

# Chiba System - Trichrome prints

NEW COLD FORMULA (Titebond Hide Glue / Fish Glue)

## 1) Choosing the right paper

While it is possible to achieve an image on various types of paper, some give far better results than others. The goal is to best retain the pigment where the solution was affected by UV light, while stripping the non-affected areas as much as possible to recover maximum "base white".

- **Arches watercolor 300g (100% cotton)**: rough grain, fine, or satin (smoother, better resolution). Tends to shrink (despite several pre-washes...), which makes it difficult to align successive layers.
- **Hahnemühle Platinum Rag**: better resistance to shrinking than Arches watercolor papers.
- **Fabriano Rosaspina 285g (60% cotton)**: originally intended for engraving, works well but risks pilling with repeated coating and brushing.
- **Clairefontaine Etival, Canson Monval, Canson XL...** (cotton/cellulose watercolor papers). Being cellulose-based I don't use them much but some Chiba printers report good results with them, sometimes even without sizing. Cyanotype on Monval gives a deep blue hue (leaning towards purple).
- **Canvas and fabrics** also work, when primed with gesso mixed with diluted fish glue (see next section for sizing instructions).



## 2) Pre-washing the paper and sizing

**For multi-layer prints of the same colour or several, overlaid colours** (e.g., cyanotype followed by yellow and magenta layers), the paper must first be soaked in a hot water bath (40°C), left for several hours (it doesn't matter if the water cools down), then completely dried. With some papers, this operation may need to be repeated several times to avoid shrinking during subsequent soaks (which could distort the alignment between successive layers of Chiba). For large formats (over 50x50cm), I always pre-wash three times.

**Sizing is essential** to avoid fogging and retain maximum base from the paper. **Sizing should take place AFTER the shrinking steps** : once the paper has been pre-washed, you can proceed to the sizing step. **Note: if you plan to print a cyanotype layer beforehand** (for better details and tonal range), **do it after the shrinking steps but BEFORE sizing**: cyanotype will adhere better to the paper without size.

**How to size your paper**: before each Chiba layer, apply a **solution of fish glue diluted in demineralized water (1 part glue to 3 parts distilled water)**. Like the Chiba layers, **the sizing layer should be rather thin** each time. You can use foam brushes and/or a lacquer roller for this. Personally, I only use a simple foam brush and "stretch" the fish glue solution well to ensure the entire paper is covered, without excess thickness (be careful not to go back over already sized areas, as it dries quickly and you may think there is no glue left and add more...).

**Let the glue layer dry for an hour or two before applying the Chiba solution.** Check by touching the paper to make sure it doesn't stick to your fingers (unless you press for a long time, which is normal in this case because the glue melts with heat and moisture). You can speed up the drying process using a hair dryer, a print dryer, or by placing the paper in front of a radiator...

### 3) Formula(s)

The proportions of each ingredient can be deliberately changed to influence certain aspects of the process or the final appearance of the image. This formula gives me excellent results, especially in trichromy (cyanotype followed by magenta and yellow layers):

- **Titebond Hide Glue (Amazon, Home Depot...)** 10g
- **Ferric Ammonium Citrate (green, same as used for cyanotype)** 2g
- **Distilled water** 100mL
- **Oxalic Acid (sorrel salt)** 1g

(!!! check with pH test strips to ensure pH is at 4, if above add more oxalic acid until pH is 4)



Start by dissolving the glue in the water. To make the process easier, you can pre-warm the demineralized water and the Titebond glue in a water bath (30-40°C is enough). Once the mixture is homogeneous, add the citrate. Finally, add the oxalic acid: first, half the amount, test with a pH strip, then the other half if the pH is not yet at 4. The solution keeps very well in an opaque bottle, away from light. **Be sure to shake it well before each use.**

Amount of Chiba needed to cover a 30x30cm surface: about 4ml // 60x60cm: 16ml... **always prepare a little more solution just in case, as the emulsion must be applied in one go**—you won't be able to add more afterwards!

