

Chapter 10

Paper and Boards

10.1 Introduction

Water hyacinth fibre can be used to produce a range of extremely attractive, speciality papers. The following are some examples;

Card for greetings cards
Attractive writing paper and envelopes
Paper for painting and drawing
Decorative card covers
Paper and card for crafts
Wrapping paper
Paper for degree or diploma certificates
Blotting paper
Greaseproof paper



Figure 10.1 Card produced in Indonesia from water hyacinth and rice straw.

The picture shows the attractive grain, superimposed with a print of the water hyacinth.

Paper produced using water hyacinth does not pretend to compete with mass produced writing paper which is made from wood pulp and is usually bleached. Rather it fills a particular market niche, for those occasions when one wants paper to be a thing of beauty.

10.2 Simple paper-making

- The following is a simple process for making paper from water hyacinth. Success with this could give you the confidence to try the procedures described in paragraph 10.3.
- Collect water hyacinth.
- Dry in the open until semi-crispy.
- Cut off the stems - use the leaves and roots for other purposes.
- Cut the stems into small cubes.
- Weigh 1gm of cubes - or take one large handful.

- Put these cubes into a blender with 3½ cups of water and mix for 30 seconds. (Given no electric power, you could use a pestle and mortar, or the grinder described in Chapter 13).
- Pour into a bowl half full of water.
- Repeat this sequence with four further one gram quantities.
- Make a wooden frame with a fine gauze. Slide it under the hyacinth and put on the bottom of the bowl. When the water has settled, gently raise the frame.
- Using a small, dry cloth, pat the water hyacinth to make it as dry as possible.
- Spread a larger cloth out on the floor. Turn the frame over, lay it on the cloth and pat more with the small cloth.
- Lift the frame so that the water hyacinth paper falls on the cloth.
- Place another cloth on top of the water hyacinth, and several newspapers on top of that. On top again, place a wooden board, and a rock or something heavy.
- After 30 minutes, take everything off the water hyacinth paper, peel it carefully off the cloth and lay it out to dry for 24 hours.

Experiment with different proportions of water hyacinth pulp and waste paper pulp, until you have the paper you like best.

10.3 Paper-making in detail

The following procedures have kindly been provided by the Mennonite Central Committee in Bangladesh. This is how they produce Biborton handmade paper.

At the household level, to produce small quantities of paper, you may take only 10% of the quantities stated below. Try to develop your own techniques for small-scale production. Do not be frightened if you feel that what follows is rather sophisticated.

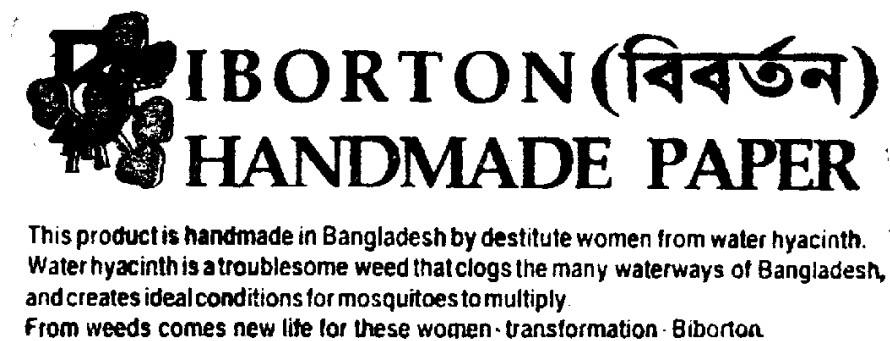
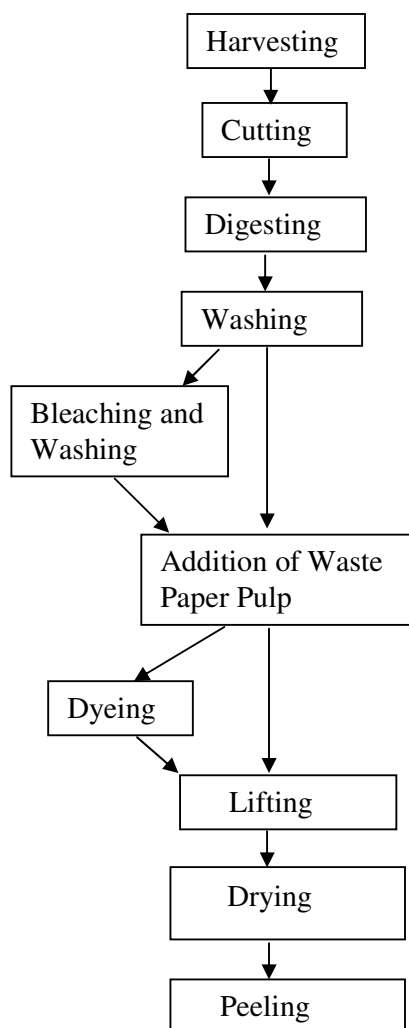


