

# Trichromy cyanotype + Chiba System

## 1) Papers

If getting an image is possible on many types of paper, some work much better than others. The goal is to retain pigment where the gelatine has been exposed to UV rays, while stripping unaffected areas as much as possible in order to recover the maximum "white-base" of the paper.

- Arches watercolour 300g (100% cotton): cloth, fine or satin (smoother, better resolution)
- Fabriano Rosaspina 285g (60% cotton): initially intended for engraving, works well but risk of pilling by dint of coat it and brush it
- Clairefontaine Etival, Canson Montval, Canson XL



## 2) Pre-washing and sizing paper

**In you are planning to make a multilayer print of the same colour or a polychrome one** (example: cyanotype then layers of yellow and magenta with Chiba), **you must first immerse the paper in a hot water bath (40 ° C)**, let it soak for several hours (it doesn't matter if the water cools down), then let it dry completely. With some papers, the operation will have to be repeated a second or even a third time **to ensure that the dimensions of the paper will no longer shrink during the following soakings. This "pre-shrink" will allow correct alignment of successive layers**). For large formats (larger than 50x50cm) I pre-shrink 3 times then sizing the back with a 4% gelatine solution, let it dry, and again immerse the paper in 40°C water.

**In order to retain maximum "base-white"** on the paper after coating, exposure and developing/clearing a layer of pigmented Chiba, **sizing is essential**. It takes place **after the pre-wash operations, on the front of the paper**. There are various possibilities to size the paper, with very variable results. These 2 methods have been tested and give satisfactory results:

- **Fine art vinyl glue ("PVA" glue )** : 2 layers of PVA diluted to 1 + 2 (water). Consider adding an extra layer (always diluted to 1 + 2) after each Chiba layer, if maintaining base-white proves difficult. The downside is that the Chiba adheres less on a PVA sized surface, especially in the highlights (it will probably be necessary to make several layers per colour if you wish to expand the tonal range)
- **Didier D method (Disactis forum)** : "I sized with unpigmented Chiba solution, the definition seems better than with diluted PVA, and then I added an extra layer of gelatine without pigment between each pigmented layer, it doubles the work but the result is interesting".
- **Jordane Roche method (works on ceramic)** : sizing with pigmented Chiba solution (white titanium, Chinese white ...) according to the normal recipe, but with a very short exposure time so that the citrate does not turn brown ... every user is to determine this time by carrying out tests beforehand. Obviously this step is done without any negative on top of the surface! After exposure, the paper follows the usual procedure: 1 minute in a hydrogen peroxide bath (1 to 3%) then clearing with hot water (40 ° C)

**Quantity of PVA for 1 layer on a 60x60cm surface: 10ml (+ 20ml water) // 60x110cm: 20ml (+ 40ml water)**

### 3) Formula

The proportions of each ingredient can be voluntarily changed to influence one or the other aspect of the final image process / aspect. This formula gives me excellent results, particularly in trichrome (cyanotype followed by layers of magenta and yellow Chiba):

<b>Gelatine</b>	<b>4% (1g / 25mL)</b>
<b>White sugar</b>	<b>4% (1g / 25mL)</b>
<b>Watercolour in tube (Sennelier)</b>	<b>8% (2g / 25mL)</b>
<b>Ammonium iron citrate (green)</b>	<b>2% (0.5g / 25mL)</b>



First pour the gelatine, sugar and watercolour into cold water, let them swell up for a few minutes before heating the emulsion to 40-45 ° C. When it's all melted add the citrate.

**Quantity of chiba to cover a 60x60cm surface: 12.5ml // 60x110: 25ml**

This formula provides good density in the shadows from the first layer. In case of multilayer (= several layers of the same colour), we can consider reducing the amount of watercolour and increase the exposure time on the following layers to get more midtones and highlights.

**The 1st cyanotype layer is exposed to get a paler than a cyanotype "normal" :**

- 1 part of 10% solution of green ammonium iron citrate
- 1 part of 10% potassium ferricyanide solution

We then expose to UV for less time than necessary for a "normal" print: in my case, I expose the first cyan layer for 20 to 25 minutes (I need 30 minutes for a fully exposed cyanotype).

