

# the ORGANIC VAT

for dyeing with indigo



Maiwa Handprints Ltd. and Michel Garcia

## 3 things you need for an Indigo Vat



(powdered indigo)

**Indigo**



(lime - calcium hydroxide)

**A Base**



(e.g. ripe pears)

**A Reducing Agent**

Let's consider each of these things...

### Indigo

Natural indigo is obtained through a non-toxic fermentation of the indigo plant. It is an extract derived from plants. Depending on the variety of indigo available locally, some artisans will make a dye vat directly from the plant leaves.

When buying indigo extract, it may be purchased as lumps (which require grinding) or as a fine powder.



The indigo plant



Indigo being extracted from plants in south India.



Indigo in paste form being cut into squares.



Dried indigo. Sometimes called a cake or rock.

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Some fruits that make excellent reducing agents.



Calcium hydroxide, ordinary lime, hydrated lime, calx - many names for the same thing. The recommended base for the organic indigo vat.

## A Reducing Agent

In many parts of the world chemicals are used to quickly prepare an indigo vat. Sodium hydrosulfite or thiourea dioxide are both commonly used as reducing agents.

A reducing agent removes the oxygen from a solution. In doing this, the reducing agent also takes the oxygen from the indigo molecule. With the oxygen removed, indigo becomes soluble in water at room temperature.

A reducing agent is necessary to make an indigo solution. Without it the powdered indigo is suspended in water but not actually dissolved.



The fish.  
Suspended,  
not dissolved  
in water.

What is the difference between a suspension and a solution? A fish is suspended in the ocean. But salt is dissolved in the ocean. You can see the fish (which remains distinct) you cannot see the salt (which has dissolved by being broken down into separate components).

Many natural substances will behave as reducing agents. These absorb oxygen and are known as antioxidants. In the indigo vat we can use natural sugars from fruits, medicinal plants, and even other dye-plants as reducing agents.

## A Base

Chemically speaking, a base is the opposite of an acid. A base is a substance that will allow the action of any reducing agent. Some bases are rather unpleasant; for example ammonia and caustic soda, while others are weak; such as soda ash and potassium carbonate. Weak bases are not very toxic - but by themselves they are inefficient.

The recommended base for an indigo vat is ordinary lime (calcium hydroxide) also known as "calx" or hydrated lime. Do not confuse it with "quick lime" (calcium oxide) which is much more corrosive, or chalk (calcium carbonate) which will not work. Ordinary lime is available at Maiwa or at a building supply store.

## About these Indigo Vats

We suggest that you take the recipes that follow only as a guide. Adapt them to use materials that are plentiful and inexpensive where you are located. As with all natural dye recipes you may find yourself adjusting amounts to suit your particular dyeing situation. These vats give the best results when made the day before you dye with them.

### Hydrating Indigo

Indigo powder *always* needs to be hydrated before being added to your vat. Sometimes alcohol is used to do this, but we have found a quick and efficient way to hydrate your indigo with marbles.

Simply fill a strong plastic container 2/3 full of marbles or smooth, round stones. Add indigo powder and cover the marbles with warm water. Shake vigorously for one minute. The indigo is now hydrated. Pour the hydrated indigo into the vat while using the lid to keep the marbles in the jar. Swirl a little bit of water in the jar to wash the rest of the indigo out and into your vat.



### Dyeing with a Basket

When using an organic vat, rather than filtering the liquid you may use a basket to keep the yarns or cloth away from the sediment. This is particularly important with the ferrous vat as the iron may cause dots or stains. Stir the vat, wait for the sediment to settle, then use a basket.

### pH

The proper pH is 9 - 9.5 for wool and 11-11.5 for cotton. You may test the pH of the vat with a test strip. If it is too low carefully add some more lime. If it is too high, then add some more fruit juice and wait a little, the pH will decrease.

The addition of more fruit juice from time to time is recommended to keep the vat reduced. Remember, the action of dyeing will introduce oxygen into the vat.

Some fruits are more acidic than others. If using very acidic fruit add more lime at the beginning until the pH is correct.

### Shades

The first shades obtained from your vat will be strongest. You will increase the depth of shades by dipping more times. For very pale shades it is best to make a vat with less indigo and dip more often than to dip once in a stronger vat.

### Exhausted Vats and Revived Vats

These vats may be revived until the amount of sediment becomes problematic. There is an art to reviving an indigo vat (check the pH, adjust, bring it up to temperature) and it can be satisfying to do so, but at some point it will be necessary to abandon the vat and make a fresh start.

### Disposal

If whisked, lime will very quickly absorb the carbonic acid of the air (CO<sub>2</sub>) and be neutralized. The lime will then be transformed into calcium carbonate (chalk or limestone) a non-toxic substance which can be poured down domestic drains. Both liquid and sediment of these vats may be used as compost.

### Variations

Mixing two organic reducing agents, such as henna and fructose, gives a strong indigo vat.

Michel Garcia suggests that individuals do their own experiments. Clear glass pots of about one liter make excellent test vats. Try different combinations or experiment with local plants and fruits.





## The Fruit Vat

Sweet fruits, rich in sugars, make excellent reducing agents. Over-ripe fruits which a greengrocer would throw away are best and may usually be purchased quite cheaply. The waste from jam production, peels, and rotten bits are also good.

### Know your fruit

We have tested a lot of fruit. Here is what we have found: Pears work well - apples do not. Fruit stones, seeds, and pits, often contain tannin that may cause uneven dyeing or marks. Bananas are excellent but must always be peeled. Mangos and peaches work well (take out the pits) plums are not good. Grapes work well - white varieties have less tannin in the skin. Fresh figs can also be used. Remember that the purpose of the fruit is to act as a reducing agent, not to provide a colourant.



