Cyanotype

Historical and Alternative Photography

Peter Mrhar

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Foreword

This series of books, with the subtitle *Historical and Alternative Photography*, is dedicated to photography enthusiasts who want to learn or upgrade their knowledge about old - but nowadays increasingly popular - photographic processes.

This series is, in fact, the compilation of my notes on the photographic techniques that I've discovered over the years, mostly through old photographic manuals and, in recent years, through the Internet. Of course, all of these procedures have been tested in practice, adapted to our modern times, and intentionally presented with a large number of photographs to clearly present the reader with the workflow and the final result.

In each book of this collection, there are step-by-step descriptions of one or more related photographic processes. They are, of course, enriched with descriptions of "secret" techniques that have often been suppressed elsewhere. Techniques described in the collection include cyanotype, salted paper, kallitype with brown print, platinum and palladium print, gum printing, and, of course, the production of digital negatives.

To work with a particular process, it is sufficient for the reader to read a single book; more demanding readers will probably need an additional resource on digital negatives, which is a kind of basis for old photographic processes in the digital age.

The subtitle *Historical and Alternative Photography* is, for many readers, probably incomprehensible, since many people use the concept of alternative photography for all photographic processes from the 19th to the early 20th century. In this collection, the term *historical* photographic processes is used for all photographic processes discovered prior to the early 20th century (cyanotype, salted paper, platinum and palladium prints, oil and gum prints, etc...), and the term *alternative photography* is

reserved for unconventional, creative processes, such as emulsion or Polaroid transfer, liquid emulsions photography, and the like.

Peter Mrhar

Cyanotype

Historical and Alternative Photography

First edition: September 2013

Graphic design: Peter Mrhar

Downloadable files and other information can be found online at www.petermrhar.com/alternative.

Warning and disclaimer

Any use and handling of chemicals poses a potential threat to health and life. As a result, every user must, prior to beginning to work with such chemicals, learn all about the dangers, warnings, safe work methods, protection techniques, and procedures in case of accidents. This information can be found online in the form of documents, MSDS (Material Safety Data Sheet), and in books specialized in this area. The author assumes no liability for any damage, injury, or loss arising from the use of the information in this book.

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About Cyanotype, chemicals, materials, and devices

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Very short introduction to Cyanotype

Cyanotype, or "blue print," was discovered in 1842 by English scientist John Frederick William Herschel (1792-1871). Due to the characteristic blue color of the resulting pictures, the procedure was relatively unpopular among the first photographers, but it was very useful for other purposes, such as copying a variety of technical and construction drawings.

The first and almost the only well-known user of cyanotype was Anna Atkins (1799 - 1871), who already in 1843 made the first photographic book with cyanotype photographs of plants. The book was called *British Algae: Cyanotype Impressions*, and after its publication, cyanotype drowned into oblivion.

Nowadays, with the increasing interest in all old, hand-printing photographic techniques, cyanotype is experiencing a new popularity. The technique is extremely simple and remarkably flexible, as cyanotype images can be developed on a wide range of materials, including paper, fabric, stone, and metal, and even on glass.

To produce photos with cyanotype, two chemicals are needed: Ammonium iron(III) citrate ($C_6H_8O_7$ xFe_3+ yNH_3 - CAS #1185-57-5), also called ammonium iron citrate, and Potassium hexacyanoferrate(III) ($K_3Fe(CN)_6$ - CAS Number: 13746-66-2) with its more common name of potassium ferricyanide. Also required are paper (or any other image carrier), a negative (or a few objects, if we want to create a photogram), a printing frame (or a sheet of glass), a beautiful, sunny day or a UV lamp, and a few liters of water for development of the photographs.

The cyanotype process consists of a few simple steps. The cyanotype solution is applied to paper, which is then dried thoroughly. On this light-sensitive carrier, objects or negative film are placed. Under UV light, objects or negative film block part of the light, while on the exposed, uncovered part, the chemical composition of the light-sensitive emulsion changes. When a photograph is developed in ordinary water, the

unexposed iron compounds are washed away from the photographs, while the newly-formed, water-insoluble iron ferricyanide, with it characteristic blue color, remains on the image carrier material.

Of course, cyanotype can also be quite complicated, although this is not so obvious. We can enhance the tonal range of a cyanotype image, as a finished blue photo can be bleached, toned to other colors etc..., but more about that later.

This photograph is a typical example of a photogram. On dry paper, previously coated with a light-sensitive emulsion, flowers were placed.

The paper, along with the flowers, was then exposed to the sun. After development in water, the unlit parts of the image were washed and the result is seen as the contours of the white flowers.

Mixing a homemade cyanotype solution

Chemicals for cyanotype can be ordered from stores specializing in alternative photographic processes, but it is often cheaper to make your own, homemade solution. The process for doing this is quite simple, and by following the safety instructions, it is also harmless in terms of your health.

As we have already mentioned, the basic chemicals which are needed for cyanotype are ammonium iron citrate (the green kind, which contains 14.5 to 16% iron is better and is more sensitive to light), and potassium ferricyanide.

In cyanotype, there are two chemical components, which are referred to, simply, as "A" and "B", and are made by dissolving each of the two chemicals mentioned above in distilled water. They are each then stored in two small brown-colored bottles, each labeled with the name of the chemical, the percentage of the solution, the date of manufacture, and the letter A or B. The chemicals are prepared separately as two components, since they can only be used for a few days, starting from the moment they are mixed together. The solution of ammonium iron citrate is commonly named component "A," and the solution of potassium ferricyanide is then component "B."

Components must be stored in a dark place, out of reach of children, and in tightly closed bottles. These light-sensitive emulsions are then mixed together in a ratio of 1:1 immediately prior to use.

As with almost any other photographic process, we can also many different formulas find in cyanotype. In this guide, we will learn only about the so-called "modern formula," as it is the most popular among users, thanks to its easy preparation and good results. Several other formulas can be found online at UnblinkingEye.com.

Required materials

Before making the solutions, we have to read all the instructions and advice for working with the selected chemicals. We have to protect ourselves appropriately, prepare the working environment, and gather up all the necessary materials and accessories. We will need the following:

1. A pair of gloves and other prescribed safety equipment
2. Two plastic spoons
3. Ammonium iron citrate
4. Potassium ferricyanide
5. Distilled water
6. A precision or kitchen scale (this is only used for weighing photo chemicals)
7. Two clean sheets of paper, size A5 (appr. 6 x 8 in)
8. A small glass funnel
9. Two brown-colored glass bottles
10. Two labels for the bottles
11. Formalin, which is a 37% solution of formaldehyde (HCHO) diluted in water (optional)

Warning. Prior to each production and use of solutions, it is best to read the instructions and warnings. Information on

safety, the so-called MSDS (Material Safety Data Sheet), can be found online or in relevant manuals.

Making a modern formula emulsion

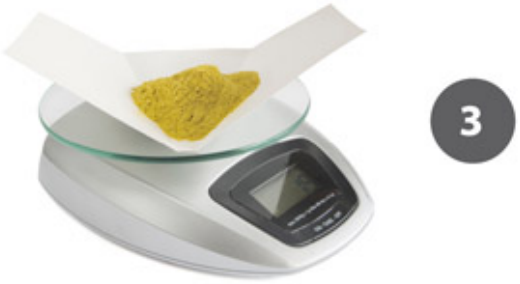
With cyanotype, this modern cyanotype formula is the most popular with users. It is composed of component A, i.e., a 20% solution of ammonium iron citrate, and component B, an 8% solution of potassium ferricyanide. For the production of 200 ml of the solution we will need the following:

- *20 g of ammonium iron citrate*
- *8 g of potassium ferricyanide*
- *200 ml of distilled water*
- *2 drops of formalin (optional)*

How to make the solution

1. At the start of the work, we paste a sticker with data about the solutions on each of the two bottles.
2. Into each bottle, we pour 100 ml of distilled water. The easiest way is to use the scale. A bottle with a funnel is placed on the precision scale (1), the scale is calibrated to the weight to 0 g, and 100 g of distilled water (2) is poured into each bottle.

3. A folded sheet of paper, size A5, is placed on the precision scale, and the scale is again calibrated to 0 g and 20 g of ammonium iron citrate is added with a plastic spoon (3).



4. Using the folded sheet of paper, we gently shake the ammonium iron citrate into the bottle that has already been filled with distilled water (**4**), then tightly close it with a cap and shake it until the chemical is completely dissolved in the distilled water.
5. Over time, mold can form in the ammonium iron citrate, but this does not affect the quality of cyanotype. The mold can be removed by filtering the solution through a paper coffee filter. Mold can also be prevented, by adding two drops of formalin to the solution of component A (**5**). Since the formalin is extremely poisonous if inhaled, it is best to **add it in an open area**.

6. The second solution is made in the same way as the first. A folded sheet of A5 paper is placed on the precision scale and 8 g of potassium ferricyanide is then poured on it (**6**).

7. Then we have to carefully pour the chemical into a flask B (7), seal it tightly with a cap, and shake it until the chemical is completely dissolved in the distilled water.
8. The bottles are then stored in a dark place. Both paper and spoons must be discarded in the appropriate place for waste disposal.

Warning. Formalin is toxic if ingested or inhaled, and will cause severe skin burns and eye damage if it comes in contact with skin or eyes. Prior to using the chemical, read the appropriate instructions and warnings. Wear appropriate protective equipment.

Paper for cyanotype

To produce photographs of great quality, it is very important to choose the right paper. Here are some hints about paper.

