper	fabric	pans
Hangers	disposable gloves (one pair per student)	
plastic trash bags	rubber bands or string	
20% Na ₂ CO ₃ dissolve 200 g Na ₂ CO ₃ in 10 L of hot water		
Urea water - dissolve 100 g urea in 1 L of water		

PROCEDURE

BEFORE CLASS:

Pre-wash fabric in hot water and a mild detergent(*Joy*, *Ivory*, *Dawn*, etc.) Detergent needs to be phosphate free. Dry on the hot dryer cycle.

DURING CLASS

1. Be sure to wear goggles, aprons and gloves.
2. Pre-activate the fiber by soaking it for 20 minutes in a warm 2% solution of sodium carbonate.
3. Squeeze out he excess sodium carbonate and bring your fabric to a clean flat surface.
4. Choose a folding pattern and fold and bind your fabric.

S. Be sure your fabric is damp before applying dye. If it is not put it back into the 2% solution of sodium carbonate

6. Place the fabric onto a rack above the *pans*. (*HINT: two linked hangers make good racks.*) Apply the color of your choice by completely saturating an area of the fabric with the dye from the dropper bottles. The fabric should be saturated with the dye but not dripping. When you are finished with one side, turn it over and repeat the same color pattern on the other side if the dye has not soaked through.
7. Place the fabric in a plastic bag with your name on it - tie the bag shut.

AFTER CLASS

1. Fabric should not be opened or washed for 8 hours (turquoise takes 24 hours to cure).
2. Rinse the tied fabric well in cool water. Remove the string / rubber bands and continue to rinse. 3. Wash fabric alone, in the washer, in hot water and a mild detergent (Joy, Ivory, Dawn, etc.) Detergent needs to be phosphate free. Dry on the hot dryer cycle.

FUTURE CARE:

The fiber reactive dye is permanent wash-fast. Colors will not run together or bleed. Wash with normal detergents after your first wash. Since the dye is attached by chlorine, keep away from chlorine bleach or pool water.

DATA:

- A. Sketch your folding pattern.
- B. Color in your dye pattern onto your folding pattern.
- C. Draw and color a representation of what your final product looked like

CONCLUSIONS:

1. Did your T-shirt turn out like you expected?
2. Was any white showing when it was folded?
Do you have white on your T-shirt?
What would increase / decrease the amount of white on your T-shirt?
3. Why is pre-washing necessary?
4. What role does the sodium carbonate play in the dyeing process?
What role does urea play in the dyeing process?
5. Did your T-shirt have colors that you did not use? Explain these phenomena.
 6. Will a garment made of polyester accept the dye? Why / Why not

SILK IN MICROWAVE

I. INTRODUCTION

Tie dyeing silk in a microwave is an alternative to traditional tie dyeing. Vinegar is used in place sodium carbonate. It only takes minutes to get the results that take traditional dyeing hours. The silk is soaked in vinegar, folded and tied, placed in microwave for 2 minutes, rinsed out, and washed.

II. PURPOSE:

To create tie dye using vinegar and the microwave.

III. SAFETY

Wear goggles and aprons.

Wear gloves when handling vinegar and dyes.

The dyes can cause an allergic reaction in the dry form, be careful not to inhale when mixing. It is best to work in a well-ventilated area and wear a dust mask if working with dyes often.

Turquoise dye contains sodium sulfate which can cause cancer if inhaled repeatedly. The dyes are not harmful in liquid form, but store them in clearly marked bottles and away from food items.

IV. MATERIALS

100% Silk item

Urea water

Dropper bottles for dyes pans

disposable gloves

rubber bands or string

Vinegar

Fiber reactive dyes

newspaper

trays

Locking freezer storage bags

V. PROCEDURE

A. Before Class: Pre-wash in hot water and a mild detergent(Joy, Ivory, Dawn, etc.) Detergent needs to be phosphate free. Dry on the hot dryer cycle.

B, Mixing the dye

1. To 8 oz. cup of warm water add 2 to 8 teaspoons of Procion dye [Some colors are noted with * on the [Procion dye](#) page (Colors with no * = 2 teaspoons)(One * = 4 teaspoons)(Two ** = 8 teaspoons)] add 1 tablespoon Urea (dissolve in hot water first).