This formula provides good density in the shadows from the very first layer. In the case of multiple layers (= several layers of the same colour), **you can reduce the amount of watercolour and increase the exposure time in subsequent layers to favour midtones and highlights.**

#### Alternative if you can't find Titebond Hide Glue:

- **“Liquid” fish glue** (hardware stores, arts & crafts supplies): 33mL
- Ferric Ammonium Citrate (green): 2g
- **Demineralized Water:** 67mL
- Oxalic Acid (sorrel salt): 1g

(same as using Titebond Glue: check with pH test strips to ensure pH is at 4, if above add more oxalic acid)

### 4) Complete Procedure

- **Pre-shrinking paper :**
  - Prepare large sheets of paper and a basin/container/bathtub large enough to immerse them entirely.
  - Fill the basin with water at 35-40°C (max temperature to avoid dissolving the internal coating of the paper, which is sometimes gelatin-based).
  - Immerse the sheets one by one, turning each several times to ensure it absorbs water evenly. If possible, cover the basin with another container to keep the heat inside.
  - Let them soak for one to two hours.
  - Remove the sheets and let them dry completely. Then repeat (one to two times depending on the paper).
- **For better definition and tonal range, print a first light layer of cyanotype** (exposed for 1/3 or 1/4 of the usual time, see Section 5):
  - Note: exposure times vary depending on the paper and your UV exposure unit, so adjustments are necessary!!!
  - Usual development. For me, a first bath in citric acid at 0.25%, then tap water until all residual salts are eliminated.

- **Sizing (before each Chiba layer) :**

- 1 layer of fish glue solution (1 part fish glue from liquid form to 3 parts distilled water)
- Optional: once dry, sand with fine grit to smoothen the surface.

- **Coating the Chiba solution**

- Like with bichromate gum, it's difficult (impossible?) to achieve a full tonal range in a single layer with Chiba. Depending on the tones you wish to emphasize, you can adjust the proportion of pigment/watercolor and the exposure time to achieve the desired tones.
- For this, I use **two different pigment concentrations**, called "**FULL**" (for an easy base calculation, I use 1/10th of the weight of watercolor in tube for 1ml of 2% Chiba solution) and "**HALF**", which corresponds to half of that (1/20th, so).
- Optional: once dry, sand with fine grit to smoothen the surface.

"FULL" Emulsion ("HALF" = ½ of these values)						
<b>Chiba solution (ml)</b> (quantity of the pre-made solution according to previous section)	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>	<b>14</b>
<b>Watercolour in tubes (grams)</b>	0,4	0,6	0,8	1	1,2	1,4
<b>Raw pigment (grams)</b> may need adjustment depending on the pigment's density	0,5	0,75	1	1,25	1,5	1,75

**!!! If you choose not to do a cyanotype, then a first layer of Chiba cyan is preferable (easier for aligning the subsequent layers):**

- 2% FULL emulsion // 3:00 exposure → shadows and midtones

**1) Magenta:**

- 2% FULL emulsion // 2:00 → shadows and low lights
- Sand the first layer with fine grit before exposure

**2) Yellow:**

- 2% FULL emulsion // 2:00 to 2:30 or more depending on the yellow pigment used (yellow pigments block UV more) → shadows and low lights

**3) Cyan:**

- 2% HALF emulsion // 4:00 to restore color balance and get a clearer sense of how to proceed

**4) Magenta:**

- 2% HALF emulsion // 4:00 to 5:00 → midtones and highlights

**5) Yellow:**

- 2% HALF emulsion // 5:00 to 6:00 (be careful of overexposure!) → midtones and highlights

**6) Cyan:**

- Most often, you'll need to strengthen midtones and highlights  
→ 2% HALF emulsion // 6:00 exposure

**7) Color correction if needed**, typically by choosing between 2:00 (FULL for shadows) and between 4:00 and 6:00 (HALF for midtones and highlights) of exposure with 2% HALF solution... sometimes FULL at 2:00 or even 1:30 to strengthen shadows and Dmax, as well as correct any color dominance (by strengthening its complementary color).

## 5) Coating the pigmented Chiba solution

**Prepare a sheet larger than the size of the image** (5cm larger on both width and length is comfortable). You can lightly mark the usable area (the image frame) with a fine pencil or by gently pressing a ruler along the edges of the negative, placed on the sheet.

**Secure the paper using tape (masking tape, for example) for ease.** The brushing movements should be brisk, as the glue solution dries quickly, and the paper will be dragged in all directions if it is not properly held in place.



**Start with a dry foam brush or Hake brush**, and dip it into the Chiba solution. Apply a certain amount onto the surface and brush horizontally, then vertically, until the edges are covered.

**Quickly, take a second foam brush (completely dry, with no solution)** and brush over the (still wet) coated paper to distribute the solution evenly. Once the image area is completely covered, you can continue brushing the solution beyond its limits to "wipe" off the excess solution.