- We need to buy an **extremely durable paper**, which, after prolonged treatment in water, does not tear and does not dissolve in the water. The most suitable is watercolor paper or paper for the graphic arts.
- For the same reason, it is advisable to **use thicker paper**. The thinner the paper, the more likely it will tear in water.
- Another very important factor is the **chemical structure of the paper**, which greatly affects the stability of the photograph. Because we know almost nothing about the chemical structure of paper, it is best to test each paper. If you don't want to learn from your own mistakes, through trial and error, it is better to use a paper recommended by other users.
- Most of the art papers have a **"right" and "wrong" side**. On more expensive papers, the "right" side is recognized by the watermark with the name of the manufacturer. If the text of the watermark is turned correctly, so the name can be read, then the right side of the paper is facing us. On the cheaper paper, the "right" side is usually smoother and its surface is better treated.
- There are papers with **smooth or rough textures**. Photographs on smooth paper will be quite sharp, while those on rough paper will be soft and almost dreamy.
- Among the properties of the paper, the **absorbency of emulsion** is also important. If the paper is too absorbent, the image will be blurred. And in the case of lower absorption, puddles of emulsion will accumulate and the photo will be unevenly exposed.
- In cyanotype, the **structure of the paper** is most important. Since cyanotype adheres very poorly to plastic materials, it is best to use a paper which is **made of 100% or at least 50% cotton**.

Paper samples on the next page are prepared with the same emulsion, exposed to the optimal, standard exposure time of the selected sample,

and developed in the same way. Nevertheless, the results are not universally valid, as they depend also on the composition of the emulsion, the moisture, UV light, etc... The examples that follow are intended only for identifying the characteristics of the paper.

- **Darkest color**. In some papers, we will achieve a very dark color, for example, on Fabriano Artistico, Arches Watercolor Cold Press.
- **A uniform distribution of colo**r. While some of the papers uniformly soak in the light-sensitive solution, on others we will see quite visible patches. These are most noticeable in bright colors. For lighter photos, smooth paper is more suitable, since it is able to produce a clearer and more uniform drawing. On the other hand, rough paper, which produces a nice image in dark tones, may result in a rather disturbing structure in the light tones.
- **White dots**. Due to the different compositions and manufacturing techniques of the various papers, white dots may occur in the photograph. The cause of these dots can be the coarse structure of the paper (Arches Watercolor) or a chemical coating, which is not suitable for the technique of cyanotype.
- **Tonal range**. Similar to the paper in an analogous photography darkroom, some papers show more contrast in the resulting photographs (Fabriano Artistico or F5), and others less (Arches Aquarelle Grain Satin, CANSON Edition, etc...).

Arches Watercolor Cold Press paper is a paper with a rough texture. Since the emulsion rinses off the paper almost too quickly, we have to make sure that the image is not washed for too long.

Arches Platine does not allow such a dark color to be achieved as on other papers, but it is able to display far more of the middle tones.

Arches Aquarelle Grain Satiné displays very dark tonal values and the color is evenly distributed over the entire surface.

Fabriano F4 is very popular in photography workshops. The paper is not archival because it is not made from 100% cotton, but it is relatively cheap. The resulting photograph is slightly mottled and quite bright.

Fabriano F5 is made of 50% cotton. Color is evenly distributed over the surface and even the slightly rough structure of the paper does not show white tips.

Plain paper is almost useless for cyanotype because the chemicals that are used to bind and to whiten the paper sometimes bleach the photograph. After long-term treatment in water, the paper will disintegrate.

Fabriano Artistico is a very popular paper. It can show very dark, evenly distributed colors. The bright tones can be rinsed quickly, so the result is a very high-contrast picture.

Canson Edition provides a very uniform distribution of the emulsion. Darker colors are very dark on this paper and there are no noticeable white dots.

Digital negatives

Light-sensitive chemicals used in almost all old photographic processes, including those used in cyanotype, are largely and almost only sensitive to sunlight or UV lamps. Because of this, the old masters of photography printed photos with the help of a contact printing frame. The process is carried out in such a way that the paper soaked with emulsion is covered with a negative film, compressed by means of the contact frame (see also Contact printing frames) and placed in the sun. The negative, of course, has to be equal to the size of the final photo.

Although photograph printing was a seemingly simple matter in the past, the making of negatives was much more complicated. Enlarging a photograph was very difficult, and exposure and processing of negatives had to be carefully chosen and adapted for the selected emulsion. Manipulation of the photograph, in today's terms, was almost impossible. Now, with the help of computers and software for processing digital photos, a photograph can be quickly manipulated. We can change its tonal values in just a few seconds; the size can be changed at will; etc...

Hardware and software

For making digital negatives, we need a personal computer. When we want to convert the analog film to a digital form, we will need a scanner. And for printing negatives, we usually use a inkjet printer.

For photograph processing, any program for digital photograph editing can be used. In this book, we will use the well-known Adobe Photoshop software.

Transparent films

Since the technique of cyanotype is quite simple and technically undemanding, digital negatives for it can be made from plain paper, from tracing paper (which was once used by technical draughtsman), or

from overhead transparencies or transparent films that are designed for offset, silk or "alternative" photograph prints. Among these materials, there are, of course, quite big differences.

The range of tones printed on plain paper (1) is very small, so the very light and the darkest tones are hardly visible.

Negatives of photographs printed on tracing paper have a slightly better tonal value, but the image is rather blurry because of the greasiness of the paper (2).

Much better negatives are those printed on overhead transparencies (3), where we will notice significantly greater tonal values, but the very best are those printed on transparent films for offset printing and "alternative" photography (4).

Transparent films for "alternative" photography or offset printing are, of course, much more expensive than others, but allow us high-precision printing, due to their special coating, which is also capable of absorbing much more color from the ink jet printer. This, in turn, allows us to print negatives of much more contrast.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Making digital negatives

Since the description of the workflow for producing digital negatives using curves or color spaces (which must correspond to the various technical requirements of the photographic processes and of the selected material) is a bit too broad for this book, this chapter describes only a few basic procedures, with which we can also achieve largely high-quality tonal values in cyanotype.

If we want to create a digital negative, we need a black & white or color digital photograph of better quality.

1. The photo is first converted to a 16-bit grayscale image (1).
2. In the next step, the photo is digitally manipulated (2) so that it fits our aesthetic requirements. Most often, we increase the contrast of the photograph and sharpen it a bit.
3. Since we are producing photographs which were made by old techniques using contact printing (without a photographic enlarger), we need to change the photograph size to the desired final size.
4. The printing resolution of the photograph is usually set at 300 dpi or more.
5. In the next step, the photograph is converted to a negative, using the appropriate command in the software (3).
6. As we will place the emulsion of the negative onto an emulsion of the paper in contact printing (5), we have to mirror the image (4).
7. Finally, the photograph is printed on suitable transparent material.

Unfortunately, the printed photograph will not have the same tonal values as the image we see on the computer screen, due to the different responses of the emulsions to various factors. If we want to adapt our digital photograph to a chosen photographic technique, a given printer, a type of paper, a chemical formula, etc.., we have to correct its tonal values. The easiest way to change those values is by the means of curves, which we will learn about in the following pages.

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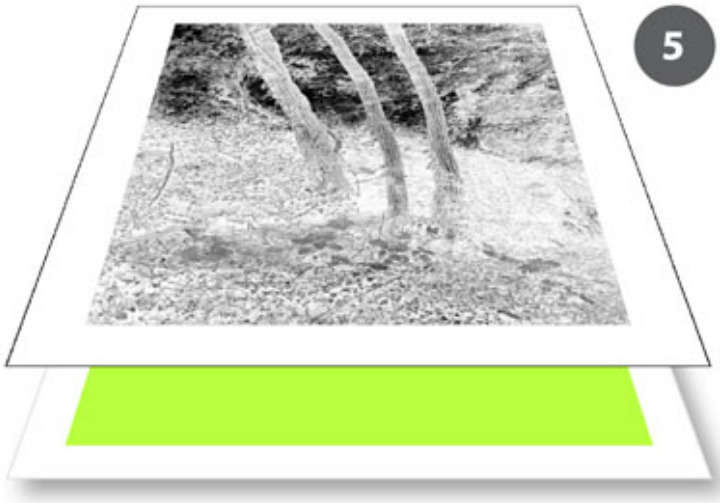
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Custom curve

On the previous page, we described a simple procedure that allows us to make a digital negative. We have also mentioned the problem of tonal values, which may look great on the computer screen, but disastrous on the printed cyanotype. The reason for this is the varying sensitivity of emulsion, the different properties of paper, and the different clearness of transparent films; the type of printer and printer inks also greatly affect the photograph tone.