In hard water add ¼ teaspoon water softener.

Sodium alginate can also be added to thicken and slow the spreading of color if desired.

B. During Class:

- 1., . Be sure to wear goggles, aprons and gloves.
2. Soak the silk item in pure white vinegar for 30 minutes
3. Squeeze out the excess vinegar and take silk to a clean flat

surface.

4. Choose a folding pattern and fold and bind your silk item.
5. .Squirt on the colors as you like. As dye spreads easily in silk, use less dye and/or add thickener.
6. Put the silk in a locking freezer storage bags big enough to allow for the expansion of the steam.
7. Place in microwave at full power for 2 minutes. To prevent bag from exploding, stop microwave every 30 to 45 seconds open bag up and let steam bubble subside. Reclose bag and continue to microwave.

BE CAREFUL – IF THE BAG POPS OPEN, IT WILL MAKE A MESS

8. After two minutes, let the whole thing cool before opening and rinsing.

WARNING! THE BAG AND THE CONTENTS ARE BOILING HOT. OPENING THE BAG WHILE HOT WILL CAUSE HOT STEAM TO FLY INTO YOUR FACE.

9. Rinse the silk item and then place in a plastic bag with your name on it. Tie the bag shut.

THE MICROWAVING PART OF THIS METHOD IS NOT RECOMMENDED FOR CHILDREN OR THOSE WHO DO NOT UNDERSTAND THE INSTRUCTIONS.

C. After Class:

Wash silk item in hot water and a mild detergent (Joy, Ivory, Dawn, etc.)
Detergent needs to be phosphate free. Dry on the hot dryer cycle. Press.

D. Future Care:

The fiber reactive dye is permanent wash fast. Colors will not run together or bleed. Wash with normal detergents after your first wash. Since the dye is attached by chlorine, keep away from chlorine bleach or pool water.

VI. DATA:

1. Draw and color in fold pattern
2. Draw and color in the final product.

VII. CONCLUSION

1. Jimmy got caught up in conversation with Betty and forgot to watch the microwave. When the time elapsed, describe the scene that Jimmy saw inside the microwave.
2. What purposes does microwaving serve?

SHIBORI

I. INTRODUCTION

Shibori is the traditional Japanese art of shaped resist dyeing. The fabric is twisted, turned and bound. The result is soft patterns and striations that look more complicated than they really are. Shibori can be traced back to 1608. At this time eight families settled along a stretch of the eastern sea road connecting Kyoto and Osaka. They took up handicraft and developed a peasant textile industry developing their own methods and techniques for working with silk and cotton.

II. PURPOSE: To observe the effects of binding and dyeing

III. SAFETY

Wear goggles and aprons.

Wear gloves when handling .

The dyes can cause an allergic reaction in the dry form, be careful not to inhale when mixing. It is best to work in a well-ventilated area and wear a dust mask if working with dyes often.

Turquoise dye contains sodium sulfate which can cause cancer if inhaled repeatedly. The dyes are not harmful in liquid form, but store them in clearly marked bottles and away from food items.

IV. MATERIALS

100% Silk or cotton item

Urea water

Na₂CO₃

Foam Brushes

disposable gloves

color mixing cups

Shibori pipe(PC pipe between 2 to 6 inches in diameter and about 2 feet long)

Dental floss

Fiber reactive dyes

Wax paper

V. PROCEDURE

A. Before Class: Pre-wash in hot water and a mild detergent(Joy, Ivory, Dawn, etc.) Detergent needs to be phosphate free. Dry on the hot dryer cycle.