**To avoid visible "brush strokes," make the last passes in one direction only** (e.g., from the left edge to the right edge), without pressing down: the tip of the foam brush should just lightly touch the emulsion layer, moving briskly to ensure a friction effect.

With some experience, you'll be able to gauge the optimal amount of solution needed for the desired dimensions. In any case, if you don't want visible "brushed" edges, masking tape is essential because you will always need to pull the solution beyond the edges of the negative. This ensures an even layer over the entire useful surface of the print. Otherwise, the solution will accumulate on the edges, and this excess will prevent correct exposure, leading to all of it washing away during development.

**The goal is to finish with a homogeneous and relatively thin layer on the useful part of the sheet.** It doesn't matter if the areas outside the usable area are excessively loaded—that's what they are meant for!

**ALTERNATIVE: A synthetic bristle lacquer roller** (foam isn't recommended as it creates bubbles):

- Quickly apply the total amount of solution needed for the print surface in a "Z" pattern. You will need to do some tests to determine this amount, as the roller will inevitably absorb part of it, and you'll need to compensate for that.
- Spread the solution using swift movements with the roller.



## 6) Exposure and colour adjustment

I prefer to start with a light cyanotype layer: it provides sharper contours, finer tonal range, and greater overall density. I then find it easier to align the magenta layer markers, and finally, the yellow layer (the brightest, least easy to align). This first layer doesn't exclude adding other cyan/blue layers afterward, using the Chiba solution to get more hues than just the typical Prussian blue from the cyanotype first layer.

For the cyanotype, I prepare a solution in equal parts (1:1) of 10% ammoniacal iron citrate (green) and 10% potassium ferricyanide.<sup>1</sup>

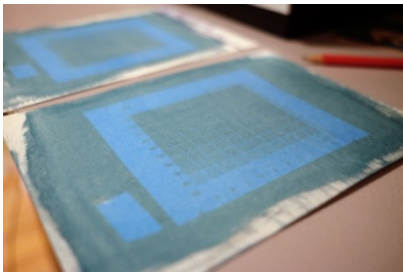
I use the negative for the cyan layer, calibrated for Chiba (**see section 7**), as it works quite well for cyanotype too, and allows me to use only one negative for both cyanotype layer and subsequent Chiba blue/cyan pigmented layers. Note: the opposite doesn't work quite as well: a negative calibrated for cyanotype doesn't give me satisfactory results with Chiba.

- For balanced colours (blues that are not too intense, especially in the shadows), **I go for 1/3 or even 1/4 of the usual exposure time**. A very pale cyanotype will allow the addition of one or more layers of blue with the Chiba, which means more choice and chromatic options to be explored.

- For a single layer of cyan and only magenta and yellow with Chiba, you can go to half or even more of the usual exposure time. I don't recommend going beyond that, as this is a trichromatic print and the cyanotype quickly becomes overpowering, preventing the other colours from expressing themselves and darkening the final result (don't forget that this isn't a monochrome print: the superposition of the three colours adds to the total density!) With cyanotype as the only cyan layer, however, you'll be limited to Prussian blue, with secondary colours (greens and purples) more limited in the future.

Finally, to restore less coloured shadows, you can print an additional Chiba layer with Payne's grey or lampblack, in a smaller proportion than for the other colours (half the weight of watercolour used for the magenta and yellow layers, for example) and with a reduced exposure time (test with half as much time to begin with).

**Exposure time:** it all depends on the brightness of the day or your UV exposure unit. For the formula presented above and with my equipment (18W UV fluorescent tubes), I expose between 1 and 6 minutes, sometimes up to 8 minutes. Notably less than for a 'standard' cyanotype on that same exposure unit!



At the end of exposure, the positive image may already be visible, like a watermark in the pigment layer. The absence of base white at this stage (the paper being covered with pigment solution) gives the image an over-exposed appearance. Don't worry: the development stage will solve this problem.

