

# INDIGO & WOAD

natural and synthetic

MAIWA  
HANDPRINTS

Natural indigo has been known and used for several thousand years. With the possible exception of iron oxides and tannins, it has probably seen longer continuous use than any other dye.

Natural indigo is obtained from indigo bearing plants, the most significant one being *indigofera tinctoria*. This shrub grows wild and is cultivated in tropical areas throughout the world.

The plant produces a colourless glucose based-substance called indican which is a precursor to indigo dye. When the plant matter is fermented an enzyme is produced which, together with oxygen, facilitates the transformation of indican to indigotin (the dyeing component of indigo).

Synthetic indigo was first created in 1880 by Adolph von Bayer. It is chemically identical to natural indigo (but without the additional elements from the plants and the extraction process). Synthetic indigo can be made more cheaply than natural indigo, is more uniform in its concentration and dyes more evenly. Yet many artisans attribute a character and depth to natural indigo which is lacking in the synthetic. The discerning eyes of a textile collectors also favour natural indigo.

Indigotin (indigo powder) is insoluble in water. To use it for dyeing it must be chemically reduced to a water soluble form known as indigo white. When fiber is added to an indigo vat (which is an amber or yellowish-green colour) and then removed, a molecular combination occurs. The indigo white oxidizes back to the insoluble blue form, where it remains in relative permanence.



Lumps of natural indigo - ready to be ground before dyeing.



A compost ball made from fresh woad leaves.

Woad is the common name of *isatis tinctoria*. In Medieval Europe it was the only source of blue dye for textiles before the importation of indigo. Like the indigo plant *indigofera tinctoria*, the leaves of the woad plant contain indican, although in much weaker concentrations. This makes colouring with woad a much more subtle and delicate art. The shades obtained from woad are slightly different from indigo and call to mind the areas where it was most popular - the south of France.

The same recipes that are used for indigo may be used for woad. Simply substitute woad powder for indigo powder.



Shutters painted with woad paint in Lectoure, France.

## Recipe for Vatted Indigo or Woad

Lye-Thiourea Vat and Lye-Hydros Vat

This is the easiest recipe. Maiwa chooses thiourea for it's studio as it has a longer shelf-life and keeps well. The thiourea vat is more forgiving than some of the other vats. This recipe is designed to dye approximately 1 pound (450 g) of cotton, silk, hemp, ramie, rayon, or linen a medium blue (or 2 pounds of fibre (900 g) a light blue). The same amount of indigo will dye twice as much wool to the same intensity.

This recipe can be doubled, halved, or made in any size so long as the proportions are kept constant.

### Supplies Needed:

indigo  
thiourea dioxide or sodium hydrosulphite  
lye (sodium or potassium hydroxide)  
synthrapol soap and soda ash (for cotton)  
orvus paste and vinegar (for wool and silk).

### Equipment Needed:

A large bucket or plastic garbage can  
quart wide mouth mason jar  
quart pot (stainless steel, enamel, or pyrex),  
measuring spoons  
wooden rod or stick for stirring  
rubber gloves.

*Note: dye equipment should be kept exclusively for dyeing.  
Never mix cooking and dyeing equipment.*



White cotton scarves are ideal for indigo dye projects.



An indigo dyer wears her colours, Laos.

### Some notes before beginning

- ⦿ Although synthetic and natural indigo are chemically identical, less synthetic indigo is usually needed in a recipe because it has a higher concentration of indigotin.
- ⦿ Indigo dyeing is rewarding; but it does require proper instruction, experience, commitment, and comprehension of what is going on in the indigo vat.
- ⦿ Deep shades of indigo are best produced by successive dippings in a weak to moderate bath rather than by making a strong bath.
- ⦿ Fabric preparation or scouring is vital. It is paramount that the fibre be free from grease, wax, pectic substances, and oil.
- ⦿ If attempting to overdye with indigo, use indigo last as indigo can be stripped out by other processes.
- ⦿ Indigo can dye all natural fibres and give shades from the palest blue to an almost purple black. The colour achieved depends on the type of vat, the level of indigotin, and the number of dips.
- ⦿ There are many types of indigo vat that have been developed throughout the ages. Each has advantages and disadvantages and every dyer develops a preference. There is the zinc-lime vat, the ferrous sulfate vat, and a whole range of natural fermentation vats.



A prestigious multi-layer indigo jacket from China.

## Scouring

Proper scouring is absolutely essential to good dyeing. Improperly scoured items do not dye level, the dye does not penetrate well and the dyed item will have poor rubfastness.

*Note: fabrics sold as "ready for dyeing" may not need scouring.*

### Scouring Cotton:

1. Use a non-reactive vessel, large enough so that the yarn or fabric will be well covered and not crowded. Fill with water.
2. Add 1 teaspoon Synthrapol and 4 teaspoons soda ash for each pound (450g) of cotton.
3. Simmer for approximately 1 hour. Cotton is full of wax, pectic substances and oil, all of which must be removed. The resulting wash water will be yellow-brown. Bleached white cotton yarns and fabrics may not need as long.