B, Mixing the dye

1. Add about ½ teaspoon dye into a plastic cup add about a teaspoon of water to make a paste to dissolve the dye.

2. Once you have dissolved the paste, add about a ½ of water

B. During Class:

1. Be sure to wear goggles, aprons and gloves.

2. Soak the silk/cotton item in ¼ cup sodium carbonate in about 1 qt of hot water for

5 minutes

3. Wring and hang dry
4. Arrange item over Shibori pole
5. Using the unwaxed dental floss securely tape to the top of the pole. Begin wrapping floss around the pole and silk/cotton item about ¼" apart.
6. Keep wrapping around pole, pleating wherever you choose – the more pleats the more texture you will have.
7. With your fingers slide the tightly wrapped section up the pole as snugly together as it will go. Hold on to the floss because your wrapping must be tight.
8. Continue wrapping and sliding the fabric up the pole until all is tightly pleated.
9. Using a foam brush, dip into one color and apply it to the silk. Apply different colors in order so as not to get too much of one color over another,
10. Continue applying dye until all of the silk is covered. Make sure you have painted enough dye on the silk. Don't flood with dye, just use enough to saturate
11. You may either set pole aside to batch overnight. or set it out in the sun to dry. Putting it in the sun will allow darker 'marbled' lines to form. While it is drying in the sun, turn the pole so all sides will react with the sun and display this added 'marbled' darkness.

C. Next day

1. Untie or cut floss, sliding off the pole and rinse in cool running water until water runs almost clear.
2. Wash silk/cotton item in hot water and a mild detergent (Joy, Ivory, Dawn, etc.) Detergent needs to be phosphate free. Dry on the hot dryer cycle. Press.

D. Future Care:

The fiber reactive dye is permanent wash fast. Colors will not run together or bleed. Wash with normal detergents after your first wash. Since the dye is attached by chlorine, keep away from chlorine bleach or pool water.

VI. DATA:

Draw and color in your item.

In which direction does your pattern go?

VII. CONCLUSION

1. Sadie did not tie her dental floss tightly. What effect would this have on the pattern of the shirt?
2. When Ezana unwrapped his shirt, he was disappointed that the shirt had more white than he anticipated. Give an explanation of what could have caused this to happen

MARBLING PAPER
Colorful Lather Printing Lab
From JCE Classroom Activity: #89

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Introduction

Paper marbling has been popular for centuries. In a Japanese version called *sumi nagashi* (meaning “ink-floating”), hydrophobic, carbon-based inks are dropped onto water and blown across the surface to produce swirls like those seen in polished marble. Rice paper lifts the ink off the surface of the water. In this Activity, you will investigate the art and science of the creation of colorful marbled paper patterns using shaving cream and food color. Shaving cream contains soap, which consists of long ionic species that have a hydrophilic (“water loving”) head and a hydrophobic (“water hating”) tail. Paper contains cellulose, which is a polymer of glucose (see below), as well as other chemical substances.

Purpose:

To observe polarity of different compounds

Procedure:

Place a drop of food color on a clean piece of non-glossy sturdy paper. Observe and record how the drop spreads.

Fill a small beaker half-full with room-temperature water. Without stirring, add a drop of food color to the water. Observe and record how the drop spreads.

Obtain a paper plate with shaving cream. Use a tongue depressor to shape the pile so that the top surface is flat and slightly larger than the paper that you will marble.

Apply only 4–6 drops of food color to the shaving cream surface, one drop at a time. Observe and record how the drops spread.

Drag a toothpick through the shaving cream and food color to create colored patterns. Press a 3.5 inch piece of paper firmly on the shaving cream surface. What do you observe through the back of the paper?

Lift the paper off of the shaving cream. Scrape off any excess shaving cream close to the paper with the side of a tongue depressor and return it to the original pile. Observe the front of the paper. What happened?

Repeat steps 5–6 to marble additional papers with the remaining tinted shaving cream, or move on to step 8.

Using a tongue depressor, mix the leftover pile of colored shaving cream until it is one uniform color. If most of the color has already been removed by paper, add 1–5 more drops of food color before mixing completely.

Using a pipet, apply a drop of water to the tinted shaving cream. Observe and record what happens.

Results:

System	Observations
Food coloring on paper	
Food coloring in water	
Food coloring on shaving cream	
Back of paper	
Front of paper	
Water in tinted shaving cream	

Questions

1. Define polarity. How do you know if a substance is polar?
2. Compare and contrast the spreading you observed when dropping food color onto clean paper, into water, and onto shaving cream. Explain your observations.
3. Based on your observations, what claims can you make about the polarity of the food color and the paper? Explain.
4. Shaving cream is a lather, similar to a foam. A foam is a colloid consisting of a gas dispersed within a liquid. (The liquid in shaving cream is water and soap, with larger sized soap particles dispersed in water.) What other common products are foam or lather colloids?
5. Artists have created beautiful marbled papers since the middle ages. How do you think an artist's understanding of materials influences his or her work? Explain your answer.