Figure 10.2 A copy of the leaflet enclosed with sales of Biborton paper

Summary of paper making procedure



Stage 1. Collection of stems.

Stages 1 and 2 must be undertaken on the same day.

Procedure

1. Find mature water hyacinth plants, i.e. plants that have stems at least 45 cm long.
2. Remove the leaves and roots with a bill-hook or sickle.
3. Tie into bundles of 250 to 300 stems. You need about 40 kg.

Stage 2. Slicing and Beating

This stage requires a mill. For instructions on how to make a simple but adequate mill, see under "Grinder or Mill" in Chapter 13.

Procedure

1. Cut the stems into short pieces, of not more than 12 cm in length.

2. Crush these pieces in the mill. Small amounts can be crushed using a pestle and mortar.

Stage 3. Boiling and Washing

Equipment and materials:

1. A stainless steel or enamel pot of about 60 litres capacity.
2. A heat source, possibly a fire of wood or dried water hyacinth.
3. A wooden stick for stirring.
4. A traditional hanging balance.
5. A bamboo basket, loosely woven, with dimensions of about 56 cm diameter and 10 to 15 cm deep.
6. A nylon net - capable of retaining the fibre and releasing the liquid.
7. Caustic soda (sodium hydroxide).



Preparation

1. Clean the boiling pot thoroughly.
2. Place 40 kg crushed water hyacinth in a bamboo basket.
3. See the note that follows on caustic soda. For ordinary paper, weigh 200g caustic soda. For natural unbleached paper, weigh 50g caustic soda.

Figure 10.3 A Greetings Card made in Bangladesh from water hyacinth and waste paper pulp. This black and white representation does not do justice to the beauty of the design.

Safety Note: Caustic Soda

Handle caustic soda with great care, as it burns the skin. Wear rubber gloves and safety glasses. Always wash hands well. Keep well out of the reach of children! If a child swallows some caustic soda, it must drink a lot of milk, or several litres of water that contains a little lemon juice or vinegar (to neutralise the alkali of the caustic soda).

Keep caustic soda in an air-tight container, as otherwise the humidity in the air will turn it into a liquid. Ideally use a home-made clay pot, failing that a plastic or enamel container, not a metal one, because caustic soda attacks all metals.

Procedure

1. Fill the boiling pot about half full with water and bring to the boil.
2. Allow the water to cool. With great care, add the weighed caustic soda. Stir carefully until it is all dissolved.
3. Add the 40 kg water hyacinth, and continue to boil for 7 to 8 hours. Stir occasionally. After this time, the stems should have turned black, and be noticeably softer.
4. Line a bamboo basket with the nylon net. Wearing gloves, pour the boiled water hyacinth pieces into the basket.
5. Wash the stems in the basket until no more black colour can be seen draining from the basket.

Stage 4. Bleaching and Washing (optional)

Boiled pulp is black in colour, and must usually be bleached before being made into paper. Bleaching is unnecessary if the paper is to be a natural colour, or to be dyed ash, maroon or bottle green.

