Twinrocker
HANDMADE PAPER
P.O. Box 413, Brookston, Indiana 47923 USA
Telephone 317-563-3119

COLORING PULP WITH PIGMENT

INTRODUCTION

Pigments are like tiny, inert, colored rocks. Because pigments do not react chemically with anything, they tend to be very light fast, resisting fading in sunlight. They can become a "paint" when suspended in a binder like gum arabic for watercolor paint or acrylic medium for acrylic paint. Pigment is also an excellent material to color paper pulp. However, when pigment is used to color paper pulp, it is suspended only in water with no adhesive like paint has.

Pigments are very easy to use and to mix together in order to create subtly colored pulps. Different pigments, such as yellow and blue, can be combined to create secondary colors, like green, before OR after the pigment is added to the pulp. For example, yellow pulp can be mixed with red pulp to create orange pulp. Several pigments or colored pulps can be mixed together to create taupe or mauve.

AN IN DEPTH EXPLANATION OF THE PRINCIPLES INVOLVED IN COLORING WITH PIGMENT:

Pigment sticks to paper pulp through a "+" and "-" attraction, a little like a magnet. The cellulose plant fiber (pulp) is anionic; it has a negative charge which increases from the pounding or beating of the fiber during pulp preparation in the hollander beater. Unbeaten, dry fiber has very little or no charge. As the fiber is beaten into a pulp, that "-" charge increases. The pigment is attracted to the pulp by adding some material which has a "+" or positive charge. Retention agent is such a material, and its only purpose is to provide the "+" charge. Internal Sizing is a mild waterproofing agent which also happens to be cationic; it has a positive "+" charge. Consequently, Internal Sizing adds both waterproofing properties AND retention properties.

Depending on how much the fiber has been beaten in the pulping process, it will have a "-" charge of, say from 1-10. A medium beating in a hollander might give it a value of 5 for instance. You then want to add a cationic material with a "+" positive charge to that same value. If you pour in too much retention agent, adding too much "+" charge, the poles on the magnet will reverse, and all the pigment will instantly come off the pulp. If this happens, just rinse the pulp, washing away the pigment and excess retention agent. Then add more pigment. You may not need anymore retention agent. There may be enough still on the fiber. If you feel like you need more, just add a tiny amount and dilute it a lot before adding it.

DIRECTIONS FOR COLORING PULP WITH SIZING AND RETENTION AGENT:
At Twinrocker, we color the pulp we use by first sizing pulp made from 3 pounds of dry fiber or 1 beater load (one 5 gal. pail of ready-to-use pulp) with 50 ml. or 5 tbsp. of our Internal Sizing. We dilute the measured sizing in plenty of water and slowly add it to the pulp while stirring to mix it in evenly. This sizes the pulp and adds some "+" charge.

Then we add the pigment to the pulp. A tiny amount of red will create a pink pulp, more red, a more intense color. The liquid pigments are very concentrated, so begin by adding just a little. If you want an intense color, add a little pigment and mix it into the pulp well, before you add more. Gradually build the intensity of the color. If you find you've added too much pigment for the color you want, just add more white pulp to make the color more pastel. After stirring the pigment in the pulp thoroughly, it should automatically stick to the pulp, and the water should be clear or almost so. If you still have pigment in the water after you have stirred the pulp thoroughly by hand, the pulp is saturated. The pigment has attached to most of the bonding sights on the fiber, and little if any more pigment will stick to the pulp. It's that simple. No rinsing is needed after coloring.

Using this method, the pigment normally attaches to the pulp quite well without the addition of any retention agent. However, if the pulp has not been beaten very much and does not have a strong "-" charge, we then add a little, very dilute retention agent (perhaps a tsp.of Reten 200 in a quart of water). Add it slowly while stirring so that the "+" charge is mixed in the pulp evenly and stop adding it when the color begins to attach to the pulp. If the color is too intense, you can lighten it or make it more pastel by adding white pulp.

A couple of our customers, who are not pulping cotton linter in a hollander beater, but in a mixer or blender instead, color their pulp using retention agent in a slightly different manner. They dilute the pigment they want to use with water, then add a little retention agent to that pigment/water mixture, and then add that mixture to the pulp.

COLORING PAPER PULP WITH PIGMENTS IS EASY AND A LOT OF FUN.
I have given you a detailed explanation of how pigments stick to paper pulp. I could have said, "It's magic." That's how spontaneous and easy it is to do. Mixing colored pulps together to create art work is as easy as mixing colored paints together. If you should have a problem, just give us a call at Twinrocker, and we'll be happy to help you.

Kathryn Clark
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Hours: Monday--Friday, 8:30am-5:00pm EST

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METHYL CELLULOSE - DIRECTIONS

Methyl cellulose is a water soluble gum useful to papermakers chiefly as a mild adhesive that does not degrade the paper. It may be used to glue paper to paper, or other fibers and materials to paper, either in the paper's wet stage (when the sheets have just been formed), or when the paper is dry. In either case, the bonding occurs only when the materials have dried.

Methyl cellulose is frequently used by book and document restorers, not only for its archival properties, but also because it is reversible, meaning that by soaking the glued paper in water, the glue can be dissolved, and the glued parts may be separated without damage.

<u>DIRECTIONS</u>	The material supplied is in the form of powdered granules. Make up a stock solution in the following manner:
<u>Stock Solution</u> *	- Dissolve 2 tablespoons of methyl cellulose in a 1/2 cup of boiling water. Stir thoroughly until all the granules have absorbed water; the solution will be extremely thick and syrupy. Then add 1 cup of very cold water, and mix thoroughly. The solution will still be extremely thick. It may be stored indefinitely in this form, in an airtight container.
<u>For Use</u> -	To use, add additional cold water to some of the stock solution in order to make a fairly free-flowing glue. A brush is useful for spreading the glue onto the paper. Or fibers that are meant to be adhered onto the paper may be dipped into the methyl cellulose solution.

We understand that some papermakers add methyl cellulose to pulp in order to strengthen it; this may be useful in the case of cotton linters pulp, which has a relatively short fiber. It does not seem necessary for the long fibered pulps, such as Manila hemp, sisal, cotton or linen rag, or the Japanese inner bark fibers. If methyl cellulose is added to pulp used for casting into plaster moulds, some difficulty may be encountered in the release of the paper from the mould, since the substance is essentially a glue.