Fabric Marbling with Shaving Cream

I. INTRODUCTION

Marbling originated in Japan around the twelfth century. In the fifteenth century another type of marbling was originated in Turkey, Persia and India. During the sixteenth and seventeenth centuries marbling spread to Europe. The process was kept secret until 1853 when an Englishman, Charles Woolnough, revealed the secret. Marbling became less popular until the 1970's when crafts helped to renew this old art form. Today marbling is going strong. The method that is used in this activity is a relative new and simplified version of the traditional ones that began in Japan.

II. PURPOSE To use shaving cream and fiber active dyes to get beautiful marble effects on fabric.

III. SAFETY

Wear goggles and aprons.

Wear gloves when handling activator (sodium carbonate) and dyes.

The dyes can cause an allergic reaction in the dry form, be careful not to inhale when mixing. It is best to work in a well-ventilated area and wear a dust mask if working with dyes often.

Turquoise dye contains sodium sulfate which can cause cancer if inhaled repeatedly. The dyes are not harmful in liquid form, but store them in clearly marked bottles and away from food items.

IV. MATERIALS

White fabric – cotton, rayon, silk or other natural fiber

Fiber Reactive MX dyes

Sodium Carbonate

Squeeze bottle to hold dyes

Foam shaving cream (aloe containing preferred)

Flat shallow pan

Plastic mixing bowls

Wire whisk

V. PROCEDURE

A. Before Class: Pre-wash in hot water and a mild detergent (Joy, Ivory, Dawn, etc.) Detergent needs to be phosphate free. Dry on the hot dryer cycle.

B, Mixing the dye

1. Dissolve the dye powders (2 tsps for colors without *, 4 tsps for colors with *, 8 tsps for colors with **) in a small amount of warm water, stirring into a smooth paste.
2. Stir in ½ cup of luke warm water. For reds and colors containing red filter the dye solution through a coffee filter to remove difficult to dissolve particles.
3. Add ½ cup shaving cream to the filtered dye solution, then pour into the squeeze bottle.

* C. Preparing the Marbling Tray

1. Dilute about half a can of shaving cream with a cup of water in a large mixing bowl
2. Whisk the mixture until well blended and thick and creamy.
3. Pour mixture into the tray until about an inch deep

D. During Class:

1. Be sure to wear goggles, aprons and gloves.
2. Pre-activate the fiber by soaking it for 20 minutes in a warm 20% solution of sodium carbonate.
3. Squeeze out the excess sodium carbonate and dry
4. Squirt the dye/shaving cream mixture over the shaving cream/water mixture in the tray in any pattern you wish.
5. Use a comb, chopstick, or any tool to swirl and spread the dye into any pattern desired
6. Place a piece of the prepared fabric on the surface of the shaving cream and dye pattern. Remove any air bubbles by pushing down gently with a tool or a gloved hand.
7. Allow the fabric to sit on the surface of the dye/shaving cream for 5 minutes, then remove fabric by lifting carefully.
8. Place on a flat surface shaving cream side up and allow to sit for 2 to 24 hours to develop the dye. The piece needs to remain moist for the activation to take place

E. 2 to 24 hours later:

1. Rinse fabric in cool running water to remove the sodium carbonate, and then increase temperature to hot.
- 2 Continue to rinse until water is almost clear.
3. Wash in hot water and a mild detergent (Joy, Ivory, Dawn, etc.)
Detergent needs to be phosphate free. Dry on the hot dryer cycle. Press.

F. Future Care:

The fiber reactive dye is permanent wash fast. Colors will not run together or bleed. Wash with normal detergents after your first wash. Since the dye is attached by chlorine, keep away from chlorine bleach or pool water.

VI. DATA

Draw and color in your final pattern on the shaving cream..