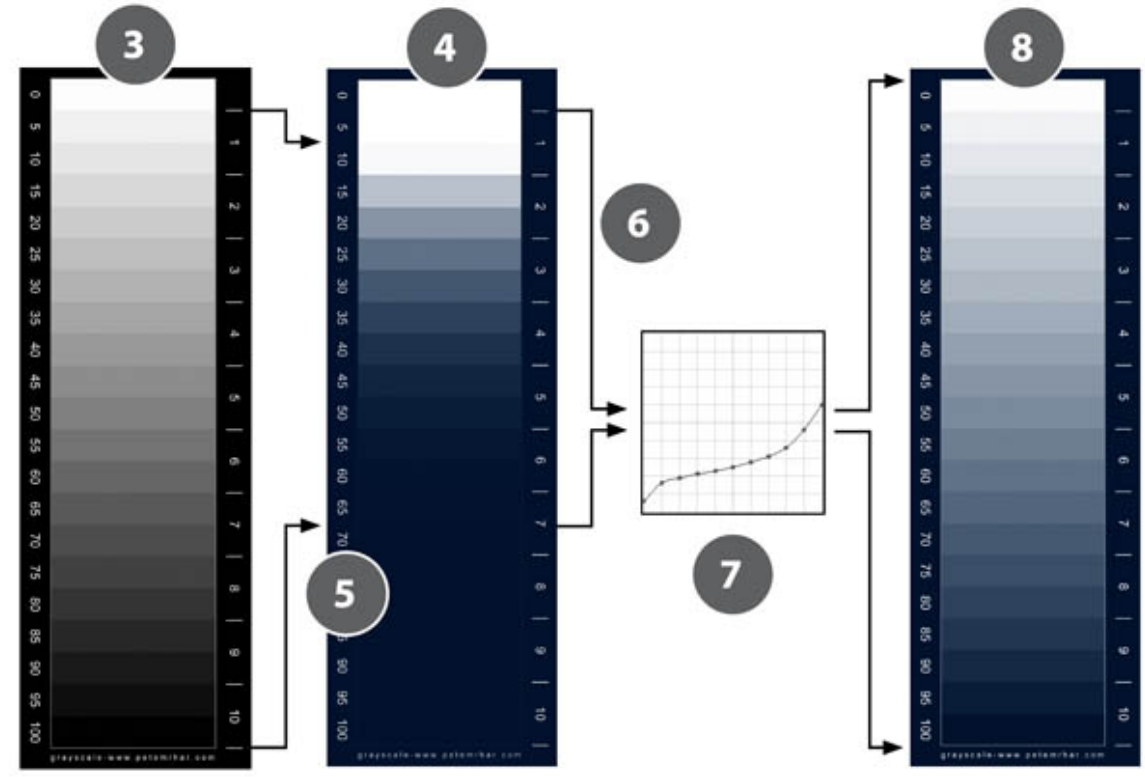
In cyanotype images printed with unprocessed negatives (1), we will frequently notice fusion of dark values into a single black surface (2).

The problem will be more easily understood if we look at a so-called grayscale step wedge, on which 21 different shades are printed. These range from completely white to a completely black color value.

The negative of a properly printed grayscale step wedge, which has evenly spaced values (3), produces similarly different values on

exposed cyanotype (4). We can see that the white color has moved to another field and the lower half of the wedge has become evenly dark, without any transition (5). To sum up, only half of the total range of values is displayed on the printed cyanotype.

Our mission is to stretch this compressed area of cyanotype values (6) in such a way that it is fully displayed (8). This is done with a variety of methods, but the simplest way to make perfect cyanotype (9) is to use a curve (7) which will produce exactly the same values as on the original picture (1).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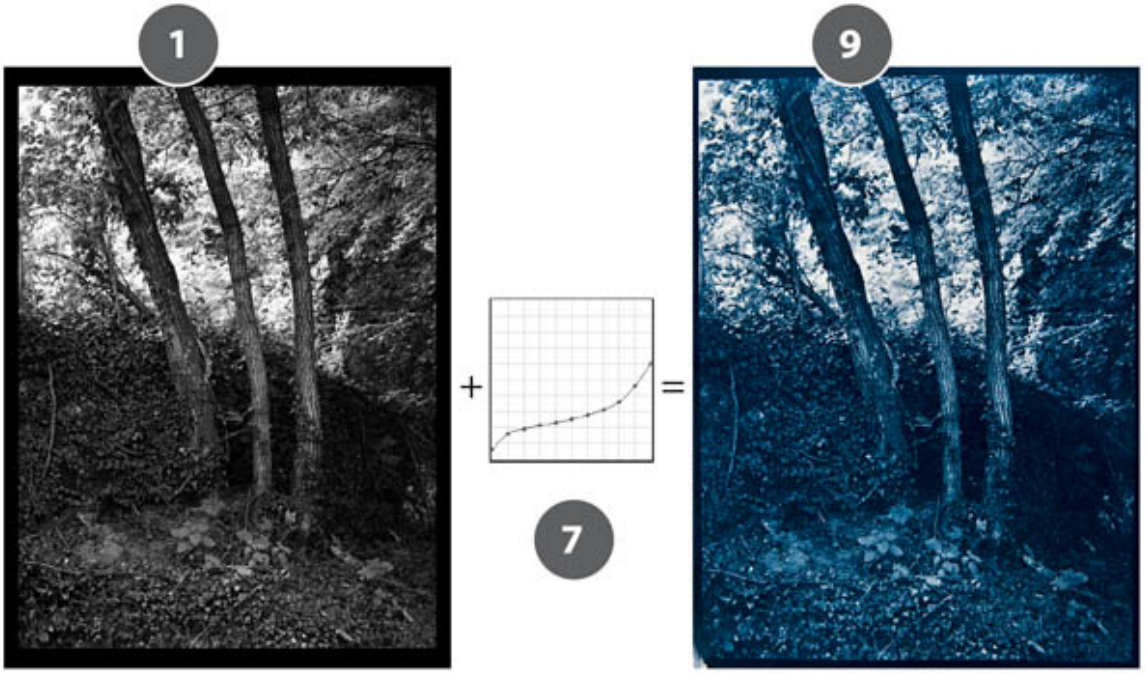
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Adding curves

Making curves for a digital negative is just one of the many methods that can be used to achieve the correct tonal values on the photograph. This method is quite simple, but still too complex to be fully described in this book.

In this section, we have therefore focused only on the method by which a so-called "average" curve is applied to a digital negative. This curve is, of course, not intended for use with a specific combination of printer, transparent film, paper, UV light ... but represents the combined, average tonal values of different printers, paper, transparencies, etc.

However, despite these generalizations, the "standard" curve can significantly improve the appearance of cyanotype prints.

For digital processing of photographs and negatives, we have used Adobe Photoshop software.

1. Before we begin with the work, we have to download the "average" curve, which is named Std-cyan-1.acv. This can be found on the internet address www.petermrhar.com/alternative.
2. In the next step, we have to convert the photograph to a 16-bit grayscale image by using the commands *Image >; Mode > Grayscale*.
3. Then the photo is digitally processed (1).
4. In the next step, we have to change the size of the photograph and its resolution (see also Making digital negatives).
5. In the Adobe Photoshop program, curves are loaded through the commands *Image > Adjustment > Curves*.
6. When the window Curves (2) is opened, we click the button *Preset options* and select the command *Load preset* (3).
7. In the dialog box, we have to find and select the file *Std-cyan-1.acv*. The file is loaded with a click on the *Load* button.
8. In the *Curves* dialog box, we will see the loaded curve (4). The curve is added to a photograph by clicking on the *OK* button. The

appearance of the photograph, under the effect of the curve, changes considerably (5).

9. Finally, the photograph is converted to a negative, then mirrored and printed on transparent film or some other transparent material.

When we print a photo that was previously corrected with the curve, we will notice a much finer and greater tonal range.

Note. More about digital negatives and the use of a custom curves, which are the modern basis for old and alternative printing techniques, can be found in the book Easy Digital Negatives.


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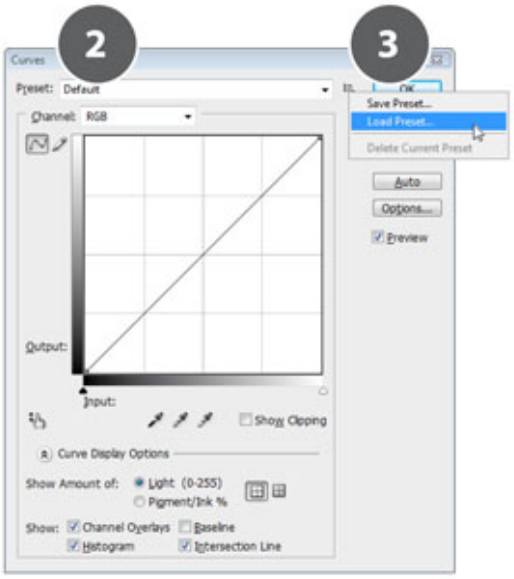
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Curves
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Channel: RGB
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Input:
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Curve Display Options
Show Amount of: Light (0-255)
Pigment/Ink %
Show: Channel Overlays
Baseline
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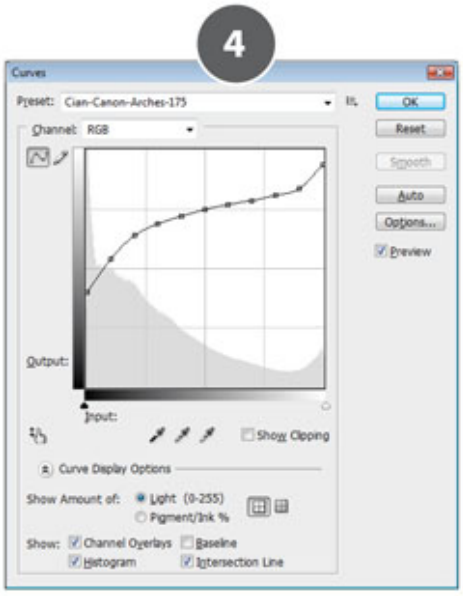
4
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Input:
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Curve Display Options
Show Amount of: Light (0-255)
Pigment/Ink %
Show: Channel Overlays
Baseline
Histogram
Intersection Line
OK
Reset
Smooth
Auto
Options...
Preview


