



## Organic indigo vat 1-2-3

This organic indigo vat method was originally introduced by botanist and chemist Michel Garcia. Natural, organic indigo (i.e. from an indigo plant) is not toxic. However, many dyers use harsh chemicals such as sodium hydrosulphite or thiourea dioxide to quickly prepare their vats. In addition, they may use synthetic indigo. Michel's sustainable method yields a vat which is just as effective using organic ingredients.

### Ingredients



#### Indigo

Many unrelated plant species contain the indican compound in varying amounts due to species as well as growing and processing conditions.

Indigo dye comes in many forms including cakes, compost, and paste. We use indigo dye powder from Indian *Indigofera tinctoria*.

##### Examples

*Indigofera suffruticosa*

*Indigofera tinctoria*

*Isatis tinctoria*

*Lonchocarpus cyanescens*

*Persicaria tinctoria*

*Strobilanthes cusia*

#### Base

Chemically speaking, a base (alkali) forms a solution with pH > 7.0, the opposite of an acid.

We recommend using Calcium hydroxide, known as pickling lime, slaked lime, or hydrated lime. Not to be confused with quicklime (Calcium oxide) or limestone (Calcium carbonate).

You can often find Calcium hydroxide in garden, home improvement, or grocery stores.

#### Antioxidant

An antioxidant removes the oxygen from a solution and the indigo molecules it contains, enabling indigo to dissolve in water at room temperature.

You can brew your own antioxidant syrup using fruit and vegetable scraps - see recipe below.

##### Examples

Fructose

Henna

## Tools



### Gram scale

The best way to ensure an accurate ratio of ingredients is to measure by weight. You can find gram scales at scientific or kitchen supply stores.



### pH test strips

Test and troubleshoot your vat using reliable pH paper that spans 0 - 13. You can purchase pH strips at scientific supply stores.



### Vat container

Tall and narrow vats are helpful as the liquid has less surface area, minimizing contact with oxygen.

For small vats, asparagus steamers with a basket inside to protect your fabric from sediment at the bottom work well.

## Instructions

### Measuring the ingredients

Measure your ingredients according to a 1:2:3 ratio of indigo to base to antioxidant, e.g. 100g indigo + 200g lime + 300g fructose.

There is no right or wrong indigo concentration for your vat. It is a matter of preference based on the understanding that less indigo makes for a lighter shade (and thus more control over the final shade as you build color through multiple dips). In addition, the greater the amount of fabric you dye, the more indigo you need. 100g to 200g of indigo powder in a 5 gallon container with a lid works well to dye medium to dark blue. Just retain the 1:2:3 ratio for the vat to work consistently.

### Brewing an antioxidant syrup

You can brew your own antioxidant syrup by cooking fruits and vegetables (flesh, peels, and tops) in water. You can include citrus skins, but not the acidic citrus flesh.



Fill a pot 1/2 to 2/3 full of organic material, add water, and gently simmer for 30 minutes to 1 hour. You can strain the hot syrup directly into your vat container as indigo reduction progresses rapidly in a warm environment.

It's hard to judge the amount of fructose in the syrup, so you may want to set up your first vat with the 1:2:3 ratio using powdered fructose or henna, but add some antioxidant syrup to the hot water to boost the reduction process. If your syrup is acidic you may need to add more lime until the vat is between pH 10.0 - 11.0.

## Hydrating the indigo

You must hydrate your indigo before adding it to your vat or you will waste about 90% of your pigment. Just massage the powder in a plastic ziplock bag with water added a little at a time to form a smooth paste.

## Mixing the vat

In a plastic ziplock bag or small container, combine lime with enough water to form a smooth paste.

Add hot water or antioxidant syrup to your vat container and mix in your indigo paste. Add the lime paste and stir. If you are not using an antioxidant syrup, add fructose powder or a soft paste of henna and stir gently and thoroughly.

Stir the vat liquid with a long spoon or rod, thoroughly scraping the bottom of the container but being careful to prevent introducing unnecessary oxygen. To finish, stir vigorously to make a vortex in the middle, then move your rod to the outside rim and slowly stir in the opposite direction to gather the foam into a "flower" in the center of the vat. The flower is indicative of the vat's health. It should be large and high, with a red-tinted dark blue metallic hue.