## 7) Developing prints

- 1) **Development:** 0.3% hydrogen peroxide (30ml 12% hydrogen peroxide + 900ml tap water) // 30 seconds to 1 minute, stirring constantly until the image is partially formed (the pigments start to dissolve in places).
- 2) **Clearing:** empty the developing solution and replace with water. Shake and remove with a soft brush (approx. 2')
- 3) **Removing the citrate (IMPORTANT for reproducible results and to ensure the print lasts):** citric acid solution of between 0.5% and 1% and stripping with a brush/soft brush until the whites are white again, removing any stains and haze caused by the citrate... this will also prevent the paper from yellowing due to citrate residue, invisible but very much present!
- 4) **Rinse:** 5' water then 10' water (then 20' water if you want to be sure of a good rinse; personally, I rinse for longer during the last layer of colour, to eliminate the citric acid that may have accumulated in the paper during the previous layers).
- 5) **For stubborn/unwanted areas,** you can use a more nervous brush, loading it with citric acid solution to help dissolve the emulsion where you apply it. Hot water also seems to work... in both cases, however, it's difficult to be precise (so it's better to be precise about exposure times/pigment proportions).



## 8) Preparing your negatives for CYAN, MAGENTA, YELLOW layers

A method shared by photographer Tony Gonzalez (<https://tonygonzalezartist.com/>) in Christina Z. Anderson's book on gum bichromate<sup>3</sup>. This method is more or less presented by a second artist in the same book, so I conclude that it must be familiar to many “gum printers” who produce multi-colour prints:

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

You get 3 separate files, in the order of the tabs: Cyan (file \_1), Magenta (\_2), Yellow (\_3).



All that remains is to process them in the same way as your other digital negatives: apply a simple Curve or Gradient Transfer Curve<sup>2</sup> (Gradient Map), then Negative (Invert) and Mirror. **Remember to include markers for aligning successive layers** (you can also use a light table to align the negatives each time).

You can also include greyscales to check that each colour has been printed correctly.

Personally, I usually slightly increase contrast of my negatives intended for Chiba, in the areas where I want to make sure the colour will hold. To do this, I use the Density+ and Density- (Dodge&Burn) tools on each of the negatives (each colour separately).

## 9) Watercolour in tubes or raw pigments?

To start with, you can use raw pigment as Halvor Bjørngård does in his founding document on citrate gelatin processes<sup>4</sup>. Personally, I prefer **watercolour in a tube, which is easier to mix homogeneously** with the citrated solution. The raw pigments tend to separate more easily in the solution, which you need to **make sure you mix well each time** before loading the brush with it.

A few thoughts :

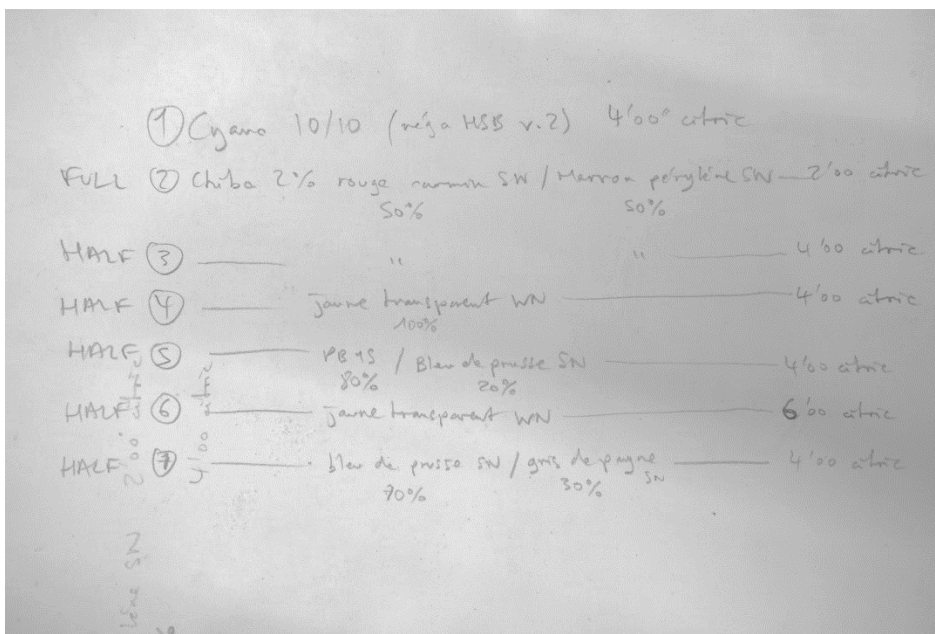
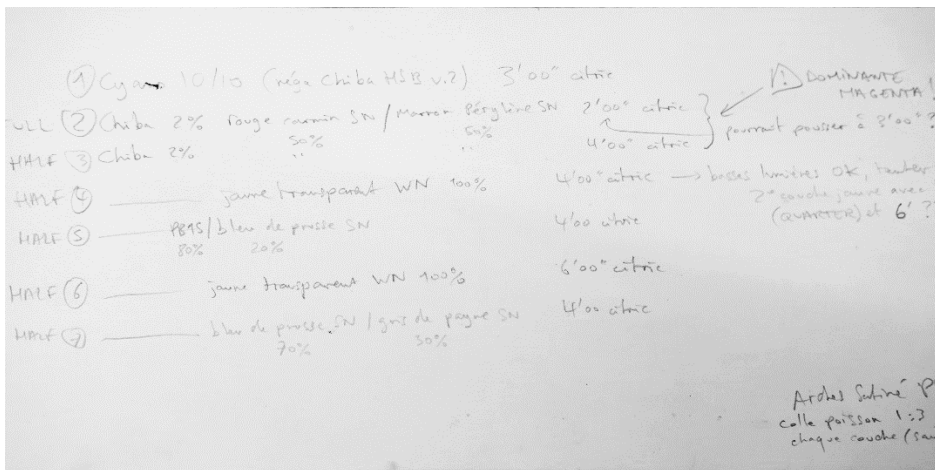
- **Choose ‘extra-fine’ watercolours for greater luminosity**, and mix evenly if you are mixing several shades for each layer of colour (e.g. magenta layer made up of 50% perylene brown and 50% burnt sienna).
- **Pay attention to lightfastness** (indicated on the tubes) if you don't want the colours to lose their brilliance over time.
- **For trichrome prints, prefer transparent or semi-opaque watercolours** (indicated on the tube by a small square). Opaque watercolours will not allow a new colour to appear when superimposed on the previous ones. They can, however, be useful for multi-layer monochrome prints, or if you wish to cover certain areas with a particular colour, without it being altered by the colour(s) already present underneath.
- **The proportions of watercolour indicated in the recipe may be adjusted** according to the strength of the pigments in each shade, or by the manufacturer. For example: 2g of Sennelier payne grey is more than enough for 25ml of Chiba solution, while 3g of natural Sienna from the same brand would be more appropriate (unless you want a very pale result... or as a second coat for medium tones).