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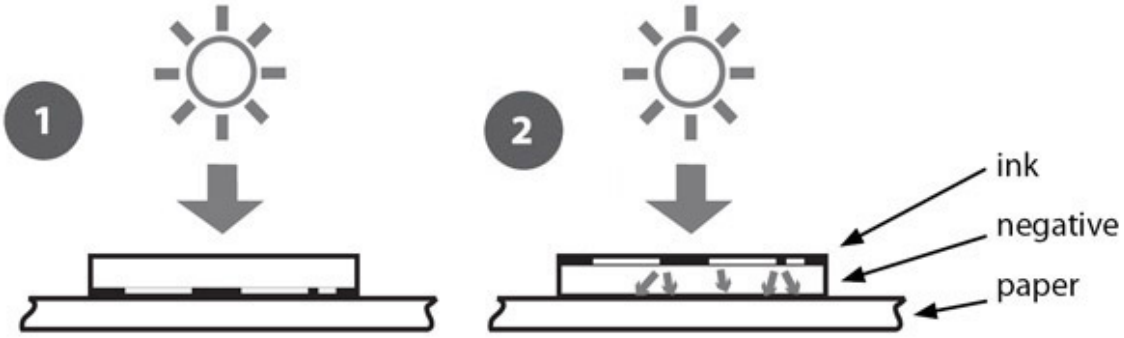
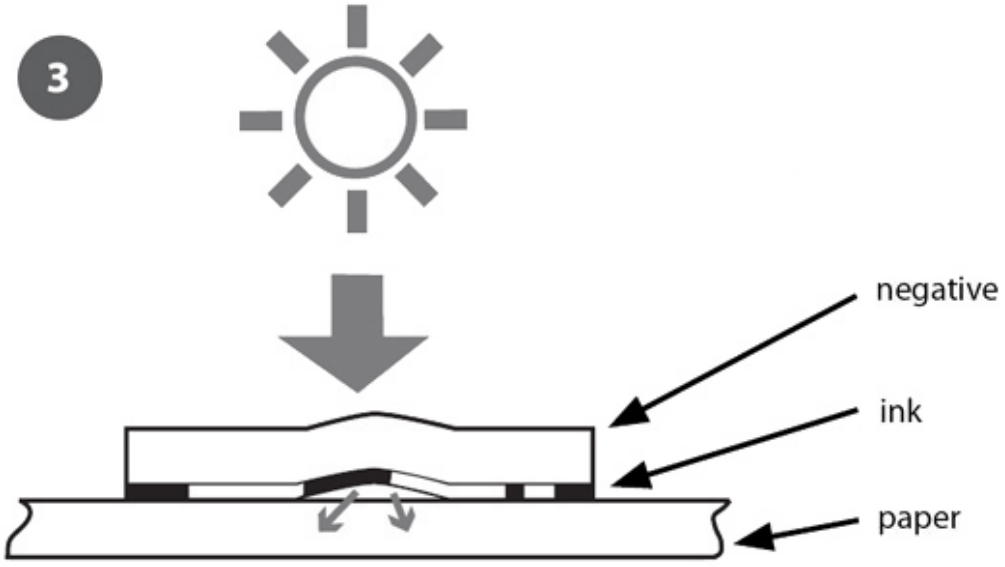
Contact printing frames

In most cases, the emulsion of old photographic processes is not very sensitive to light, so for the printing of such photographs we cannot use conventional photographic enlargers, in which an ordinary incandescent lamp is installed. Exposure is possible only under strong UV light with a so-called contact print. This means that we have to tightly press the negative, which is the same size as the final size of the photo, on light-sensitive paper. This is done with the help of a contact printing frame. The photo is then exposed under a UV light, e.g., the sun or special UV lamps.

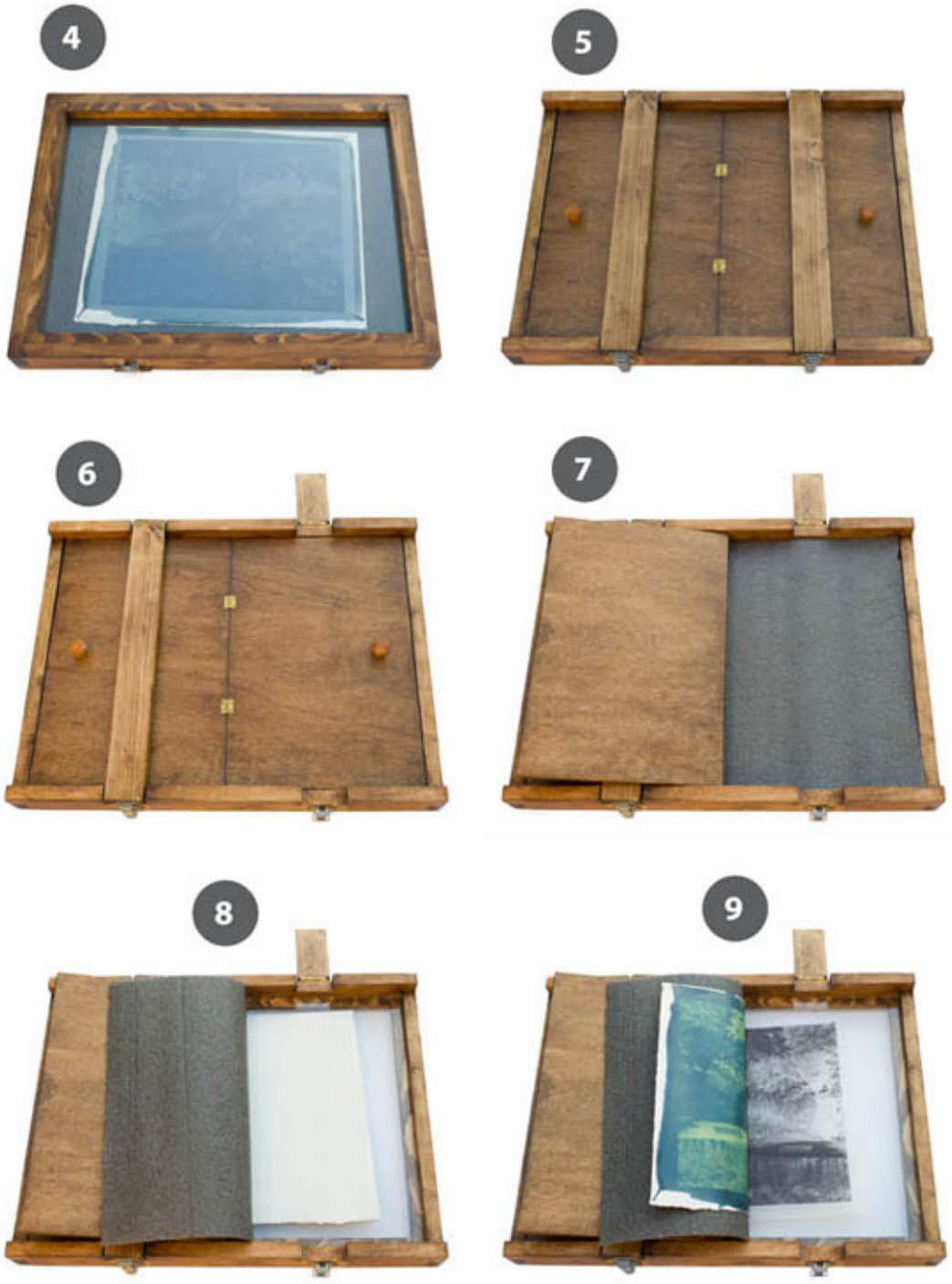
1. Since every negative is printed on a transparent surface which is of some thickness, we have to **place the emulsion of the negative onto an emulsion on the paper** (1). Otherwise, because of the thickness of the negative, light might disperse under the negative resulting in a blurred picture (2).



2. A blurry photograph also appears when the negative is somewhat distant from the surface of the paper (3). Because of this, the **negative must be tightly pressed against the paper**; this is done with a contact printing frame.

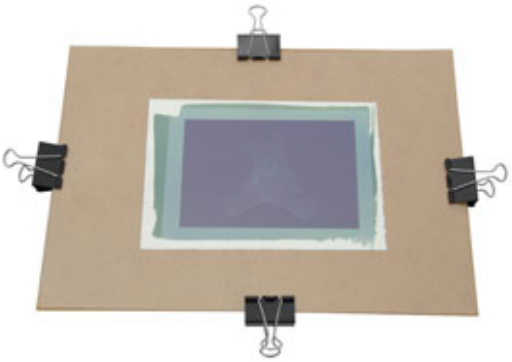


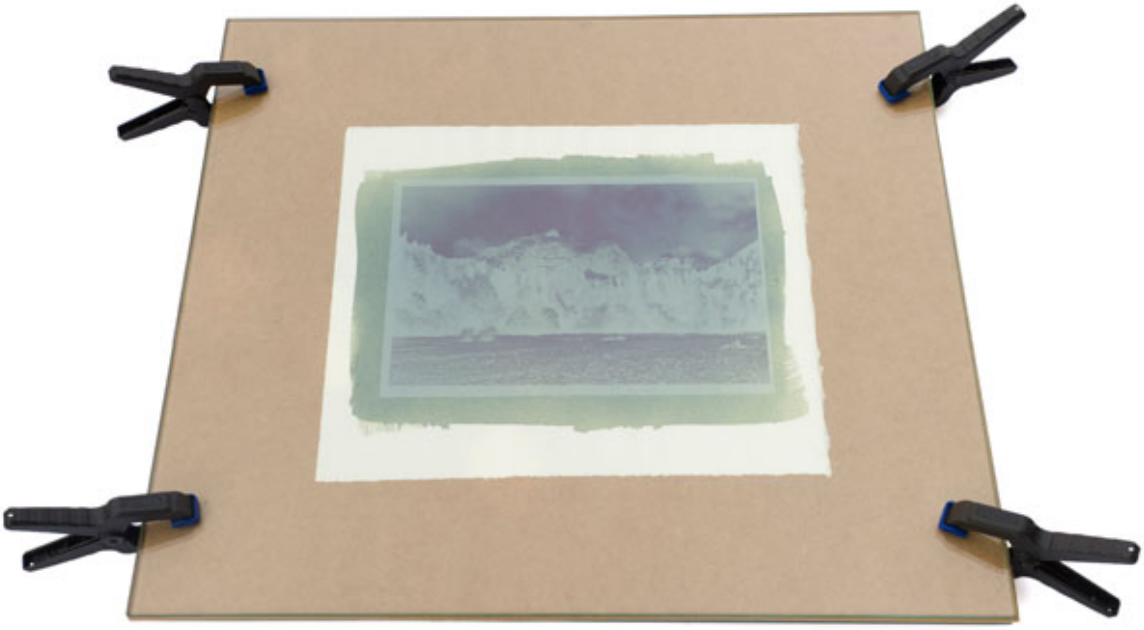
3. In some photographic processes, we can check the correctness of the photograph exposure during the exposure itself. This can be done with the help of a classic contact printing frame (4), which is composed of two or more moving panels (5). In this case, we can open only one side of the frame, while the other side is still pressing the negative to the print. In this way, it can't be moved (6, 7, and 8). Now we can lift the paper with the negative (9), check the exposure, and continue or stop exposing the photograph.