<u>PRECAUTIONS</u> Methyl cellulose is a non-toxic substance. The premium grade of it is used as a food additive. The only possible hazard is that certain persons may be sensitive to the dust from the powder, and therefore a protective dust mask should be worn when handling the dry material.

* - These directions have been prepared in accordance with the manufacturer's suggestions. However, we have found that the methyl cellulose can be dissolved in very hot tap water instead of boiling water.

NAGASHIZUKI AND TAMEZUKI

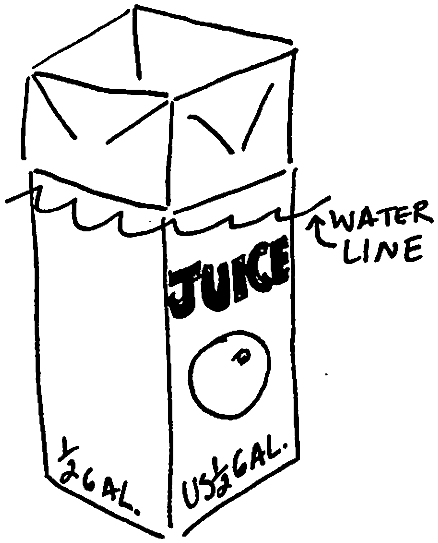
Although there are many forms of "hand-papermaking" practiced in the world today, traditionally speaking there are two distinct methods for producing sheets in large numbers. The Japanese call these two methods NAGASHIZUKI and TAMEZUKI. TAMEZUKI is "hand-papermaking" as the West knows it. NAGASHIZUKI however refers to a very different process and the following chart is designed to introduce NAGASHIZUKI and to help clarify some of the basic differences in the two methods. Technically the "Oriental method" is of great importance in thin papermaking. Historically it has been the papermaking method of the Orient for at least 1100 years. Inasmuch as the technique is completely different from our "hand-papermaking"; we in the West, as Dard Hunter has suggested, would do well to adopt the term NAGASHIZUKI, and perhaps TAMEZUKI as well.

The following chart is a general description of the two processes: a catalyst for conversation. Definitive lines are sometimes hard to draw between the two methods. The chart excludes more primitive papermaking methods used in Nepal, Buthan and Thailand as well as paper casting techniques.

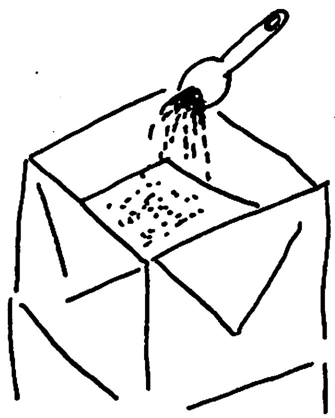
	NAGASHIZUKI	TAMEZUKI
TERM ORIGIN FROM THE JAPANESE	"Nagasu" to flow over a horizontal plane or to flush as in "flush a toilet" plus "suku" to make paper.	"Tameru" to retain or to fill and hold plus "suku" to make paper. (from Dard Hunter)
COUNTRIES	Japan, Korea, Taiwan, and China	Europe, Japan, U.S.A., Canada, and India.
STUFF	Relatively unbeaten, free, long, bast fiber. Sometimes shorter bamboo or rice straw.	Most commonly linen or cotton rag, or cotton linters; "beaten" to a degree.
VAT MIX	"Tororo" or another suspension agent added to the vat of water and fiber to disperse fiber and slow drainage. A viscous solution.	Water and fiber only; a watery feeling.
SHEET FORMING ACTION	Repeated charges are scooped from the vat and rapidly "sloshed" back and forth and side to side across the surface of the mould. A LAMINATION process; lumps or long strands in the stuff are kept in constant motion and do not form into the sheet.	A single dip with shakes front to back and side to side while all the drainable water passes through the mould surface. A FELTING process. Any knots or lumps in the stuff are caught in the sheet.

HOW TO MAKE FORMATION AID

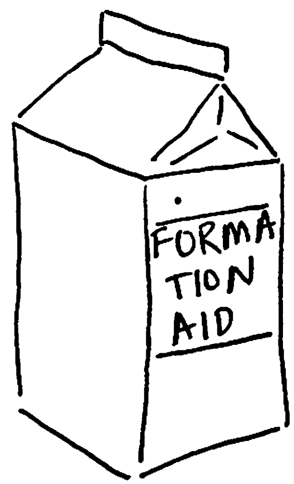
ONE→ FIND A ½ GALLON CARTON OPEN UP THE TOP – FILL WITH COLD WATER



TWO→ SPRINKLE 1TBL OF FORMATION AID ON TOP OF WATER



THREE→ CLOSE UP CONTAINER – LET SIT OVERNIGHT IN REFRIGERATOR



FOUR→ THIS IS A CONCENTRATED SOLUTION USE 1 PART FORMATION TO 3 PARTS WATER – STRAIN CONCENTRATE THROUGH PILLOWCASE TO AVOID GLOBS

* KEEP REFRIGERATOR – 2-3 MONTH LIFE

Carriage House Paper

at Brickbottom
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Orders: 800-669-8781
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617-232-1636

COAGULANT

Coagulant is a powder to which water must be added in order to prepare a viscous substance which is capable of radically altering the nature of the paper pulp with which it is used.

Preparation
The powder should be mixed with cold water in the following proportion:

1 gram powder to 1 liter of water
or
1/2 teaspoon powder to 1 quart water

Place an empty container under the water faucet, out of which a slow, steady stream of water should be flowing. Slowly add the powder with one hand, mixing constantly and thoroughly with your other hand. If there are lumps, then you are probably adding the coagulant too quickly. Let the solution sit for several hours before using it, stirring occasionally. This ensures that the powder has been completely dissolved.

A more concentrated solution may be made by increasing the proportion of powder mentioned above. This may be stored for future use, as it will last for many months.

The dry powder has a fairly indefinite shelf life, provided it is stored in an airtight container, in a dry place.