Draw and color in you final product

Were they the same? Explain why or why not.?

VII. CONCLUSIONS:

1. Describe what type of mixture was made after whisking shaving cream and water together. Describe an experimental procedure that could be conducted to prove or disprove your conclusion.
2. Do you think shaving cream is polar or nonpolar? What experimental evidence do you base this on?
3. Mary was running out of time and did not take the time to remove the air bubbles from the apron that she was marbling. What effect did this have on her final product?

REFERENCES AND ORDER INFORMATION

Dharma Trading Co.
P.O. Box 150916
San Rafael, CA 94915
(800) 542-5227
www.Dharmatrading.com

Flinn Scientific
PO Box 219
Batavia, IL 60510-9958
www.FlinnScientific.com

PRO Chemical & Dye
P.O. Box 14
Somerset, Mass. 02726 508p676-3838 1-800-2-BUY DYE
www.prochemicalanddye.com

Harris, Sulfiati. Rainbow Tie-dye. Duncan Express. 1999

Down and Dirty How To's: Tie-Dye Instructions

1. Fold and/or tie the fabric into the desired patterns. The designs will be more defined if you wet the shirt and squeeze or spin out excess water before folding.



2. Wear your dust mask and dissolve 1 cup (8 oz.) of [Soda Ash Fixer](#) per gallon of warm water. Soak the tied garments about 5-15 minutes (until saturated). Reuse solution until gone. Squeeze out excess so garment is just damp, not dripping.



3. Using your dust mask and gloves, combine water with all chemicals except dye. Add liquid to dye gradually, pasting up to avoid lumps. Apply dye with squeeze bottles, paint brushes, sponges, etc., as many colors as you want. Easiest to use a funnel to pour dissolved dye into squeeze bottles.



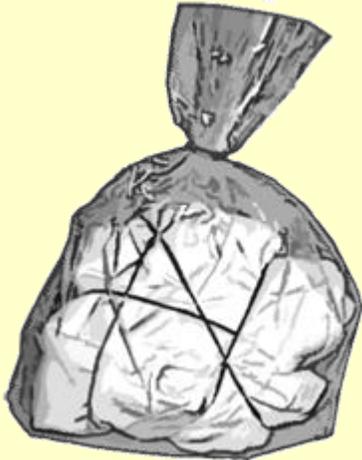
#Dye Formula:

- **8 oz. cup of warm water**
(not hot, body temperature)
- **2 to 8 teaspoons of [Procion dye](#)**

*Some colors are noted with * on the [Procion dye](#) page
(Colors with no * = 2 teaspoons)
(One * = 4 teaspoons)
(Two ** = 8 teaspoons)*

- **1 tablespoon [Urea](#)**
(dissolve in hot water first).
- **1/4 teaspoon [water softener](#)**
(if needed)
- **[Sodium Alginate Thickener](#)**
(A little to slow spreading, and control color, if desired.)

4. Put fabric (still tied) in a plastic bag (the idea is to keep it wet and chemically active - any method of keeping it wet is O.K.) and let sit for at least 4 hours but preferably 24 hours to "cure". Shorter times work better in summer, and longer times are needed when it is cold.



5. Remove from bag and while still tied, rinse off the excess dye under cold running water (faucet, hose or shower), then rinse in warmer water while you untie and after garments are untied, until water runs fairly clear. Have your washing machine pre-filled with hot water with [Synthrapol](#) or [Professional Textile Detergent](#) and throw in the clothing as soon as it is rinsed, running it through a full cycle.



Silk in Microwave

1. Mix the dye solution as in the [Soda Soak Method](#).
2. Soak the silk item in pure white vinegar for 30 minutes (replaces the Soda Ash in the Soda Soak method. Vinegar is much easier on silk, but needs the extra heat to "fix" the dye.
3. Squeeze out the excess vinegar and tie silk in desired pattern or scrunch.
4. Squirt on the colors as you like. As dye spreads easily in silk, use less dye and/or add thickener
5. Put the silk in a locking plastic bag big enough to allow for the expansion of the steam. The heavier duty bags work best. Place in microwave at full power for 2 minutes. To prevent bag from exploding, stop microwave every 45 seconds to let steam bubble subside.