You can develop with a first slightly acidified bath: a citric acid solution of 0.25% to 1% is enough for 2 to 5 minutes <sup>1</sup> .

This is of course done with a calibrated negative for the cyanotype (using curves or a gradient map).

**Quantity of cyanotype to cover an area of 60x60cm: 15ml // 60x110: 30ml**

### 4) Coating

Inspired by the "Didier D" method of the Disactis forum:

**Use a paper with larger dimensions than those of our image** (5cm more in width and length are comfortable). You can slightly mark out the useful area (the image frame) with a fine pencil or by pressing slightly with a ruler along the edges of the negative.

**Fasten the paper with tape (masking tape for example) for ease** . Brushing movements must be lively, the gelatine dries quickly and the paper is dragged in all directions if it is not well secured. Having a free hand (ie. not busy holding the paper) is quite useful: coating mobilizes the whole body, there is a part of craftsmanship and a part of martial art in this process coming from the country of the rising sun ;)



**We start with a foam brush or Hake SEC brush** that we dip in the citrated and pigmented gelatine (**40-45° C or a little more, the solution will be easier to coat**). We put a certain amount on the paper and we brush horizontally then vertically until exhausted at the edges.

We quickly brush with a second foam brush (completely DRY, without solution nor water) on the paper which has just been coated to spread the solution evenly. Once the image area is completely covered, we can continue brushing the solution beyond its borders to "wipe out" excess solution.



In order not to see brushstrokes, the last passages are only made only in one direction (ex: from the left edge to the right edge), without any pressure : the end of the foam brush lightly touches the emulsion layer and strokes are very vivid to ensure a friction effect.

With a little experience, we can predict the moment when the gelatine begins to set, forming small pigment patches. With a little experience, you can stop brushing just before it happens. If such is the case do not throw your proof, because with a little thoroughness and a good brush it will be possible to eliminate these excesses in the clearing step.

The goal is to have a homogeneous and relatively thin layer, on the useful area of our paper. No matter if the edges are excessively loaded, it is what they're intended to precisely!

**ALTERNATIVE : the paint roller** with soft bristles (foam rollers do not work) :

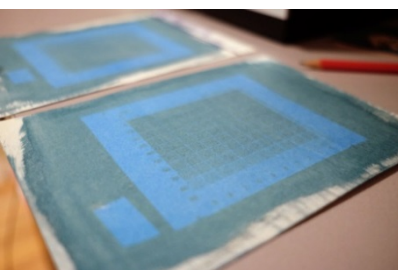
1. **Quickly** pour the total amount of (hot) solution needed by drawing a "Z" on the surface of the print. Tests will be necessary to determine which quantity is best because the roller "drinks" part of it, which will have to be compensated.
2. Spread the solution evenly with **quick gestures** with the roller



## 5) Exposure

I prefer to perform the cyanotype layer first. Then I find it easier to align the marks on the magenta layer, then, lastly, the yellow layer (the lighter, less obvious to spot).

For the cyanotype, I prepare a solution in equal parts (1 + 1) of 10% of ammoniacal iron citrate (green) and 10% potassium ferricyanide, following the recipe recommended by Christina Z. Anderson (see Notes). I prepare the negative corresponding to the cyan layer in the same way as for any cyanotype, and then expose it for a duration which is a function of the desired effect. If I want balanced colours (ie. blues not too strong, especially in the shadows), I go for half the time it would normally take to get a well exposed cyanotype (in my case, 15 minutes instead of 30 habitually). Otherwise, it is possible to vary this duration all the way to the full exposure time usually required. This surely helps getting finer details along with a wider tonal range. In return, the blue tint will be significantly more pronounced. To restore less blueish shadows, you can print an additional Chiba layer with Payne's gray or lamp black (using the Cyan negative), less concentrated than for the other colours (1g instead of 2 for a "normal" colour layer like the magenta one, for instance).