Use of the Coagulant
When the coagulant is mixed with pulp that already contains either Carriage House Retention Agent or Sizing, the pulp will **flocculate**, that is, coagulate and form clumps. This phenomenon can be used to create some very special effects, and is particularly effective with luster pigments or the regular type of Aardvark pigments. The flocculated pulp can be left in its clumpy stage, or the clumps made smaller by dispersing the pulp in more water by hand, or a blender can be used to further separate the clumped fibers. In any case, the flocculant keeps the pulped fibers distinct from other pulps, and maintains the integrity of individually colored pulps in the papermaking vat. Important: The coagulant depends upon its use with either the retention agent or sizing - the reaction only occurs when a few drops of the viscous coagulant is added to pulp that contains retention agent or sizing. **Only a little** of the coagulant is needed for this reaction.

Alternatively, when the coagulant is mixed with pulp that contains **neither** retention agent **nor** sizing, the pulp will not flocculate. When used in this manner, the coagulant is exactly the same as formation aid.

For more information on the use of coagulant in papermaking, please refer to the article "Decorative Papermaking: Special Effects Using Luster Pigments", by Donna Koretsky in *A Gathering of Papermakers*, Carriage House Press, 1988.

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DIRECTIONS FOR USE OF CARRIAGE HOUSE RETENTION AGENT

Carriage House Retention Agent is a cationic poly(amine) specifically manufactured for the retention of pigments, dyes and other fillers in paper pulp.

The following brief notes have been abstracted from the book, *Color for the Hand Papermaker*, by Elaine Koretsky, published by Carriage House Press, 1983.

Please note that all pigments, dyes, and other chemicals should be handled with care. For more information as to the proper precautions in working with art materials, contact: Center for Occupational Hazards, 7 Beekman St., New York, NY 10038. The Center has several detailed publications on this important subject.

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The directions given are based on the coloring of 450 grams (1 lb.) of dry pulp. Adjustments may have to be made for various kinds of pulps, and for differences among various kinds of pigments and dyes.

The first step is to beat or hydrate the pulp in 10 liters (2.5 gal.) of water.

1. Application of pigments:
Add 30 grams (2 tbls.) retention agent* to the pulp, and beat or mix at least 10 minutes. Add 30 grams (2 tbls.) of a water-dispersed pigment* to the pulp and beat or mix at least 10 minutes. Drain the pulp, and rinse if desired. If dry, powdered pigment is used, make a water dispersion of the pigment first, before adding to the pulp, by pasting it with water or a few drops of alcohol, then adding more water and dispersing the pigment as well as possible. Be aware that for deeper colors, more pigment has to be used, with a correspondingly greater amount of retention agent; for tinting, less. With certain pigments, to obtain maximum depth of color, up to 75 grams (5 tbls.) of retention agent may be necessary. However, be aware that there is a saturation point, at which the pulp will simply not hold any more pigment satisfactorily.

2. Application of dyes, either direct dyes or fiber reactive (e.g., Procion) dyes:
Follow the directions given on the dye packages for use with cotton cloth, adapting them to pulp. Remember to hydrate or beat the dry pulp first, before application of the dye. When the dye and other substances (i.e., salt and/or soda ash) have been used, and the coloring procedure is finished, add 20 grams (4 tsps.) retention agent* to the pulp and mix or beat for 10 minutes. Then drain and rinse the pulp. The retention agent will definitely minimize rinsing in the case of direct dyes, and will help somewhat in the case of fiber reactive dyes.

* the amount of retention agent or pigment should be diluted in at least a half liter (2 cups) water, so that it will be better dispersed in the pulp.

INSTRUCTIONS FOR THE USE OF AARDVARK COLORS

Aardvark colorants were first developed by Carriage House Paper and are pigments formulated specifically for the coloring of paper pulp. They have been carefully selected for their coloring properties and excellent light fastness. Pigments are insoluble, finely ground particles which are deposited physically on the fiber, and must be held onto it by mechanical means. The pigment has no affinity to the material it is coloring, and requires the use of a binder. The Carriage House Studio recommends a retention agent, a cationic substance which will give the pulp a positive charge. The pigment dyestuffs tend to have a negative charge, and therefore will remain affixed to the pulp if the proper quantity of a cationic fixative has been added.

Method of Application

1. Make pulp

Directions given are in terms of coloring one pound (450 grams) of dry fiber or pulp.Weigh out the dry fiber and pulp it, (in a hydropulper, beater, blender, etc.) If you are using a blender and making many small batches of pulp, then put all the batches together in one large container. If you are coloring less than one pound, then use the measurements proportionately.

2. Add retention agent

Dilute the desired amount of retention agent in one pint (1/2 liter) of water, and stir it into the pulp. We usually do this operation, and all the succeeding steps, while our mixer is running continuously. However, it is quite successful to do manual mixing, particularly when coloring small quantities of pulp, using your hand, or other type of stirring rod..Mix thoroughly, for about 10 minutes.

3. Add pigment

Prepare the water dispersed pigment by first shaking the bottle well, as the pigment tends to settle. Measure the desired amount of pigment, put it into a beaker, add one pint (1/2 liter) of water, and stir thoroughly. Add the pigment to the pulp, while mixing or stirring; either keep your mixer running for around 15 minutes, or stir occasionally over that period of time. See if the pulp holds its color. If there is no bleed, or practically none, then the coloring procedure is finished, and you are ready for papermaking. You should not have to rinse the pulp with water. If a lot of colored water drains from the pulp, you may have added too much pigment or not enough retention agent. Allowing the pulp to sit overnight increases color saturation.