Be careful - if the bag pops open, it will make a mess.

6. After two minutes, let the whole thing cool before opening and rinsing and washing in Synthrapol.

Warning! The bag and the contents are boiling hot.

Opening the bag while hot will cause hot steam to fly into your face.

The microwaving part of this method not recommended for children

or those who do not understand the instructions.

Enjoy!

The Shibori with fiber reactive dye

1. Dissolve about 1/4 cup soda ash in about 1 qt. of hot water. Presoak item in this solution for about 5 minutes.

2. Wring and hang dry.

3. Arrange item over shibori pole

4. Using the unwaxed dental floss securely taped to the top of the pole, begin wrapping floss around the pole and suit about 1/4" apart.

5. Keep wrapping around pole, pleating wherever you choose-the more pleats the more texture you will have.

6. With your fingers, slide the tightly wrapped section up the pole as snugly together as it will go. Hold onto the floss because your wrapping must be tight.



7. Continue wrapping and sliding the fabric up the pole until all is tightly pleated.



8. Mix up 3 colors of dye, about 1/2 teas. of each into a plastic cup with about a teaspoon of water to make a paste to dissolve the dye. Once you have dissolved the paste, add about a 1/2 cup of water.



9. Using first color, paint a section with one dye color, paint next section with second color, and paint third color onto next section. Repeat colors until you have painted the entire piece.

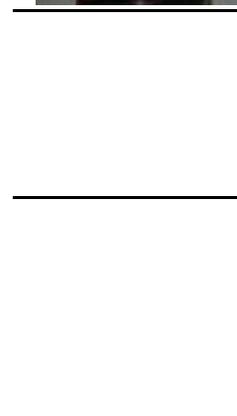


10. Set pole aside to batch overnight.



11. Untie or cut floss, sliding off the pole and rinse in cool running water until water runs almost clear.

12. Wash with Synthrapol in hot water and rinse again. You can run this through a small cycle of your washing machine or you can do this by hand. Let dry or put into dryer.



Marbling Paper

- 1. Squirt a layer of shaving cream into a tray.**
- 2. Dribble food color dyes (your choice of color and how many) onto shaving cream**
- 3. Use a wood craft stick and swirl the food color into a design.**
- 4. Gently place the paper on top of the design and press down to remove air bubbles.**
- 5. Gently lift paper off or the shaving cream.**
- 6. Scrape the excess shaving cream off.**
- 7. Lay flat to dry.**

Marbling Fabric

- 1.** Dissolve one cup soda ash in one gallon of hot water. Soak the fabric in the soda ash solution for 5-10 minutes, wring lightly and hang dry.
- 3.** Dissolve your dye powders (2 tsps. for colors without an *, 4 tsps. for colors with one *, 8 tsps. for colors with two *) in a small amount of warm water, stirring into a smooth paste. Stir in 1/2 cup lukewarm water. For reds and colors containing red, filter the dye solution through a coffee filter or piece of silk to remove difficult to dissolve particles. Add 1/2 cup shaving cream to the filtered dye solution, then pour this mixture into the squeeze bottle.
- 4.** Dilute about half a can of shaving cream with a cup of water in a large mixing bowl. Whisk the mixture until well blended and thick and creamy. Pour mixture into the tray until about an inch deep.
- 5.** Squirt the dye/shaving cream mixture over the shaving cream/water mixture in the tray in any pattern you wish. Use a comb, chopsticks, or any tool to swirl and spread the dye into any pattern desired.
- 6.** Place a piece of the prepared fabric on the surface of the shaving cream and dye pattern. Remove any air bubbles by pushing down gently with a tool or a gloved hand.
- 7.** Allow the fabric to sit on the surface of the dye/shaving cream for 5 minutes, then remove fabric by lifting carefully. Place on a flat surface shaving cream side up and allow to sit for 2 to 24 hours to develop the dye. The piece needs to remain moist for the activation to take place.
- 8.** Rinse fabric in cool running water to remove the soda ash, and then increase temperature to hot. Continue to rinse until water is almost clear, then wash in hot water and Synthrapol to remove any excess dye. Dry, press and voila!