Exposure of the Chiba layers: depends on the brightness of the day or your UV lightbox. For the Chiba formula presented in part 3, and with my equipment, I expose for 4 hours (240 minutes). 2 days of spring sunshine in Brittany have given me similar results. Quite surprising, knowing that it takes me around 30 minutes for the cyanotype (14 minutes for a Van Dyke).

Right after exposure, the positive image must already be visible, like a watermark in the pigmented layer. The absence of white-base at this stage (the paper being coated with pigmented solution) gives an overexposed appearance to this picture. Don't worry: the development and clearing stage will solve this.

## 6) Development

### 1. 1st bath : 30 seconds in hydrogen peroxide from 1% to 3%

To obtain 1% hydrogen peroxide, dilute supermarket hydrogen peroxide 10 volumes (= approximately 3%) with 2 parts of water. More economical, you will find in DIY stores 12% hydrogen peroxide. In this bath, the citrated gelatine polymerizes in proportion to the UV rays received, and thus retains the pigment in that same proportion.

**Be careful to fully immerse the entire sheet of paper!**

### 2. 2nd bath : 5 to 10 minutes in water at 35-40 ° C

- 1<sup>st</sup> method (= small sheets, fit in a tray) right after the 1<sup>st</sup> bath, dip the sheet face down in hot water, wait a few seconds then grab it by an edge and do as if you were peeling it from the surface of the water. The friction induced allows to remove the pigment from non-exposed areas (sort of a "mechanical" development). Repeat this gesture as much as needed, checking the image from time to time. You might need to have a second tray of hot water ready on the side to move the sheet for final clearing
- 2<sup>nd</sup> method (large formats = 50x50cm and more): right after the 1<sup>st</sup> bath, we suspend the print vertically (on a drying rack for example) and sprinkle it with lukewarm to slightly hot water (40°C to 45°C maximum) using a shower hose. I recommend using the end of the hose without the head and medium flow because the spray projection is too aggressive and risks clearing out the image excessively. Also, better start with just lukewarm water and gradually increase the temperature until you see the image slowly beginning to clear in certain areas. By stripping in too hot water from the start you might see the entire layer disappear suddenly!

Throughout its stay in the hot water bath, the last layer is very fragile. It is therefore possible to brush it gently with a brush to force clearing, remove excesses or general haze of the image as well as stubborn areas in which we want to see the white base of the paper reappear. In the manner of "gommistes", it is possible during this stage to give express a personal interpretation of the image, to blur, remove or leave parts of it. The colour layer being fragile even in the shadows, I recommend using a very soft bristle brush, such as SoftAcqua range by Raphaël. Foam brushes and Hake brushes, if they are perfectly suited to the coating stage, proved to be too aggressive when I used them for clearing.



**It will be very useful to have a preview of the original image (in colour) nearby**, as a reference so as not to overdo it but also to remember areas which, on the contrary, need clearing.

### 3. 3rd bath : 10 to 20 minutes in cold water

This last bath, the water of which can be renewed several times, removes the residual citrate present in the paper. Once immersed in cold water, the gelatine hardens quickly and once dry it will become very resistant.



This capacity of the gelatine to harden "definitively" subsequently guarantees the possibility of adding other layers without the previous layers being affected during development / processing. So, **we can brush and tone down in warm water a layer of freshly exposed yellow, without the layer of magenta below being affected.** However, if necessary, we can still tone down or even erase a dry layer by soaking it in hot water and rubbing hard with a stiff bristle brush.

## 7) Preparation of CYAN, MAGENTA, YELLOW negatives

Method shared by photographer Tony Gonzalez (<https://tonygonzalezartist.com/>) in Christina's book Z. Anderson on bichromate gum<sup>3</sup>. This method is more or less presented by a second artist in the same book, I therefore assume that it must be known to many "gommistes":

- 1) Open a colour image, 8-bit RGB mode
- 2) Prepare it as you wish: levels, curves, sharpness, retouches...
- 3) Save before flattening the image
- 4) Image -> Adjustments -> Colour balance -> Cyan -35
- 5) Image -> Adjustments -> Hue / Saturation -> Saturation +30
- 6) Image -> Mode -> Multichannel
- 7) In the "Channels" tab at the bottom right (next to the layers tab): Separate channels

We then obtain 3 separate files, in the order of the channels: Cyan (file \_1), Magenta (\_2), Yellow (\_3).