Specific Amounts

1. **Pigment Blue 15** (phthalocyanine)
   2 tbls. (27 grams) retention agent
   2 tbls. (27 grams) pigment
2. **Pigment Green 7** (phthalocyanine)
   3 tbls (50 grams) retention agent
   3 tbls (50 grams) pigment
3. **Pigment yellow 83** (diarylide-azo: orange-yellow)
   4 tbsp (60 grams) retention agent
   7 tsps.(35 grams) pigment
4. **Pigment yellow 74 (LF)** (arylide-azo: lemon yellow)
   4 tbls (60 grams) retention agent
   1 tbls (18 grams) pigment

5. **Pigment red 112** (naphthol)
   4 tbls (60 grams) retention agent
   7 tsp. (35 grams) pigment   Note: This pigment tends to bleed. For maximum saturation, leave overnight, then drain and rinse and you should get a rich red with little or no bleed
6. **Pigment violet 19 - Quindo red** (quinacridone)
   4 tbls. (60 grams) retention agent
   7 tsps. (35 grams) pigment
7. **Pigment violet 23** (carbazole dioxazine)
   8 tsp. (40 grams) retention agent
   8 tsp. (40 grams) pigment
8. **Pigment black 7** (carbon)
   4 tbls. (60 grams) retention agent
   6 tbls. (90 grams) pigment   Note: These amounts produce a deep black. For maximum saturation, leave overnight and water should run clear
9. **Pigment yellow 42** (iron oxide: ochre)
   5 tbls. (75 grams) retention agent
   4.5 tbls. (70 grams) pigment
10. **Pigment red 101** (iron oxide: mars red)
    5 tbls. (75 grams) retention agent
    6 tbls. (90 grams) pigment
11. **Pigment brown 6** (iron oxide: burnt umber)
    5 tbls. (75 grams) retention agent
    6 tbls. (90 grams) pigment
12. **Pigment white 6** (titanium dioxide)
    2 tbls. (27 grams) retention agent
    2 tbls. (27 grams) pigment

Suggestions and precautions

1. Always dilute a tiny amount of colorant or chemical when adding it to a very large amount of pulp. This ensures better dispersion.
2. If pigment dries onto the container or its lid, be sure that flakes of dry pigment do not fall into the jar or the pulp, as dried flakes of pigment can cause blotchy or mottled paper. If necessary, strain the pigment through a nylon stocking.
3. Handle the colorants and other chemicals with care at all times. Observe the precautions listed on the labels. Do not ingest or inhale. Safety data sheets on each of the pigments are on file at the Carriage House and are available upon request. For more information on art hazards or safety, consult the Center for Occupational Hazards, 5 Beekman St., NYC, NY 10038
4. All Aardvark colorants have been personally tested by the Carriage House Studio. Aardvark Colors does not assume responsibility for unsatisfactory or harmful results incurred by users of these products or methods. Complete information on all these pigments, as well as other potential colorants, may be found in Color for the Hand Papermaker, a manual published by the Carriage House Press

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CONDENSED INSTRUCTIONS FOR THE PI SYSTEM

Photographic Process developed by Catharine Reeve & Marilyn Sward for *The New Photography*, Prentice Hall, 1984

The following instructions are for use with handmade paper made using Hercon 40 as an internal size or Kozo papers using Aquapel as the internal sizing agent. Fine Art papers of 100% Rag content such as D'Arches + FABRIANO are also useable.

MATERIALS NEEDED:

The following are in addition to standard Darkroom equipment

1. Rockland Colloid "Liquid Light"
2. Sauce pan and hot plate or burner
3. Small wide mouth container and brushes
4. High contrast 35mm negatives
5. Extra strips of paper for test strips
6. Dektol developer in a 1:2 solution
7. White Vinegar in a 1:2 solution with water
8. Rapid Fixer with Hardener
9. Permawash
10. Helpful but not essential: Contact Print frame, Large Paper Safe or Light-tight box, 3M step table, two polyester screens for drying

Steps:

1. Heat the emulsion bottle in water until you feel it become liquid do not shake the bottle, and do not open until in the darkroom.
2. Mark back sides of paper to be coated with an "X" as emulsion dries clear.
3. In the darkroom pour the emulsion into a container and brush onto the paper surface. Also coat a test strip for each different paper
4. Leave papers out to dry in the dark. Turn off safelight.
5. After papers are dry clip test strips to paper and store in box.
6. Test exposure. Average time will be 20sec. at f4.
7. Set up chemicals, all must be between 60-70 degrees.
8. Developing times are: Dektol 1-2min., Stop bath 2-4min., Fixer 10m Water wash, Perma-Wash, Final wash, each at least 10 min.
9. Place on Polyester screens to dry and to prevent curling set second screen on top. NEVER dry mount these images.

PHOTOGRAPHIC PROCESSES CONTD.

NOTE: Properly sized handmade papers work well with many different alternative photographic processes. Some you might wish to try;

1. Cyanotype
2. Gum Bichromate
3. Salt Paper
4. Kallitype, Van Dyke, or Brown Print
5. Platinium, Palladium

SOURCES of SUPPLY:

Kits with instructions for the above processes:

Photographers Formulary
PO Box 5105
Missoula, MT. 59806

LIQUID LIGHT is available at most large photo supply houses or direct
Rockland Colloid Corp.
302 Piermont Ave.
Piermont, New York 10968

ADDITIONAL READING:

THE NEW PHOTOGRAPHY, Catharine Reeve & Marilyn Sward, Prentice Hall 1984.
ALTERNATIVE PHOTOGRAPHIC PROCESSES, Jan Arnow, Van Nostrand Reinhold 1982.
KEEPERS OF LIGHT, William Crawford, Morgan & Morgan, 1979.

"My own creative work comes to me like a gift, pushing itself into my consiousness.... To be a creative person is a significant privilege as well as a great responsibility."

Ruth Bernhard
from Recollections
by Margaretta K. Mitchell

COLORING AGENTS FOR PAPERMAKING

by Marilyn Sward

Papermakers are concerned with coloring agents that easily combine with water and cellulose. Another primary concern for artists is the lightfastness of that coloring agent when combined with the fiber.

To speak of coloring agents it is important to understand that cellulose pulp has a chemical charge which is negative (anionic) and that most dyes and pigments also are negatively charged. This makes it difficult for them to adhere to the fiber without the addition of a positive (cationic) charged substance in the form of a retention agent.

Color is referred to using two terms: Hue being the actual color and Saturation being the density of the color. We may have a red hue low in saturation making it "pink" or high in saturation making it "scarlet."