The contact printing frame is a necessary tool for serious work, but even without it we can, with a little more effort, produce technically excellent photos.

Instead of a contact printing frame, we can use two sheets of glass or Plexiglas, with a thickness of about 5 mm, between which we place a sheet of cardboard. This prevents exposure from underneath the photo. In doing so, we need to make sure that the glass is free from impurities and is not coated with a UV protection layer. The pressure between the plates is achieved by clamps.





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Exposing and developing cyanotypes

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What do we need?

A given method for making cyanotype takes place in a few stages. At first, we have to coat the paper with emulsion, normally indoors under an ordinary lamp that is weaker than 40 W. The cyanotype is then exposed to the sun or to UV light using an appropriate unit. The basic materials and tools that we will need to produce a cyanotype are shown below:

1. Two bottles of cyanotype solutions A and B
2. Two syringes for separate dosage of solutions A and B
3. A small container with water to clean syringes and brushes
4. A laboratory beaker, flask, or ordinary glass for mixing solutions
5. A photograph carrier (paper, cloth, glass, metal...)
6. A brush
7. Paper towels to clean the brush
8. A photograph negative or objects to create a photogram
9. A hair-dryer to speed up the drying of paper
10. A contact printing frame
11. A tray for water and, optionally, additional trays for bleaching and/or toning photos.


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The workflow

The entire procedure for making cyanotype is presented on the following pages.

1. Before we begin to work, we have to gather all the materials and tools that we will use, which depends, of course, on the way in which we want to make the photograph.
2. We need two solutions: ammonium iron citrate and potassium ferricyanide (see next page - 1). The chemicals are mixed into a light-sensitive emulsion in a ratio of 1:1 just before the application of the emulsion.
3. On the carrier material of the photograph (2), for example paper, stone, glass, fabric, metal, etc.., the cyanotype solution is applied (see also Application of emulsion) (3).
4. In the next step, we have to dry the paper or other chosen photograph carrier (4).
5. Objects or a negative film are placed on paper with a light-sensitive emulsion. This blocks out part of the light (5).
6. When the negative and the paper are placed in a contact frame (6), they are ready for exposure.
7. The photograph is exposed according to the selected standard exposure time (see also Exposure time for a photogram and Exposure time for negatives).
8. The photograph is developed (see also Developing and rinsing the photo) in pure water (7). In doing so, unexposed iron compounds are washed off the photograph, while blue, ferric ferricyanide, now insoluble in water, remains on the image carrier material.
9. After we have finished the exposure of the photograph, we rinse it for 15 minutes in tap water (8) to remove all unused chemicals.
10. When the photograph is dry, we have a blue photo (9) which can be our final product. If we wish, however, we can further change its color with bleach and various toners.
11. If we want to simply lighten up a photograph (10), we immerse it for a few moments in washing soda or household ammonia (see also

Bleaches and formulas).

12. The blue color of cyanotype is often converted to other colors. We can change the color of non-bleached photos (9), or we can change the color of photos that were previously bleached in washing soda or household ammonia (10). If we color the bleached photographs, we will get a photo with saturated colors (11), while toning the unbleached photographs (12) creates a darker photograph of higher contrast and with sometimes quite distinct black & white tones.
13. Photographs can be toned, not just once, but many times. The photograph marked with number 13 was first bleached, then toned with tea from oak bark, then washed in water and further toned with coffee.
14. Photographs can also be bleached with a brush, only in selected areas (see also Creative toning processes). This technique produces an image with interesting two-color combinations (14).
15. After toning, we rinse the photo for 15 minutes in running water.

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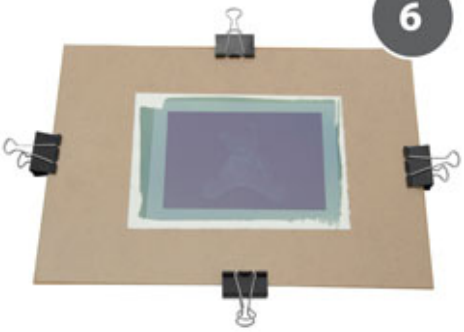

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15 min.

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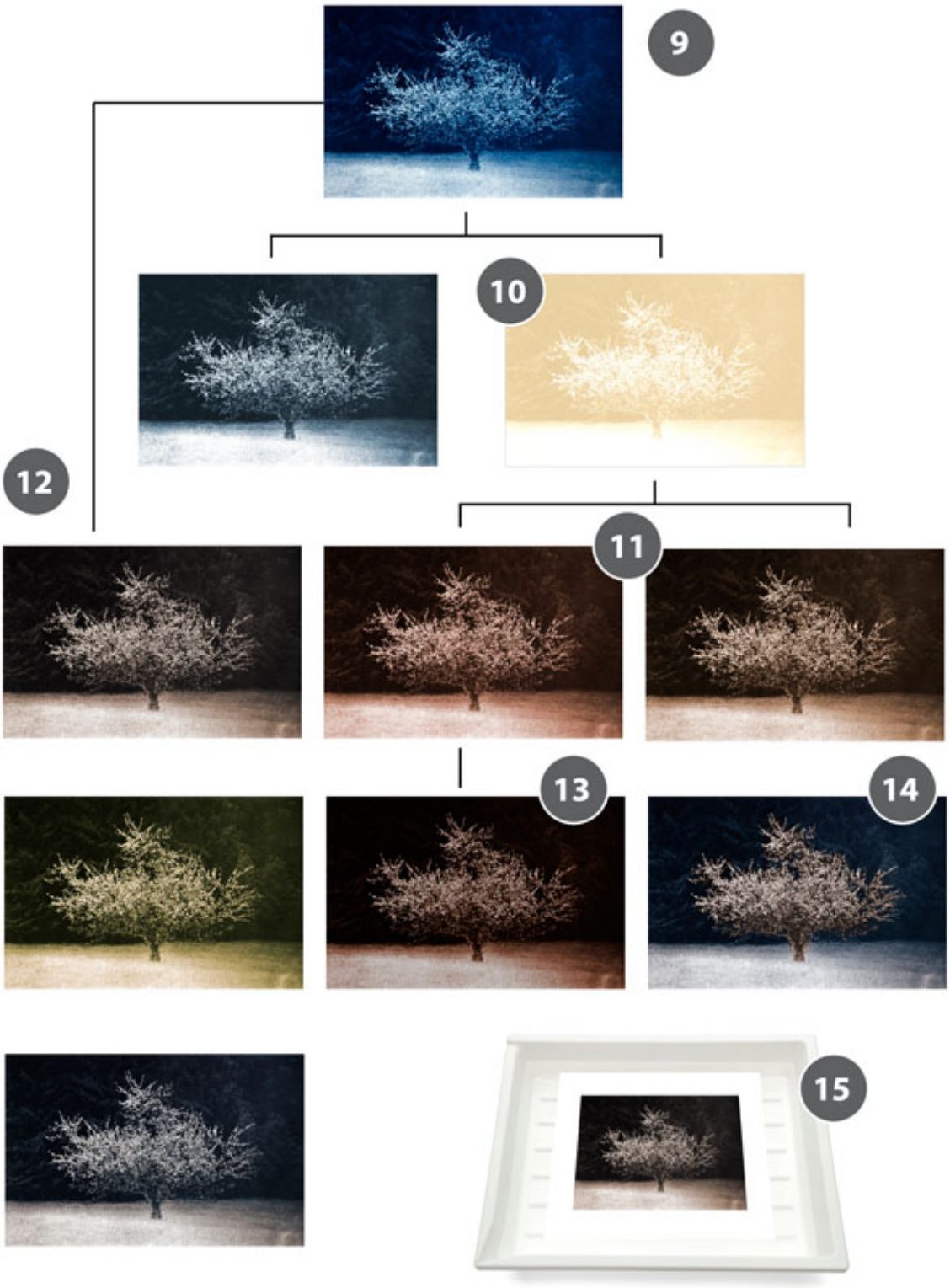
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Application of emulsion

There are as many ways to spread the cyanotype emulsion onto the paper as there are tools for brushing. Some users prefer to use an ordinary brush, while others prefer to work with a glass rod, Blanchard's brush, or a foam brush, etc...