In Maiwa's studio we have found that fruit which have ripened on the vine or tree are remarkably better.

### For a vat of about 10 to 15 litres

- 50 g powdered indigo
- 1 kg over-ripe fruit.
- 30 g lime (calx).

In a saucepan, mash the fruit a little and boil in water for a few minutes.

Fill a stainless steel vat  $\frac{3}{4}$  full with hot water.

Filter the juice from the boiled fruits and put in the dye vat. Keep the mash. You may need it to restart or adjust the vat. If you have decided to dye with a basket, you may put all the boiled mash directly into the vat.

Add hydrated indigo to the large vat. The quantity of indigo depends on the depth of shade. But for 15 liters, 50 g will give beautiful dark blues. Add the lime (calx).



The blue flower on top of the vat. For a reduced vat it should be a deep navy blue - not a lighter cobalt shade.

Stir the vat gently. Do not whip it. You do not want air in the liquid. Wait for a few minutes. Then stir again. Repeat this three or four times. The vat will form a bronzy surface and some blue bubbles will appear. The bubbles need to become dark blue and the vat should be a yellow green. There should not be too much sediment in the body of the vat (it should have settled).

Heat until the liquid reaches 120° F / 50° C. You may then turn off the heat. Dip the fabric or yarn you intend to dye. Immerse for 15-30 minutes (up to 60 minutes for wool).

Rinse in cool water. This will expose the indigo to the oxygen that is in the water while also removing particles of dye matter.

Hang in the air in order to oxidize the indigo. It will turn from greeny-yellow to blue. Make certain this process is complete before dipping again.

A final rinse can be done with neutral soap in water. Vinegar should be added (1/2 cup per bucket) for wool.

When you are ready to dye again, check the pH of the vat. The sugar from the fruit neutralizes the action of the lime. So if necessary, carefully add more lime - a teaspoon is suitable. Check the temperature. Reheat the vat.



The coppery surface of a reduced indigo vat. If you draw your finger across the top, the trail in the sheen should not rejoin by itself.

A reduced indigo vat. Note the green tinge to the body of the vat.



## The Date Vat



### For a vat of about 15 to 20 litres

- 75 g powdered indigo
- 90 g sodium carbonate
- 300 g chopped dates (no pits) or sweet date paste
- 250 g lime (calx)

*Prepare as with the fruit vat.*

This is a good vat to prepare over a three-day period. Allow the vat to reduce and come to the correct pH slowly. Remember that sugar reduces the pH so you must keep testing the pH and adding lime.

## The Fructose Vat



### For a vat of about 8 to 10 litres

- 20 g Natural indigo
- 60 g fructose
- 40 g lime (calx)

*Prepare as with the fruit vat.*

## The Henna Vat

This is an easy vat to make. The method is the same as the Fruit Vat, but instead of boiling fruit you boil plant material that is rich in antioxidants. These are dyes that contain flavonoids, for example, henna, madder or osage. Remember that these materials are used as reducing agents, not as colourants. If you have a strong henna vat (for example) and have finished dyeing, you can use the half-exhausted vat for this recipe.



### For a vat of about 15 to 20 litres

- 75 g powdered indigo
- 150 g henna (200 g of madder or osage)
- 50 g lime (calx)

*The procedure is the same regardless of the dyestuff used. Prepare as with the fruit vat.*

Boil the henna for a few minutes and filter. Then boil again in order to extract the full potential of the plant. Combine the two batches of liquid together in the vat.

Add 75 g indigo and more boiling water. Add the lime. Heat to a temperature of 120° F / 50° C.

This vat will give better results if used the next day. When you are ready to dye you must first check the pH. If it is low, correct it by adding some lime. Then warm the vat to 120° F / 50° C - stirring gently from time to time.

This vat can be used until exhausted, or it can be combined with a fruit vat.

## The Secret of a Starter Solution

Sometimes it is easier to get your vat working in a small container and then transfer the contents of the small container to the full-size vat. The contents of the small vat is known as a "starter solution." In a concentrated form the indigo tends to reduce more quickly and completely. Use the hot liquid from the boiled mash (in the case of fruit), all the indigo and half the lime in the starter solution. Add the remaining lime to the filled large vat. Once the starter has reduced it can be added to the big vat. The starter solution needs to be warm in order to reduce. Sometimes a starter solution can also be used to kick-start or revive a dormant vat.



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## The Ferrous Vat

This is called the “1, 2, 3” vat – it is a cold vat that is great for cotton and silk; however, it is not recommended for wool because of the iron.

The Ferrous Vat gives a beautiful dark indigo and has the advantage of being a cold vat that keeps for months. It is good for printing as it does not require long dips. It is a vat that has been known throughout history.

### For a vat of about 10 to 15 litres

- 40 g Natural indigo (1 part)
- 80 g ferrous sulphate (2 parts)
- 120 g lime (calx) (3 parts)

Start with hot water – almost boiling. Add the indigo to the vat, then the ferrous sulphate, then the lime. Wait for the vat to turn yellowy-green. Check for the bronze surface and the dark bubbles. Begin to dye with short dips (10-15 minutes). Oxidize in water and then the air.

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Michel Garcia teaching in the Maiwa Studio

*Michel Garcia is a botanist and dye chemist with a deep knowledge of colour on a molecular level. The recipes outlined here were developed by him to create an efficient indigo vat using eco-friendly ingredients.*

*Michel has been teaching and lecturing at the Maiwa Textile Symposium since 2009. He has worked with Maiwa in India as a dye specialist. Michel and Maiwa founder Charlotte Kwon meet on a regular basis to conduct natural dye research, explore recipes and test procedures. Together they are always looking for techniques that give the most exquisite colours - made to outlast the fibres they adorn.*



Charlotte Kwon teaching the organic vat in Peru.