The following is a grouping for coloring agents:

1. VEGETABLE DYES - These dyes may be made from any natural substance by cooking the plant material for approximately one hour, straining the vegetable matter from the liquid and mixing the liquid with fiber that has been beaten. This mixture is cooked for 1/2 hour, drained, washed with a mordant (common mordants are lye or wood ash, alum, caustic soda, cuperic sulfate). Then the fiber is washed clean. These dyes are interesting; however, the mordants are harmful to the archival properties of the paper and the resulting colors are seldom lightfast.

   Natural materials for dyes are: onion skins, walnut husks, madder, cochineal, marigold.

2. BASIC DYES - These are hydrochloric salts of color bases. They are high in saturation but poor in lightfast properties. They are used primarily in the paper industry for low grade papers.

3. DIRECT DYES - These are sodium salts of azoic compounds. They are intense and bond well to cellulose but are not lightfast

4. ACID DYES - This is alkali salt of a sulphonic acid. They are used in textiles because they are able to bond to wool and silks. They are used in the paper industry to deepen color. Their lightfastness is poor.

5. PIGMENTS - These are substances grouped according to the attached chart. They are considered organic in the chemical sense as being derived from carbon based materials or inorganic, mineral based.

Naturally occuring inorganic pigments (such as raw umber) are the colors of antiquity and are very permanent. Very few of these inorganic pigments are "natural" as we use them today. They are produced synthetically. They also have the disadvantage of taking larger amounts to produce strong color. Pigments become "fillers" and can cause the paper to weaken when they are used in large quantities.

It is important to know that Color Index numbers and names are given to pigments. The number will indicate the pigment's chemical composition. The Color Index name will also contain a number, for example, Pigment Blue 15, Color Index number C.I. #74160.

The following pigment groupings with their Color Index # colors are recommended for lightfastness by Elaine Koretsky.

1. Carbon: Pigment Black 7

2. Iron Oxides: Pigment Yellow 42
Pigment Red 101
Pigment Brown 6

3. Phthalocyainnes: Pigment Blue 15
Pigment Green 7

4. Azo: Pigment Yellow 83
" " 74 (LF)

5. Dioxarzine: Pigment Violet 23

6. Quinacridone: Pigment Red

These pigments are all used with a retention agent.

RETENTION OF PIGMENTS

Retention agents hold the pigment to the fiber because the retention agents are cationic (positively charged). Lee McDonald sells #292 which has a high molecular weight and is a polyacrylamide. To aid in processing this it may be added to methanol alcohol. This keeps it from "clumping".

1. Fill blender with water (4-5 cups).
2. Add 1 "pinch" (1/8 tsp.) retention agent (may be mixed in alcohol).
3. Blend on high speed 10 seconds.
4. Pour into glass container and let stand 1/2 hour or may be made ahead.

PREPARATION OF PIGMENTS

1. Always wear a dust mask when mixing pigments.

2. Grind a small amount (1 tsp. or less) to a fine dust with a mortar.

3. Mix in a small amount of water (1/4 cup or less) and make a paste. With some pigments it may be helpful to use alcohol rather than water for the paste.

4. Add to beaten pulp and adjust color as necessary. Remember, finished paper is many shades lighter than wet pulp. Squeeze a small piece of pulp dry to test color.

5. Add retention agent to pulp and pigment mixture until the water "clears".

NOTE: In some cases it may be desirable to add retention agent to pulp before adding pigment. This should be tried if it is extremely difficult to retain the color. Some pigments clear quickly. Some may improve with standing. Most should be given at least 15 minutes.

6. Add sizing after color is fully retained. It should be noted that Lee McDonald suggests adding the sizing before the retention agent; however, my experience indicates it is difficult to judge when color is retained if sizing is added first.

To test for retention: Put 1/2 cup retention agent in a glass jar. Add one or two drops of color. It should clump up rather than disperse. If it disperses, a retention agent of the opposite charge should be used.

FOR ADDITIONAL INFORMATION:

COLOR FOR THE HANDPAPERMAKER
by Elaine Koretsky
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Sevans Road
Brookline, MA 02146

Graphic Chemical & Ink
P.O. Box 27
728 N. Yale Ave.
Villa Park, IL 60181

Lee McDonald
P.O. Box 264
Charlestown, MA 02129

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Brookston, IN 47923

FROM: COLOR FOR THE HAND PAPERMAKER by ELAINE KORE

ignorance.

DYES — Natural Organic

1. Direct dyes: saffron flowers, annatto seeds, turmeric rhizomes
2. Dyes requiring mordant: logwood, cutch, suo, marigold, walnut, et al.

Natural dyestuffs produced from animal substances, notably certain shellfish and insects, all requiring use of mordants

lac, cochineal, murex

PIGMENTS — Inorganic

kaolin, orpiment, cinnabar, azurite, lapis lazuli, malachite, iron oxides, e.g., raw sienna, raw umber

PIGMENTS — Organic

indigo, woad, lakes of alizarin and logwood

ALL THE SUBSTANCES LISTED ABOVE THE LINE ARE NATURALLY OCCURRING

ALL THE SUBSTANCES BELOW THE LINE HAVE BEEN SYNTHESIZED IN SOME MANNER

DYES — Synthesized Organic

1. Direct dyes
2. Basic dyes
3. Acid dyes

These are the most common types of colorants used by the commercial paper mills

4. Fiber-reactive dyes
5. Disperse dyes
6. Naphthol (azoic) dyes
7. Vat dyes

These colorants are mainly used for textile dyeing and printing

PIGMENTS — Inorganic, Synthesized from materials of mineral origin

burnt umber, burnt sienna, mars pigments, chrome, cadmium, ultramarine, Prussian blue

PIGMENTS — Organic, Synthesized from carbon compounds

monoazo: hansa, toluidine, para, naphthol, lithol

disazo: diarylide

phthalocyanine

quinacridone

anthraquinone

indigoid

carbazole dioxazine

carbon (produced by burning certain organic substances; not synthesized)

Figure 1. Chart showing relationship of some common dyes and pigments.

Directions for specific pigments:

Use these amounts as a guide to the best color saturation without overloading the pigment. Feel free to experiment with other amounts. The iron oxides will not give as intense saturation as some of the other pigments do in any amount.