It only remains to prepare them as we would with any other digital negatives: add a simple Curve or a Gradient Map<sup>2</sup>, then Image -> Adjustments -> Negative (Invert) and Edit -> Transform -> Flip horizontal. **Consider including reference marks for aligning successive layers.**

**Personally, I tend to strengthen contrast of my negatives intended for Chiba**, particularly in the areas where I want to make sure the colour will hold. For this I use the Dodge & Burn tools **on each of the colour negatives (after Channels separation).**

## 8) Watercolour in tube

Beginning with the Chiba System, I do not recommend using raw pigment as does Halvor Bjørngård in his founding document of citrated gelatine processes<sup>4</sup>. Unless you know how to make your own watercolour, **it is far easier to use watercolour tube** (or gouache most probably, but I haven't tried it yet!).

Some considerations:

- **Prefer "extra-fine" watercolour** for more luminosity, and homogeneous mixtures if you mix several shades for each colour layer (ex: magenta layer composed of 50% brown perylene and 50% burnt sienna).
- **Pay attention to lightfastness** (indicated on the tubes)
- **For trichromes, prefer transparent or semi-opaque watercolours** (indicated on the tube by a small square). Opaque will not allow the synthesis of a new colour when superimposed on the previous one. They can however be useful for monochrome multi-layer prints, or if you want to cover certain areas with a particular colour, without it being affected by the one (s) below.
- **The watercolour proportions indicated in the recipe can be adjusted according to the strength of the pigments** of each shade, also varying from one manufacturer to another. Ex: 2g of Sennelier Payne's gray is enough for for 25ml of Chiba solution, while 3g of natural Sienna from the same brand will be more suitable (unless you want a very pale result ... or as a second layer for medium tones).

Many works are devoted to colour-matching. Christina Z. Anderson's excellent guide to the gum bichromate process<sup>3</sup> includes an entire chapter dedicated to the Cyan-Magenta-Yellow trichromy. It offers

numerous combinations in order to obtain certain atmospheres, taking into account the characteristics of each pigment (strength, opacity...). Invaluable reference for beginners in my opinion!

This does not of course prevent you from creating your own colour charts which will serve as a reference before any project, but also a great opportunity to become more "intimate" with them. A rather "zen" activity, in perfect harmony with where the Chiba System was born ;)



I wish you all the best in your experiments with this fantastic process. Have fun and, please, don't hesitate to share your findings with the community :)

## Notes:

- 1 Christina. Z. Anderson, Cyanotype: the blueprint in contemporary practice (ed. Focal Press Books)
- 2 Peter Mrhar: Easy Digital Negatives - Historical and alternative photography
- 3 Christina. Z. Anderson, Gum printing: a step-by-step manual (ed. Focal Press Books)
- 4 The Chiba System: A Non Toxic Alternative to the Dichromate Processes (Graduate School of Science and Technology - CHIBA UNIVERSITY) -> [https://polychrome.nl/file\\_download/4/TheChibaSystem-HR.pdf](https://polychrome.nl/file_download/4/TheChibaSystem-HR.pdf)

## Online :

This document can be downloaded from my website:

→ <http://www.francoisdelr.fr/tutoriels/>

As well as on the Facebook group dedicated to the Chiba processes:

→ <https://www.facebook.com/groups/chibasystem/>

Find and share publications on this topic on Instagram with **#chibasystem**:

→ <https://www.instagram.com/explore/tags/chibasystem/>

Benchmarks for aligning negatives and gradients by colour (Google Drive):

→ [https://drive.google.com/drive/folders/1ylt0X25VY4S\\_LcfOIuLC3ntcQxcgRM3D?usp=sharing](https://drive.google.com/drive/folders/1ylt0X25VY4S_LcfOIuLC3ntcQxcgRM3D?usp=sharing)