## Testing the vat

Wait at least fifteen minutes for the vat to improve. Observe before you proceed:

- The surface should be shiny with a coppery film.
- Dark bubbles, metallic and reddish, (the flower) should appear at the surface.
- If you stick a piece of white paper just under the surface, or sample with a spoon, the liquid should be a clear dark green or golden brown. When you take it out and expose it to the air you should see it turn from green to blue as the indigo oxidizes.

You can test the pH of the vat with a test strip; aim for 9.0 - 9.5 to dye wool, 10.0 to 11.0 to dye silk, and 11.0 - 11.5 to dye cotton. Adjust low pH by slowly adding more lime. If pH is too high, add more antioxidant. Give the vat a few minutes to react and then test again. For best results, use the vat after a couple of hours, when the sediment has settled to the bottom and the vat liquid becomes clear brown, indicating the indigo is completely reduced.

## Dyeing with the vat

Every time you interact with the vat, be careful to move slowly and deliberately so you don't introduce more oxygen into the liquid.

Scoop the flower from the surface of the vat and put it into a container for safekeeping. Add the flower back to the vat when you close it after each dye session.

Gently lower a basket into the vat to keep your cloth away from the sediment on the bottom. In Japan dyers use an open weave flat bamboo basket with a string attached so it can be removed to stir the vat after each dye session.

If you soak your fabric in water before dyeing, wring it out as much as possible before you introduce it to the vat. Dip your cloth gently into the vat until it is fully submerged. Knead the cloth under the surface to encourage the indigo to reach every part. After a few minutes under the surface, squeeze the fabric tightly and remove it from the vat. Do your best to remove it smoothly without excessively dripping or aerating the vat.

Oxidize the indigo on your cloth by squeezing it tightly, stomping on it in a dry towel or newspaper, or submersing it in water. After it is completely oxidized (all green has turned blue), you can dip it again to achieve the desired shade. Remember that wet cloth looks darker than dried. Soak the finished cloth in water 15 minutes to 2 hours and rinse well. Dry in shade.

Indigo binds physically to cloth, so you can achieve dark blue by repeatedly dipping and oxidizing to build up layers of indigo. Unlike other dyes, letting your fabric sit a long time in the vat will only make the color slightly darker. Insufficient dipping and oxidizing leads to crocking (color rubbing off the cloth when dry). Indigo blue is weak against friction; hence the way blue jeans fade. Indigo and all natural dye colors are weak against ultraviolet light, so store or display them away from direct sunlight.

We recommend periodically adding more lime and antioxidant or another small portion of strong 1:2:3 solution to the vat, as the action of dyeing will deplete the indigo pigment in ("exhaust") the vat.

## Reviving the vat

You can revive your vat until the amount of sediment interferes with your dyeing. If an inactive dye vat becomes moldy, skim off the mold and stir well, making sure to reach the sediment on the bottom. Reviving the vat will involve troubleshooting by checking and adjusting the pH and raising the temperature. Indigo likes to be very warm (approximately 60°C) and heat will speed up the reduction process. If there is not a sufficient amount of indigo in the vat to achieve a medium to dark blue, add a small portion of strong 1:2:3 solution to the vat.

## Disposing of the vat

Whisking air into the vat will neutralize the lime by allowing it to absorb the CO<sub>2</sub> in the air, creating Calcium carbonate (limestone) which can be poured down domestic drains. Both liquid and sediment from the vat may be composted.

## Michel Garcia



Michel Garcia is a botanist, chemist, dyer, and naturalist. He is the founder of Couleur Garance (1998) in Lauris, France, and established Le Jardin Conservatoire de Plantes Tinctoriales (The Botanical Garden of Dye Plants) in 2000 as a horticultural resource for chemists, natural dye researchers, and botanists. He has been instrumental in revitalizing the natural dye practice in France and abroad.

You can learn more about natural dyeing and Michel's methods from the *Natural Dye Workshop* DVD series produced by Yoshiko Iwamoto Wada. Watch the DVD trailers and learn more on [www.naturaldyeworkshop.com](http://www.naturaldyeworkshop.com).