Pigment Blue 15 phtalocyanine
1. Add 24 gm. (1 1/2 T) pigment

Pigment Green 7
1. Add 45 gm. (3 T) pigment

Pigment Yellow 83 diarylide - azo: orange-yellow
1. Add 32 gm (2 T) pigment

Pigment Yellow 74 (LF) arylide - azo: lemon yellow
1. Add 16 gm (1 T) pigment

Pigment Red 112 naphthol
1. Add 32 gm (2 T) pigment

Pigment Violet 23 carbazole dioxazine
1. Add 36 gm (2.5 T) pigment

Pigment Black 7 carbon
1. Add 78 gm (5 T) pigment

Pigment Yellow 42 iron oxide ochre
1. Add 60 gm (4 T) pigment

Pigment Red 101 iron oxide: mars red
1. Add 75 gm (5 T) pigment

Pigment Brown 6 iron oxide: burnt umber
1. Add 75 gm (5 T) pigment

Quinacridone Red
1. The pigment is in powder form, and must be dispersed in water. Weigh out 12 gm (4 T). Using a mortar and pestle, grind the pigment into a paste with a dew drops of alcohol or ethylene glycol and water. After it is in smooth paste form dilute further with water, as mentioned in general directions. If the pasting seems difficult, then put the pigment/water in a blender, with some pulp, and let the blender hydrate it all for a few seconds.

Suggestions and Precautions

1. Be aware that the only truly accurate measurements of these substances is by weight. Using a triple beam balance, it is very easy to measure extremely small amounts. All measurements are in grams, though approximate volume measurements of tablespoons are listed in parentheses. It is important to stress that the conversions from weight to volume are approximate, and vary from one substance to another. For instance, 1 Tablespoon of Pigment Red 101 weighs 26 grams, and 1 T of Quinacridone red powder weighs only 3.5 grams. Each substance has its own specific gravity, which is the ratio of weight to volume, using water as the standard. Thus a strict weight measurement is the most accurate. The volume approximations will also work, though the final result may not be identical to the samples made by weight.

2. Always dilute a tiny amount of colorant or chemical when adding it to a very large amount of pulp. This ensures proper dispersion.

3. Handle the colorants and other chemicals with care at all times. Observe the precautions listed on the labels: Do not ingest or inhale. The powdered pigments create a fine dust which may be irritating, and a face mask should be worn until the pigment is in a water dispersion. Data safety sheets on each of the pigments are on file, a set of them is available for $2.00. For more informatin on art hazards and safety, consult the Center for Occupational Hazards, 5 Beekman St. New York, NY 10038.

4. Aardvark Colors does not assume responsibility for unsatisfactory or harmful results incurred by users of these products and methods.

5. Complete information on all these pigments may be found in <u>Color for the Hand Papermaker,</u> a manual written by Elaine Korestky, can be ordered through us.

Lee S. McDonald *Fine Hand Papermaking Equipment*
523 Medford St. Charlestown, Massachusetts *617-242-2505*
Mailing Address: P.O. Box 264 Charlestown, Ma. U.S.A. 02129

Karen Stahlecker, 1985
Papermaking Workshop
Visual Arts Center of Alaska

DYES

PAPER PULP AND PROCION "M" DYES

1. Know original dry weight of fiber

	* %wf (dyestuff)	** salt %wf	soda ash %wf
Pale	.5%	20%	9-10%
Medium	1.5%	40-60%	9-10%
Dark	4%	106-160%	9-10%
Very Dark	8+%	266+%	9-10%

*% of weight of dry fiber - adjust for known weaker and stronger colors.

**more can be used as necessary to increase dye saturation.

2. Color is obtained by the relationship of (weight) amount of dye (salt and soda ash) and weight of dry fiber, NOT the amount of water. Use amount of water necessary to easily stir the paper pulp. Use a drying container (glass, plastic or stainless steel) large enough to hold fiber and water with additional room to add salt and soda ash dissolved in additional water.

3. Blend measured dye with small amount of cold water to form a smooth paste.

4. Add very warm water to this paste and stir to dissolve.

5. Water in dying container is at 105° (approximately.) Add dissolved dye; add wet but strained (thick) pulp and stir very well.

6. Measure salt and dissolve in very warm water. Add 1/3, stir well, wait 5 minutes; add 1/3 more, stir well; wait 5 minutes; add last 1/3 - stir well; leave for at least 15 minutes, (or even overnight, if time permits) stirring occasionally. More salt may be used for even deeper colors.

7. Measure soda ash, add to warm water to dissolve, add to fiber and dye bath. Agitate frequently, during the first 10 minutes - total reaction period is a minimum of 45 minutes.

8. After soda ash reaction, pulp may be strained and rinsed OR - Carriage House amber retention agent (10 ml/liter H20 for 200-300 gm fiber) is measured, diluted with water and stirred into pulp - leave at least 15 minutes. Then strain and rinse pulp.

9. Pulp should be well rinsed and show no sign of bleed before ready to use.

aardvark colors

INSTRUCTIONS FOR THE USE OF AARDVARK COLORS

Aardvark colorants are pigments formulated specifically for the coloring of paper pulp. They have been carefully selected for their coloring properties and excellent light fastness. Pigments are insoluble, finely ground particles which are deposited physically on the fiber, and must be held onto it by mechanical means. The pigment has no affinity to the material it is coloring, and requires the use of a retention aid to hold the pigment to the fiber. The retention aid acts like a bridge to link particles of pigments to individual fibers. Without use of a retention aid it will take more pigment to get the same intensity of color and the pigment will tend to run. We recommend our Cationic retention aid #292 as being the most suitable. Use it in quantities recommended in the retention aid instructions.

Method of Application

The directions given below are for coloring 400 grams (14 ozs) of dry fiber. The measurements given for specific pigments below will give the deepest saturation of color without pigment overloading. Lesser amounts will produce lighter hues while greater amounts will not affect the color appreciably.