Brushes

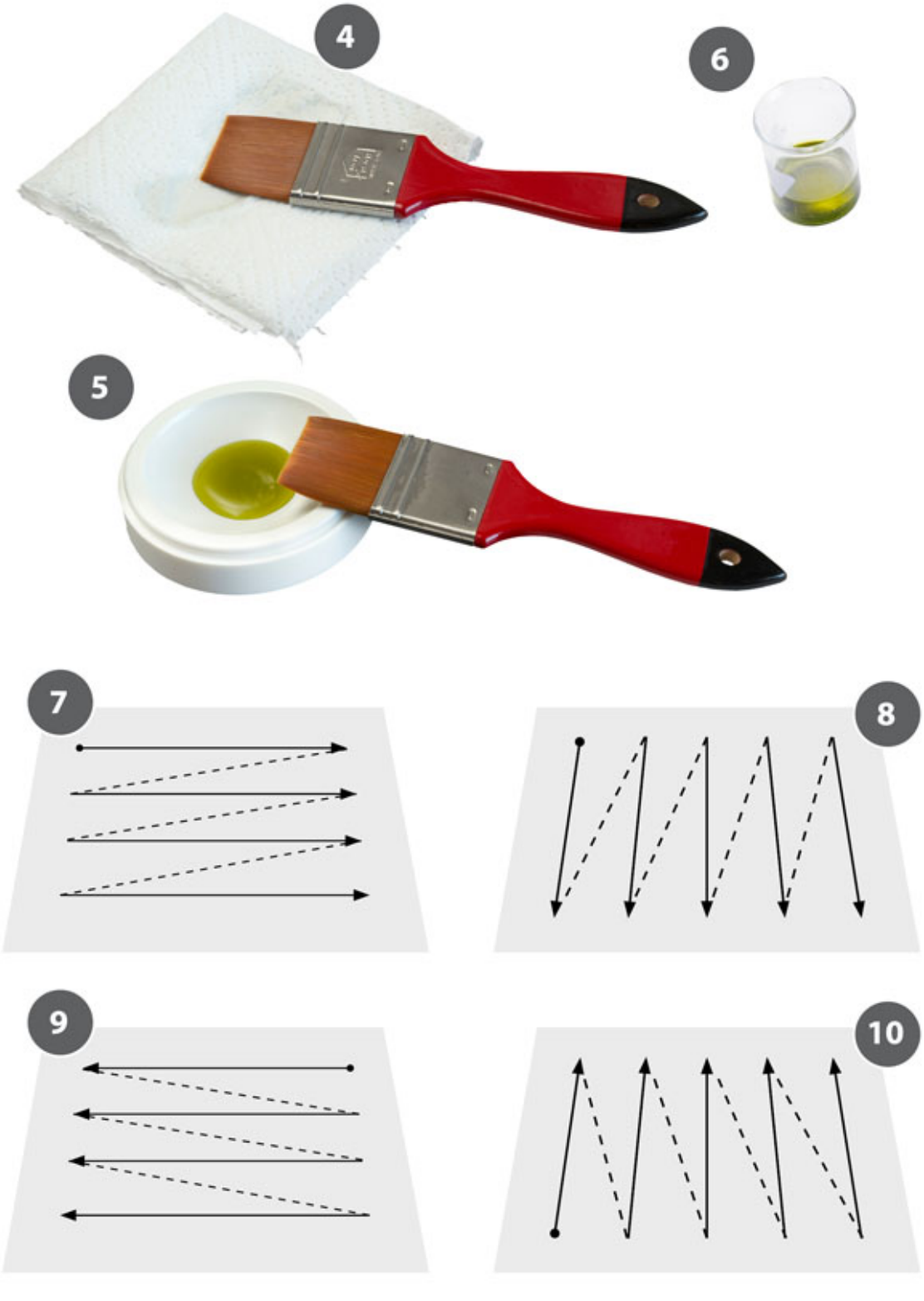
Brushes which are used in old photographic techniques should be made, as recommended by other writers, without any iron content or parts, since these react with the chemical emulsion and destroy it. Personally, I have never had this problem, but sometimes "an ounce of prevention is better than a pound of cure." The most popular brushes that are free of metal are foam brushes (1) and extremely soft, hake brushes (also called jaiban), which are made from goat hair attached to a wooden handle (2). Ordinary flat brushes (3) of the appropriate size are commonly used for applying the emulsion. Let's keep the rules simple: the larger the area that we want to brush, the broader the brush we should use. The best are brushes that do not absorb too much emulsion and do not leave hair on the paper.

Prior to application of the emulsion on paper, the brush is immersed in water so that its hairs swell slightly and soften. A saturated brush will also absorb less emulsion, which can be quite expensive. The brush is then wiped with a dry paper towel (4).

Emulsion can be applied in several ways. It can be poured into a wide shallow container (5), for example in a plastic saucer; we can apply it with a brush and spread it gradually onto the paper; and the like. The required amount of the emulsion can also be poured from a cup (6) onto the paper, where it is then spread with a brush.

Emulsion is applied with light strokes in the horizontal and vertical directions (7-10).

While we wait for the emulsion to be slightly absorbed into the paper, it's better to wash the brush and wipe it with a dry towel.

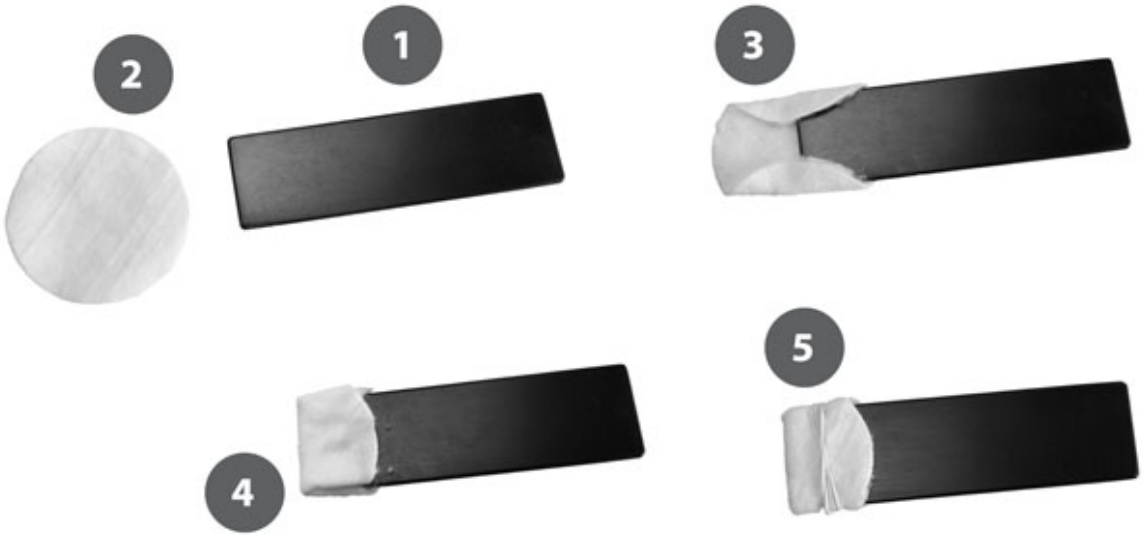


Blanchard's brush

A Blanchard's brush is nothing but a rectangular tile made of glass, plastic, or wood, to which we fasten a soft cloth or cotton swab with a rubber band or tape. The biggest advantage of this brush is that it does not contaminate the chemicals, because the tile can be thoroughly washed and the fabric is usually discarded after each application. Another advantage is that it is extremely easy to make such brushes to any size. In addition, this method is inexpensive.

The instructions for making a Blanchard's brush are as follows:

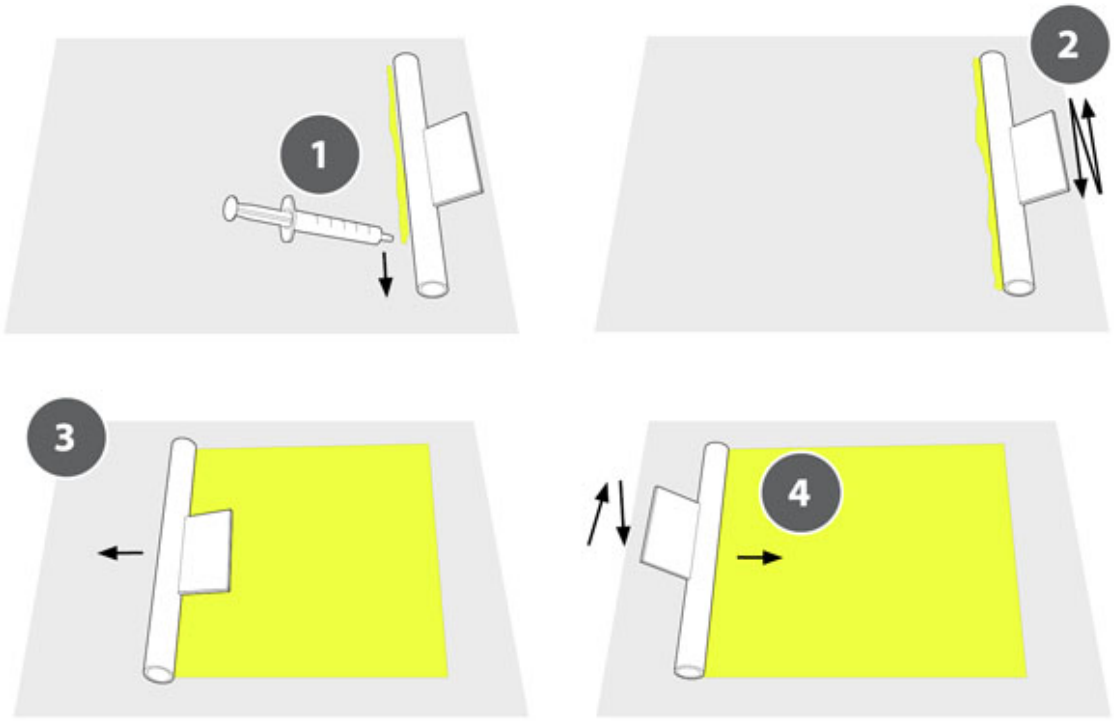
1. We cut the rectangular tile from plastic, wood, etc... to the desired size (1).
2. In the next step, we find or make a pad which will be used for the application of the emulsion. In this case, we have used cosmetic pads (2).
3. Half of a pad is placed under the tile and the edges are folded up (3).
4. The second half of the pad is folded over the tile (4).
5. The pad is mounted to the plate with a rubber band (5) or with a piece of adhesive tape.



Glass rod

The glass rod is a special device made of glass tube or rod to which a holder is fixed. The advantages of this device are fast and accurate application of emulsion on large paper surfaces; they are easy to clean; and, finally, the glass does not absorb chemicals. This device has also two drawbacks. For the application of emulsion on different sizes of paper, we need tools of different lengths, and we have to use the precise amount of emulsion.