Many books are devoted to colour matching. **Christina Z. Anderson's excellent guide to gum bichromate<sup>3</sup>** includes an entire chapter devoted to Cyan-Magenta-Yellow trichrome prints. It **presents several harmonious combinations to achieve certain moods**, taking into account the opacity characteristics of the different pigments. A must-have if you're just starting out!



This doesn't mean you can't **make your own colour charts to use as a reference** prior to any project, while at the same time familiarising yourself with each colour and its association with complementary colours. A “zen” activity in perfect harmony with the birthplace of the process ;)

**... and of course, do keep track of your mixes and process, taking notes behind your prints or separately 😊**



## Notes :

<sup>1</sup> Christina. Z. Anderson, **Cyanotype : the blueprint in contemporary practice** (Focal Press Books)

<sup>2</sup> Peter Mrhar, **Easy Digital Negatives – Historical and alternative photography**

<sup>3</sup> Christina. Z. Anderson, **Gum printing : a step-by-step manual** (Focal Press Books)

<sup>4</sup> **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 Resources :

This tutorial is available for free, to download from my website :

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

My method for printing with the Chiba process is only one among many others. It has improved over the years thanks to the invaluable contributions of members from this group :

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

Find out Chiba printed images on Instagram using **#chibasystem** :

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

Curves for cyanotype, Step Wedges to calibrate negatives for Chiba (Easy Digital Negatives), Registration marks and more:

→ [https://drive.google.com/drive/folders/OB-PhlUAjeumcTnIFaF9yc0d4NWs?resourcekey=0-1mynhQmGWmakFYWKaA\\_pHA&usp=sharing](https://drive.google.com/drive/folders/OB-PhlUAjeumcTnIFaF9yc0d4NWs?resourcekey=0-1mynhQmGWmakFYWKaA_pHA&usp=sharing)

## Special thanks :

- Didier D. for giving me the opportunity to try out this brilliant process with a simple tutorial for the gelatine-based version.
- Charles Guérin for finding the bridge between Chiba and Leimdruck (fish glue), paving the way for a cold method that's much simpler to use than the original gelatin-based formula...
- Habib Saidane for the discovery with Titebond Glue and all the other impressive findings (check out the Chiba facebook group for his “vegan recipe”, “spray on” chiba, etc. Keep it up 😊)
- And all other members of the Facebook group for sharing their numerous, always motivating experiences, contributing to this unique sharing community around the world 😊