The order of addition is :

1) Pulp
4) Sizing (if using)
3) Pigment
2) retention aid change the charge of pulp

1. Prepare the 400 grams of fiber in a lightning mixer, beater etc.
2. Shake the water dispersed pigments well as the pigment tends to settle, measure the desired amount of pigment and dilute in 1 liter of water, stir well.
3. Add the pigment to the pulp and let run 5-10 minutes more.
4. Add retention aid as according to its instructions and mix for another 5-10 minutes.
5. Check for color retention if there is color still in the water add more retention aid.
6. At the end excess pigment can be removed by rinsing in a strainer with several gallons of water. In many cases this is optional and should be done only as needed.
7. If you are having trouble retaining color try reversing the order of the addition of pigment and retention aid.

ULP — → CHARGE T
PIGMENT —

Lee S. McDonald Fine Hand Papermaking Equipment
523 Medford St. Charlestown, Massachusetts 617-242-2505
Mailing Address: P.O. Box 264 Charlestown, Ma. U.S.A. 02129

MIYAKO DYES

Aiko's Art Materials Import
714 N. Wabash Chgo, IL

For dying fibers for papermaking such as abaca, hemp and kozo, Miyako DIRECT DYES may be used as follows.

PREPARE THE PULP FOR DYEING: Break up the pulp so that the dye will be absorbed evenly. Kozo may be dyed after cooking and rinsing but before beating or may be dyed after beating. Abaca and hemp should be presoaked and either broken up with a paint mixer or a short time in the blender.

AMOUNT OF DYE: Dyes come in 2/3 oz. bottles. This amount will dye 1 lb. of material to a medium shade or 1/2 lb. material to a dark shade.

UTENSIL FOR DYEING: Enameled pot large enough to immerse fibers entirely and have room to stir.

AMOUNT OF WATER FOR DYEING: Enough water to easily stir the fibers. The amount of water in the pot does not affect the intensity of the finished color--this is determined by the amount of dye in proportion to the weight of the pulp (dry weight.)

ASSISTING AGENT: Salt is used with DirectDye for better dye penetration into the fibers: 1/4 c./ light colors, 1/3 c. for dark colors, and 1/2 c. for black or indigo. (Proportions based on 1 lb. fibers and full bottle of dye.)

DISSOLVING DYE: Use a small bowl or glass jar, put dye into container then add 1 cup (or less) of BOILING water. Stir well, dissolving dye completely. This concentrate can be stored indefinitely if covered tightly and kept cool.

COLD DYE METHOD: Pour some boiling water into the dying pot and add the necessary amount of concentrate. Stir well, then add cooler water to amount needed to cover fiber. Add wet, prepared fibers and stir well. Stir frequently and leave in dye about 30 min. to an hour.

USE OF ASSISTING AGENT: Add the amount of salt needed to boiling water, stir to dissolve, then stir into the vat after about 30 min. of dyeing time has passed. Leave for 10-30 minutes, frequent stirring.

RINSING: Complete and thorough rinsing to remove all salt and excess dye is critical. It is easiest to put the pulp in a screen type strainer and pour first warmer then cooler water through the pulp until the water runs clear.

File Name:

Paper Fibers

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FIBERS FOR PAPERMAKING

by Marilyn Sward

In the 18th centry Dr. Jacob Christian Schaffer took 18 months to produce paper from wasps nests, sawdust, willow wood, tree moss, hop tendrils, aloe leaves, barley, hemp, mulberry, stinging nettles, clematis, wood bullrushes, cabbage stalks, lily of the valley, water moss, potatoes/skins and insides, horse chestnut leaves, and tulip leaves. He was trying to replace rag pulp. It took almost 100 years before the paper industry saw the potential in these alternatives.

Fibers may be grouped into three categories:

1) Animal; wool, hair, fur

2) Mineral; asbestos, synthetics

3) Plant

Plant fibers are most important to handpapermakers. There are five subgroups:

1) Seed hair - Seed hair of plant: cotton

2) Bast - Inner bark of stem: linen, hemp, kozo, mulberry

3) Leaf - Manilla, corn husk

4) Grasses - Straws, bamboo, iris

5) Wood - Coniferous: pine
   Deciduous : aspen/poplar

These vats should not be over 2 1/2 feet deep and may be lined with heavy gauge plastic sheeting. Vats are filled with water before the pulp is added.

PULP

It is important to note that the best pulp is prepared by using a hollander type beater. This equipment hydrates the fiber without cutting it. However, for experimentation, a home or commercial blender may be used. Paper of high quality may be recycled by tearing it into 1" squares, soaking it in water (the longer the better - even overnight) and then adding it to the blender which should be 3/4 full of water. Add no more than one cup of cut paper to the blender or the motor will burn out. Woven fabric may also be recycled for pulp. Use natural fibers and cut pieces approximately 1/4 to 1/2" square. Cook these by boiling in water to remove dye and sizing. A caustic such as washing soda may be used to begin breakdown but care should be taken to rinse the cloth carefully after cooking.

It should also be noted that abbaca linters available from Lee McDonald break down easily to form a very high quality pulp. Again they should be torn into 1" squares. This is easier to do if the linter is dampened first. It is helpful to soak the linter before blending it.

Pulp should be collected in a bucket after blending. Each blenderful will make approximately three (3) 8 1/2 x 11 sheets of average thickness. You may use this as a guide to determine the amount of pulp to prepare. Pulp is added to the vat to reach the desired consistency. The ratio of pulp to water determines the thickness of the finished sheet. And pulp should be added to the vat as sheets are formed to keep the ratio the same. Usually this is done after 2-3 sheets are completed.

SHEET FORMATION

A felt is placed on a hard waterproof surface. It may be placed in a large photo tray to contain the water run off. The surface of the felt is dampened with a sponge and water. Next the pulp in the vat is stirred to distribute it evenly. If internal sizing is to be added it is done at this time. The stirring is repeated to disperse the sizing. The mould and deckel attached together are grasped firmly in both hands and placed parallel to the back side of the vat perpendicular to the water surface. In a single motion the mould and deckel are drawn down under the water in a scooping motion parallel to the bottom of the vat and lifted straight up out of the water keeping the mould surface flat and parallel to the water surface. As the mould is drawn up above the water surface it is jiggled from side to side and front to back to align the fibers for strength. Water is allowed to drain from the mould, the deckel is removed and the mould is placed long edge down perpendicular to the felt surface. The mould is carefully rocked down to allow the paper surface to transfer to the felt. This process is called couching (pronounced "kootching"). Another damp felt is then placed on top ready for the second sheet. The process is repeated until a "post" or stack of 10-15 sheets have been formed.