Equipment and materials

1. A clay pot with a volume of about 60 litres. A round pot 66 cm in diameter and 35 cm deep has such a volume.
2. Rubber gloves.
3. Traditional hanging balance.
4. Large stainless steel spoon.
5. Plastic mug, capable of measuring 1 litre.
6. Polythene sheet to cover the clay pot, about 75 cm square.
7. Bamboo basket, as in stage 3 above.
8. Nylon net - as in stage 3 above.
9. Bleaching powder. Calcium hypochlorite, containing 55% to 65% available chlorine, is ideal. Always wear gloves when dealing with bleaching powder or solution.

Procedure

1. Clean the 40 litre clay pot thoroughly.
2. If the paper is not to be dyed later, weigh out 300g bleaching powder on a hanging balance. If it is to be dyed later in any colour other than ash, maroon or bottle green, weigh out 100g bleaching powder. Place the powder in a 1 litre plastic mug and fill the mug with water. Stir to dissolve the powder.
3. Place the boiled water hyacinth in the clay pot. Add the bleaching powder solution, and additional water until the hyacinth is just covered. Stir thoroughly by hand.
4. Cover the pot with a sheet of polythene and leave it for 30 minutes, after which time the fibre should be lighter in colour.

- Line the bamboo basket with a piece of nylon net, and pour the bleached fibre into the basket. Wash the fibre in the basket until no bleach smell remains.

Stage 5. Waste paper pulping

Water hyacinth pulp needs to be washed with waste paper pulp in order to produce paper with sufficient strength.

Equipment and materials:

- Waste white paper. Waste paper can be collected from schools and offices. The paper must be white writing paper. Newspaper and newsprint are not suitable.
- Waste paper pulper.
- Clay pot of volume about 60 litres as in Stage 4 above.
- Traditional hanging balance.
- 1 litre plastic mug
- Bamboo basket
- Nylon net.

Procedure

- Weigh 1kg waste paper, and tear into pieces about 5cm square by hand.
- Place in the clay pot, just cover with water, and soak for 24 hours.
- Clean the pulper thoroughly. Place half this paper in the pulper, fill the pulper 3/4 full with water, put the lid on and run until the mixture has a smooth consistency - usually after about 15 or 20 minutes.
- Drain the pulp using the bamboo basket covered with the nylon net.
- Repeat the procedure with the other half of the soaked paper pieces.
- Take up the corners of the nylon net and squeeze out the excess water.

Mirrorwork Snowflakes

These beautiful cards are made in the rural areas around Mymensingh in Bangladesh, where skilled craftspeople have been producing fine embroidery for centuries.

Many hours of patient work are spent creating the beautiful embroidery for these cards. The fair wages paid to the craftspeople, mainly women, give them a degree of financial independence and the ability to make choices for themselves and their families.

This unique and beautiful product is made by craftspeople at Ideas International for Traidcraft plc, Kingsway, Gateshead, Tyne and Wear NE11 0NE. Tel: (0191) 491 0591.

Figure 10.4 This note accompanies the Greetings Cards illustrated in figure 10.3

Stage 6. Pulp mixing and Dyeing with chemical dyes

Equipment and materials:

- A lifting vat, about 100cm by 80cm, and 30cm deep. It can be made of wood, concrete or galvanised iron.

2. Traditional hanging balance.
3. Clay pot of volume about 60litres as in stage 4 above.
4. Nylon net, rubber gloves, stainless steel spoon, 1litre plastic mug
5. Dyes.

The amount of dye to be used must be learnt by experience. The amounts recommended are as follows:

Green	400g	Blue	400g
Pink	100g	Purple	250g
Bottle green	150g	Maroon	150g
Ash	50g	Mustard yellow	250g
Navy blue	300g	Bright yellow	300g

Procedure

1. Divide both the water hyacinth pulp and the paper pulp into four equal amounts.
2. Place one part each of the water hyacinth pulp and the paper pulp into the vat, fill 3/4 full with water, and mix thoroughly by hand.
3. If the paper is to be dyed, place the appropriate weight of dye suggested by the above table into the plastic mug, half fill with water and mix thoroughly. Pour this dye solution through a small piece of nylon net and mix by hand for 15 to 20 minutes. Wear rubber gloves. Inspect the fibre carefully to ensure that it has taken the dye.

Stage 7. Paper lifting, drying and peeling

Paper lifting is the process of distributing the pulp into a uniform layer on a net. It needs some considerable skill.