An exactly measured quantity of emulsion is applied using a syringe along the entire length of a glass rod which has been placed on a flat sheet of paper (1). Then we push the glass rod forward and with left-right movements evenly distribute the chemicals over its whole width (2). We push the glass rod against the paper surface and with a steady movement we push it to the end of the paper (3). At the end, we lift the rod, put it behind the puddle, and push it toward the beginning of the paper (4). After application of the emulsion, we wash and wipe the rod.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Preparing the paper

Cyanotype emulsion is applied to the paper or other image carrier in an enclosed, darkened space, usually lit by a regular, weak lamp of up to 40 W.

1. On the paper, which should be slightly larger than the negative, we put the negative and mark its corners with a pencil to show the extent to which we will brush the emulsion (1).
2. In a laboratory beaker, a flask (4), or a plain glass, we measure the required amount of component A (2) with the first syringe (3), and then the same amount of component B (2) with a second syringe. We then wash both syringes.
3. In the next step, we mix together components A and B. We may agitate the cup or use a glass rod, which should be used for that purpose only.
4. The emulsion is poured, or otherwise transferred, onto the paper (5) and then evenly brushed over the paper (see previous section).
5. The paper is put aside for a few minutes (7) so that the emulsion is absorbed, and then it is dried with gentle, warm air from a hair dryer (8). If we don't want to use the hair dryer, the paper can be placed in a dark room for an hour.
6. When the paper is completely dried, it is ready for the exposure (9).
7. In order to achieve slightly darker tones, the paper may be brushed with a second layer of emulsion (10).

Note. When applying emulsion, we have to take care that we don't apply too much of it, because it can create puddles which will be visible on the finished image. If we apply too little emulsion, the picture will become brighter (11).

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5 min.

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Exposure time for a photogram

Before we begin to make a photogram, we must determine the optimal exposure time. This time is often the time in which the darkest tone that the photographic emulsion can display is achieved. Or rather, it is the time beyond which the color on the image cannot become darker, even if we prolong the exposure time.

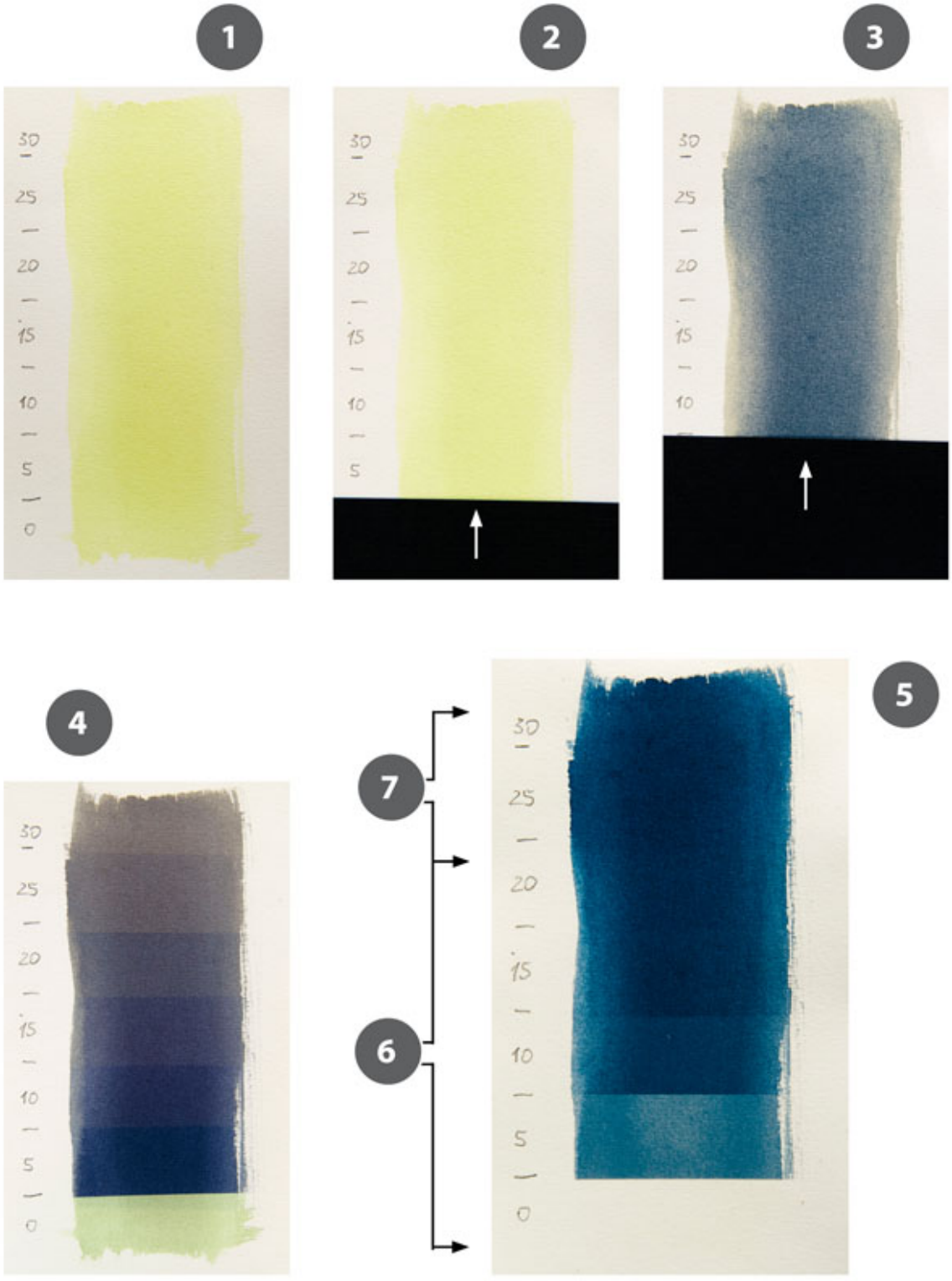
Exposure time depends on many factors: the type of paper; the thickness of the spread; the number of coatings; the ratio of chemicals in the emulsion; the humidity; the quantity of UV light and the type of UV light; the distance between the paper and the UV lamp, and, in the case of outdoor exposure, weather conditions, time of day, etc... The most important fact is that we can achieve constant results only when none of the above-mentioned parameters is changed.

Exposure time is found with a simple test, as follows:

1. In the case of a photogram, we use a piece of paper, size 20 x 10 cm, coated with an emulsion. Once the paper is dry, parallel lines are drawn on it. These are used for orientation while covering the emulsion with a piece of thin black cardboard. At one side of the paper, we write intervals; in the example below, they are 5 minutes long (**1**).
2. Next, we place the paper with the emulsion on a flat surface. We put the thin, black paper or a piece of plastic on the first line. This will be our first, unexposed strip (**2**). The paper is covered with a glass plate and taken into sunlight or under a UV lamp.
3. After the chosen time interval (in summer sun, one minute, and in the winter or in cloudy weather, 10 minutes, etc.), we lift the glass and move the black paper up to the next line (**3**).
4. When we gradually cover parts of the paper brushed with emulsion, we will see our chosen exposure time at the end of the scale of different color values (**4**).
5. The test paper is developed in water, washed, and dried. The result is a scale of blue tones (**5**).

6. In the next step, we have to review the results and find the most optimal exposure time during which the darkest color is reached. On paper, we look for dark values which, despite increasing exposure time, did not change. In the example below, the value from 5 minutes up to and including 20 minutes changes and becomes darker (**6**). The dark color of the strips which were exposed for 25 and 30 minutes did not become darker (**7**). Optimal exposure time for this photogram is, therefore, 25 minutes, because after that time, regardless of how long we continue to expose the image, there will be no change in the tone values of the picture.

In our example, we can also notice an interesting strip of clean, slightly metallic-brown color which appears in the upper, dark parts of the photograph (**4**). This metallic-brown color is the sign that the cyanotype is sufficiently exposed and ready for development.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Exposure time for negatives

Finding the optimal or so-called standard exposure time for negatives is the same as checking exposure time for a photogram, but with the exception that here we have to take into account the thickness of the film that blocks part of the UV light.

Of course, constant results can be achieved only in the case when there are no changes in any parameter that affects the exposure. Briefly, this time, we must use the same paper, coated in the same way; use the same brand of transparent films, etc...

The procedure for finding the time in which the darkest color of emulsion under the negative is reached is as follows. A clear, unprinted transparent film is placed on paper with emulsion. The paper is gradually exposed in chosen intervals under UV light (see previous page), developed, and dried. When, in the dark color values, regardless of prolonged exposure time, there are no further visible changes, the time of the darkest value of emulsion (or so called standard exposure time) is found.

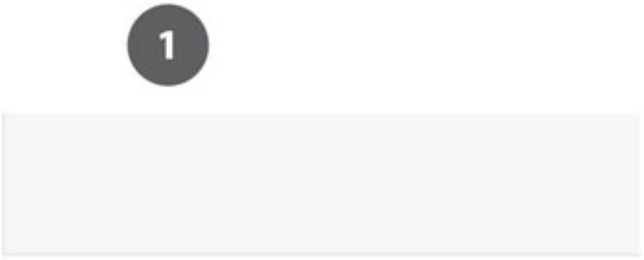
Although in the cyanotype process there are never any problems with pure bright values of the image, it's better to know some additional information about them. The time in which emulsion does not darken the original color of the paper is known as time of maximum white. Technically, this is the time at which UV light has not yet penetrated through the black, printed transparent film in such a way that the emulsion hasn't been exposed.