### Scouring Silk and Wool:

1. Use 6 gallons (24 litres) of hot water per pound (450g) of fibre.
2. Add 1 teaspoon Orvus Paste soap.
3. Add yarn, fleece, or piece goods and heat gently 140°F (60°C) for approximately 1 hour. Turn gently but do not agitate.
4. Allow fibre to cool down slowly and then rinse in warm water.

## Preparation of Stock Solution

*Caution: a mask should be worn to avoid inhaling any powders; especially lye, thiourea dioxide, or sodium hydrosulfite.*

1. Fill a quart size wide mouth mason jar with hot water. Dissolve 1 to 1.5 teaspoons of lye.
2. Add 2 teaspoons of fine synthetic indigo powder, or 2 - 4 teaspoons finely ground natural indigo and stir for 2 minutes. (if you have natural indigo in lumps use a mortar and pestle to grind it to a fine powder before adding.)
3. Add 1 teaspoon of thiourea dioxide or 2 teaspoons of sodium hydrosulfite and stir for about a minute.

If reduction of the indigo starts properly, the colour of the surface of the liquid should change to a purplish violet with a coppery sheen. Place a lid on the jar and set aside in a warm room (or place in a pan of warm water) for about 60 minutes. The solution will change from an opaque blue to a translucent brown-yellow as it reduces. Check the stock solution to see if it is ready by dribbling some solution on the side of a white cup. Note the change from clear yellow to opaque blue as the indigo is reintroduced to the oxygen in the air. At this point the stock solution may be used or kept up to a week. If kept longer the solution may need to be revived. Heat gently to about 50°C (120°F) and add some more reducing agent (thiourea or hydrosulfite) and stir well.

## Tips

- ☉ If the stock does not reduce after 60 minutes it may do so if left overnight.
- ☉ The solution does not have to be absolutely clear. A cloudy solution usually means the indigo was not ground finely enough.
- ☉ Be careful not to heat the stock solution above 140°F (60°C). Indigo in its reduced form will be destroyed by excessive heat.



Adire oniko - a tied resist indigo technique from Africa.

## Preparation of the Vat

1. Put 5 gallons of hot water 110-140 °F (45 - 60 °C), in a plastic pail or garbage can.
2. Add 1/8 teaspoon of lye into the water and stir until dissolved. This makes the vat slightly alkaline so that the reduced indigo from the stock solution does not re oxidize when added.
3. Add 1/2 teaspoon of detergent (Synthrapol or Ivory liquid). This will help the indigo penetrate the fiber and will break up oxidized indigo on the surface of the vat.
4. Add 1 teaspoon of thiourea dioxide or 2 teaspoons of sodium hydrodulfite and stir gently until dissolved. Cover the vat and allow it to reduce for about 15 minutes.
5. Carefully lower the jar of stock solution into the vat and pour out the contents (avoid pouring from above as this adds oxygen). Use all the stock solution for cotton or half for the same weight of wool.
6. Stir gently and allow 30-60 minutes for the vat to turn yellowish green.

## Dyeing

Wool should be wetted out prior to dyeing. Cotton, linen and silk may be added either wet or dry for different effects.

1. Add the fabric to the vat carefully, avoid splashing.
2. Wearing rubber gloves, work the fabric through the vat gently, allowing 10 - 30 minutes for this first dip.



An outdoor indigo vat used by ajrakh blockprinters.

3. Squeeze the fiber out underneath the surface as much as possible and gently lift out of the vat. Open the fiber to allow the air to get at the fibre. The colour change from yellow to blue never ceases to fascinate dyers and observers.
4. The fibre may be redipped any number of times to achieve the desired shade. Allow 30 minutes of oxidation (avoid hanging in direct sun) before redipping.
5. If a pale clear shade of blue is desired, reduce the immersion time to about 1 minute. Have a basin of warm water ready and when you take the fibre out of the indigo vat place immediately in the water for 30 - 60 minutes.
6. After the final dip allow the fibre to oxidize 24 hours before rinsing and washing.
7. Final washing is very important to neutralize the pH. Rinse very thoroughly. Wash with a gentle pH neutral soap. Rinse well and dry. Silk and wool benefit from an additional rinse with a small amount of vinegar and water before drying.



The indigo plant

## Disposal or Storage

When the indigo vat is exhausted it will lose its greenish-yellow shade and cloth dipped into the vat will no longer hold a blue colour after washing. At this point the thiourea (or hydro-sulphite) is spent. The vat now is chemically inactive but still has a high pH. It may also still contain indigo. The pH can be brought back down through the addition of vinegar and the vat can be disposed of by pouring down the household drain.

If the vat is not exhausted it cannot be disposed of this way. There are two options, continue dyeing to exhaust the vat or let it exhaust itself by standing over time.

If storage space is available, consider storing the vat. A vat may still contain valuable indigo (or woad). An exhausted vat may be revived through the addition of small amounts of thiourea (or hydrosulphite) and indigo (or woad). A completely exhausted vat may also be reactivated through heating and the addition of a second batch of stock solution.