Equipment and materials

1. Lifting vat, as in stage 6.
2. Lifting net. A wooden frame of outside dimensions 66 cm by 51 cm is made from wood between 2 cm and 2.5 cm square. Nylon net is stretched over the frame and secured in place.
3. A small sharp knife.

Procedure

1. Stir the pulp mixture (either dyed or undyed) in the vat by hand to make sure the pulp is well suspended.
2. Grasp the lifting net with two hands, and dip it into the pulp, putting the near end in first.
3. Carefully lift the net out of the pulp, leaving a uniform layer of pulp on the net.

4. Place the net in a horizontal position for 2 to 3 minutes, to allow the water to drain.
5. Put the net in the sun so that the paper is completely dry. It may be placed vertically. Dyed paper should not be allowed to dry in the sun for more than 5 hours, or it may begin to fade.
6. When the paper is dry, use the knife to prise it up at the edges and carefully peel it off the net.

The paper-making process is then complete. A good quality result can be judged by:

- a uniform thickness.
- no obvious blemishes such as tears or stains.
- a size of 60 cm long by 46 cm wide.

10.4 Variations

The following suggestions are largely based on research undertaken at the Regional Research Laboratories in Hyderabad and Jorhat, India. See Thyagarajan (1983).

Pulping: It is possible to use a mixture of freshly harvested and dried water hyacinth stalks. The fresh material can be crushed in a crusher (possibly some sort of mangle) in order to reduce its bulk.

Boiling and washing: The cooking time, and the quantity of caustic soda used, can be varied, depending on the grade of paper required. If cardboard is to be produced, then the caustic soda should be replaced with about half the weight of lime.

Bleaching: The bleaching process was undertaken at Hyderabad at a temperature of 35 to 40 degrees centigrade for four hours. For a thorough result, the process was repeated, after washing, rinsing with dilute caustic soda and washing again.

Pulp mixing: Cotton rags as well as waste paper were pulped to produce different grades of paper, as shown in Table 10.1: (rags take a lot longer to pulp, typically 5 to 6 hours in stead of 20 minutes)

Stock preparation (i.e. adding of dyes and chemicals): For the various grades of paper and card, the dyes and chemicals listed in Table 10.2 are added:

The mixture needs to be beaten to ensure that the chemicals are taken up by the pulp.

<u>Type of paper</u>	<u>Digestion</u>	<u>Pulp Blends (per cent)</u>			<u>Bleaching</u>
		<u>Water Hyacinth</u>	<u>Rags</u>	<u>Waste Paper</u>	
Bond paper	caustic soda	60	40		two-stage
Art card paper	caustic soda	60	40		two stage
Coloured card paper or cover paper	caustic soda	65		35	single stage
Black photo album paper	caustic soda	50	50 (coloured rags)		none
Cardboards	lime	80		20	none

Table 10.1 Data for Digestion, Pulp Blends and Bleaching

<u>Type of Paper</u>	<u>Dyes and chemicals (per cent)</u>					
	<u>Dyes</u>	<u>Titanium dioxide</u>	<u>China clay</u>	<u>Sodium silicate</u>	<u>Rosin soap</u>	<u>Alum</u>
Bond paper		2.0		4.0	10.0	
Art card paper		2.0		4.0	10.0	
Coloured card paper or cover paper	0.05		5.0	3.0	2.0	5.0
Black photo album paper	2.0				1.0	2.5
Cardboards			5.0	3.0	2.0	5.0

Table 10.2 Data for Dyes and Chemicals

There is clearly scope for experiment with different fibres. The Housing and Building Research Institute in Dhaka, Bangladesh, has experimented with three separate 50:50 mixtures of water hyacinth pulp with pulp from straw, bagasse and banana leaves in making boards.

The Ryan Foundation in India claim that good paper for school note books and printing paper can be produced from a mixture of 30% water hyacinth pulp, 30% pulp from the mulberry plant and 40% paper pulp.

Finishing: The final paper product can be cleaned and then 'calendered' to a smooth finish by passing between two heavy smoothing rolls - if such equipment is available or can be constructed!