PRESSING
DRYING

The type of drying used controls the finished surface of the paper and the degree of cockle or buckling the paper does. For ideal surface character and close fiber formation, papers should be placed into a hydraulic or weighted press to remove excess water. The post may be placed between boards and weight may be applied to the top. If this method is used, it should be left weighted for at least 1/2 hour. If ironing is used each sheet of paper is ironed dry individually using a top cloth to cover the paper surface.

After pressing (not ironing), sheets of paper are carefully lifted from the felt surface and placed against a formica board. They are then brushed using a wide soft brush from the center to the edges much in the manner of applying wallpaper. Papers should remain against the boards until thoroughly dry.

CLEAN UP

Be certain to protect all drains from pulp. Plumbers love papermakers. Empty the vat by sieving pulp and water. Pulp that has been separated may be gathered into a ball and squeezed to remove remaining water. This ball may be left to air dry or refrigerated or frozen. It may then be soaked and briefly blended again with water to reuse.

JOHN MASON: PAPERMAKERS BEWARE.
THERE IS A MAGIC AND A MYSTERY IN THE PROCESS.
WE STOLE IT FROM THE WASPS AND
THEY HAVE BEEN VENGEFUL EVER SINCE.

PROPOSAL

Starting with three kozo fibers* (Nasu, Thai and Japanese Green Bark) produce a printing paper from each for comparison. Sizing of the paper along with printing using the traditional Japanese water base technique will also be used for comparison of the papers characteristics.

* A fouth fiber was added-Alabama kozo

PROCEDURE

	beginning dry weight	% of cook/ time	picking time	beating time
Nasu	250 grams	20% cook/ 3 hours	2 hours	45 minutes
Japanese Green Bark	250 grams	20% cook/ 3 hours	2 hours	75 minutes
Thai	250 grams	20% cook/ 3 hours	2 hours	45 minutes
Alabama	350 grams	20% cook/ 5 hours	1 hour	30 minutes

All fiber were scraped down to the white inner bark. Thai kozo has a brown film different than the bark on the other fibers. After soaking this film softens and can be easily removed to lighten the final color. The other fibers have dark bark can be separated and pulled off. The Alabama kozo was the easiest to remove.

Along with scraping the only different process was in the rinsing of the fiber. After the cook each fiber was thoroughly rinsed to lighten the color of the fiber. An additional rinse was also done after beating

Nasu sheets formed quickly with few strings and clumps in the vat. Some problems with sheet sliding on su during forming. Final sheet is a warm off white.
Japanese Green Bark vat was stringy with some discolored fiber. Final sheet is white with most stringy fiber in the sheet.
Thai sheets formed slowly but overall formation was the best. Final sheet is white.
Alabama vat had few clumps and formed easily. Final sheet is a warm beige.
A Mixture of the remain fiber from the other vats was combined to form additional sheets. The vat was stringy with clumps because it was the tailends from the other vats.

The different sheets were sized with a 6% glue solution that was brushed on. This proved to be too strong of a solution, so after drying the paper was soaked to release some of the glue. This also helped to dampen the paper for printing.

The printing was done on four woodblocks of mahogany and pine. The mahogany has a open grain which show on the finished print, but this wood is brittle and will not support line work. The pine will support lines and was used for the red block. I used watercolors in the traditional Japanese technique with the exception of using rice paste in the process. Unfortunately my printing is not consistant enough in this technique to draw srong conclusions about the different papers.

The only paper that I had problems with was the Alabama kozo. During printing there was some delamination of the paper during the rubbing to transfer the color to the sheet.

CONCLUSION

All the different fibers worked well in the project. Though the Alabama kozo did not do well in printing, it was the easiest fiber to prepare and took less time to prepare. If I was forced to pick the best paper it would be the Thai kozo. When time is taken in scraping and rinsing it produces a white sheet and when compared with the others has the best formation and fewest imperfections (stringy fibers, specs and clumps).

Nasu

Japanese
Green Bark

Thai

Alabama

Mixture of
all fibers

ADDITIONAL FIBERS

by Marilyn Sward

There are several natural fibers that may be gathered locally and prepared for papermaking. The following is a brief description of a few of these. For more extensive information consult Lillian Bell's book Plant Fibers for Papermaking.

MILKWEED

HARVEST:	Early fall before pods are open. Remove leaves and top section with pods.
PREPARATION:	Steam cut stalks for 1/2 hour until outer layer peels easily. Bark may be scraped with a knife or left 2 weeks to soak off.
COOK:	Use 1 quart soda ash in 4 gallons of water. Cook for 3 or more hours. Let stand overnight before rinsing. Rinse and remove dark specks.
BEAT:	Hand beating is easy. Fibers are short and somewhat difficult to contain in beating area.
FORMATION:	May be used for Eastern or Western sheet forming. Board drying is recommended.

CATTAIL

HARVEST:	Either green or dry. Finished color of paper will dry either tan or brown. Caution: Cattails are considered protected plants in some areas so do not harvest without checking local regulations.
PREPARATION:	4-6 oz. of soda ash per gallon of water is used for this. Cook down twice. Cook once and allow to stand overnight. Drain and rinse and add fresh water with new soda ash. Cook another 4-5 hours and again allow to stand overnight. Rinse.
BEAT:	Difficult to hand beat. Cut in small pieces for blender or process in hollander.
FORMATION:	Eastern or Western board drying.

CORN HUSKS
CORN STALKS

HARVEST:	Fall after crop is harvested. Color of paper varies from light green to tan depending upon dryness of plant.
PREPARATION:	Use stalks and seed husks. Steam stalks for 2 hours to loosen fiber. Soak husks at least 24 hours. Cook with 4 oz. washing soda per gallon of water for two hours. Do not overcook or it will become sticky.
BEAT:	Difficult to beat husk fiber by hand. Cut into small pieces for blender or use hollander.
FORMATION:	If well beaten: Eastern or Western. If long fiber remains: Nepalese Indian poured method.