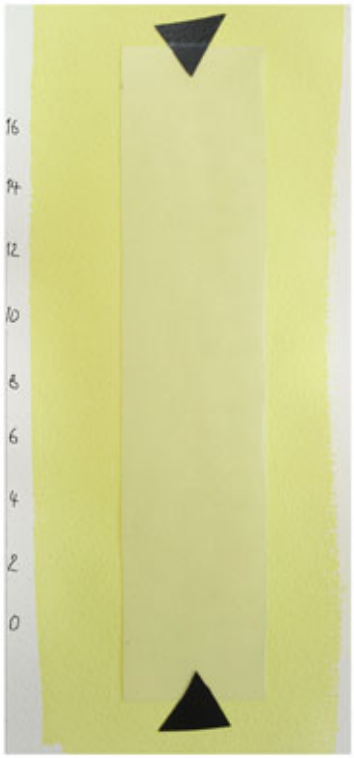
In practice

1. A transparent film (1) is placed on the light-sensitive paper.
2. The film is secured on the paper coated with emulsion with adhesive tape, so it will not move (2) during the exposure.
3. The negative is covered with black cardboard and a sheet of glass, and gradually exposed (3), in the way we described in the previous

section.

4. After the exposure (4), the paper is developed, dried, and ready to verify the results.
5. In the example below, the value of a dark color is the same after 14 minutes of exposure - this is our standard exposure time or time to achieve a maximum black (5).
6. Our exposure time is, therefore, 14 minutes.

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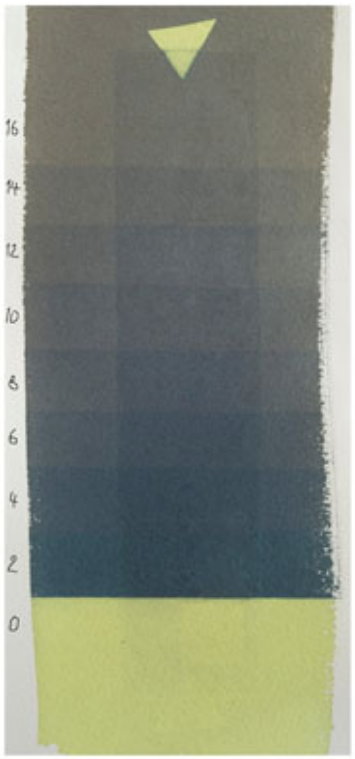
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Developing and rinsing the photo

Developing the cyanotype is extremely easy. It is sufficient to immerse the photo for 5 to 10 minutes in a tray filled with tap water. After this time, the unlighted chemicals are almost completely rinsed, while the rest of the paper is covered with a wonderful but slightly lighter blue color.

If we want to see the final, darker values of cyanotype immediately (otherwise they will become visible in the air after a few hours), we should put in 5 ml of 3% hydrogen peroxide into one liter of water for developing. Hydrogen peroxide can be bought in every better-stocked pharmacy.

When the photograph is developed, we rotate the photo with the picture up and rinse it an additional 15 minutes in slowly flowing water. This is necessary to get rid of any residual chemicals.

When rinsing, we have to be careful that the stream of water does not run directly on the image, because the color might be washed out.

After washing, the photo is dried.

Instead of in water, the cyanotype can be developed in various chemicals that enable us to further correct exposure. This technique will be described below.

Warning. Hydrogen peroxide is a powerful oxidant that is harmful if swallowed and will cause serious eye damage. It is best that before each use of chemicals we read the relevant instructions and warnings.

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Advanced techniques

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Herschel process

The cyanotype process of developing, as was used by its inventor John Herschel, is slightly different from today's method. In the book The Silver Sunbeam, by John Towler, 1866, as well as in other old photography manuals, we find that Herschel did not expose the paper with a mixed solution of the two components, but he soaked the paper only in component A. Once the paper was dried and exposed, he developed the photo in component B, i.e. potassium ferricyanide.

Since the photos made with this technique have very large and beautiful tonal range (2), it is used in cases where the negative is too dark or lacks more than half of the dark tones (1). With the Herschel process, we can produce a photograph which can sometimes have the same tonal values as the original photo, without any processing of the negative (see also Custom curve).

The disadvantage of this process is that the colors can be easily washed away from the image.

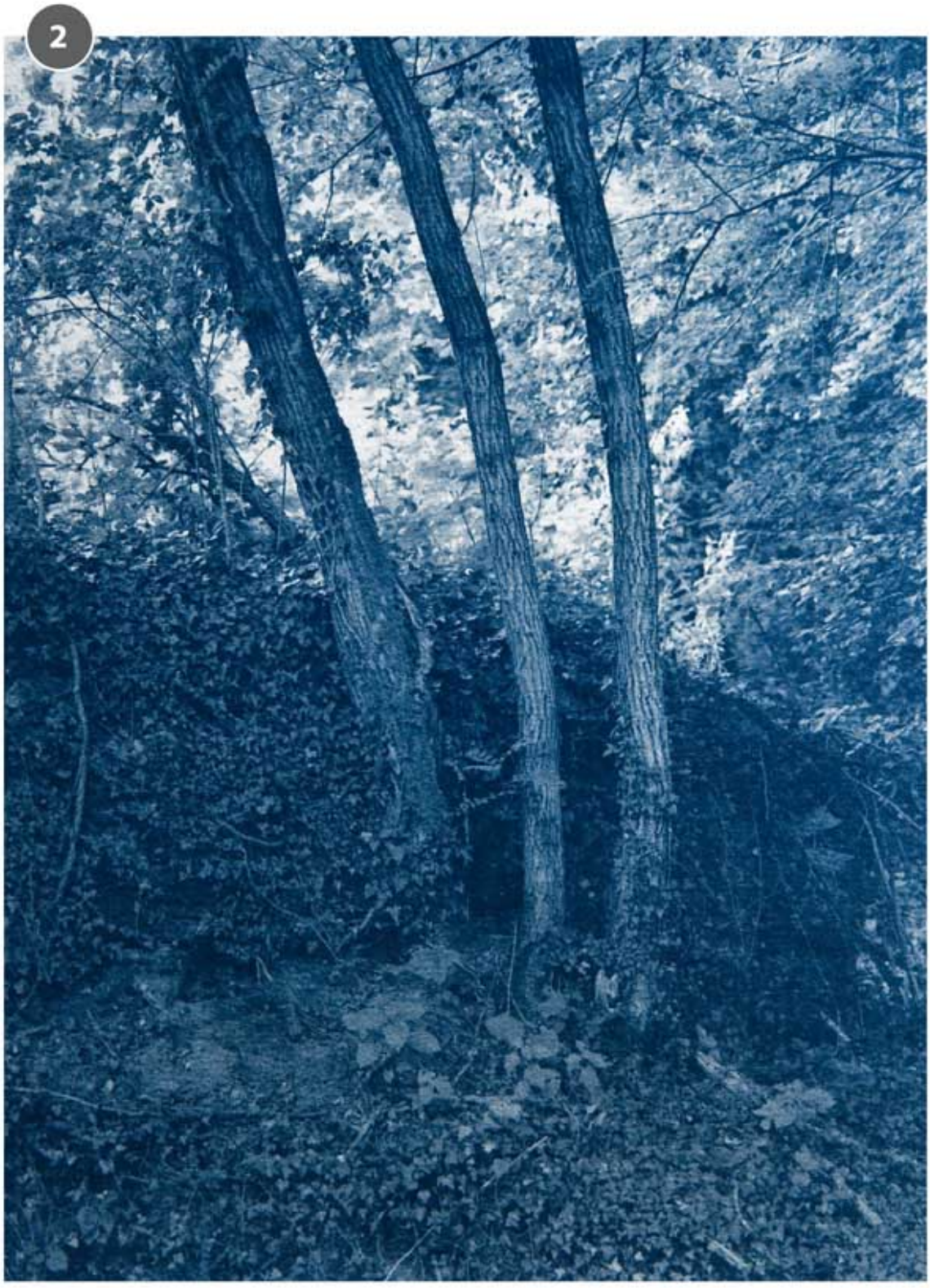
For making photos by the Herschel procedure, the following is needed:

- *A bottle of ammonium iron citrate (component A)*
- *A 2% solution of potassium ferricyanide*
  (10 g of potassium ferricyanide are dissolved in 500 ml of water)

The procedure is as follows:

1. The paper is coated with component A and then dried.
2. The photograph is exposed for 3/4 of the normal exposure time for cyanotype processing.
3. The 2% solution of potassium ferricyanide is poured on (or used to immerse) the exposed paper, on which very bright contours of the image are visible.
4. The photograph is carefully washed in water and dried.

1


2

Whitening a cyanotype

A photograph which was exposed too much or is too dark (1) can be slightly bleached after developing (see also Bleaches and formulas). In doing so, one has to be careful because this kind of whitening can result in loss of contrast (2). Such a photograph should be toned, in addition (3).

For whitening, regular household bleach (a 3 to 8% solution of sodium hypochlorite - NaOCl), household ammonia (5 to 10% solution of ammonia - NH_3), or washing soda (sodium carbonate - Na_2CO_3) of arbitrary concentrations are traditionally used. For more gentle whitening, it is better to use a smaller concentration of bleach. In any case, washing soda is more recommended for whitening because it has a more uniform whitening effect and is less toxic than other bleaches. Household bleach and household ammonia have a few drawbacks: they have an unpleasant odor and they are poisonous. When working with these chemicals, we have to use appropriate protective equipment.

The bleaching process is very simple.

1. If it is dry, the photograph is first soaked in water. In this way, the bleach reacts evenly across the entire paper surface.
2. The wet photograph is immersed in bleach and observed for changes.
3. When the desired effect is achieved, the photograph is immediately moved into a water bath so that the bleaching is stopped.
4. At the end of the bleaching process, the photograph must be thoroughly washed in running water for at least 15 minutes, and optionally further colored.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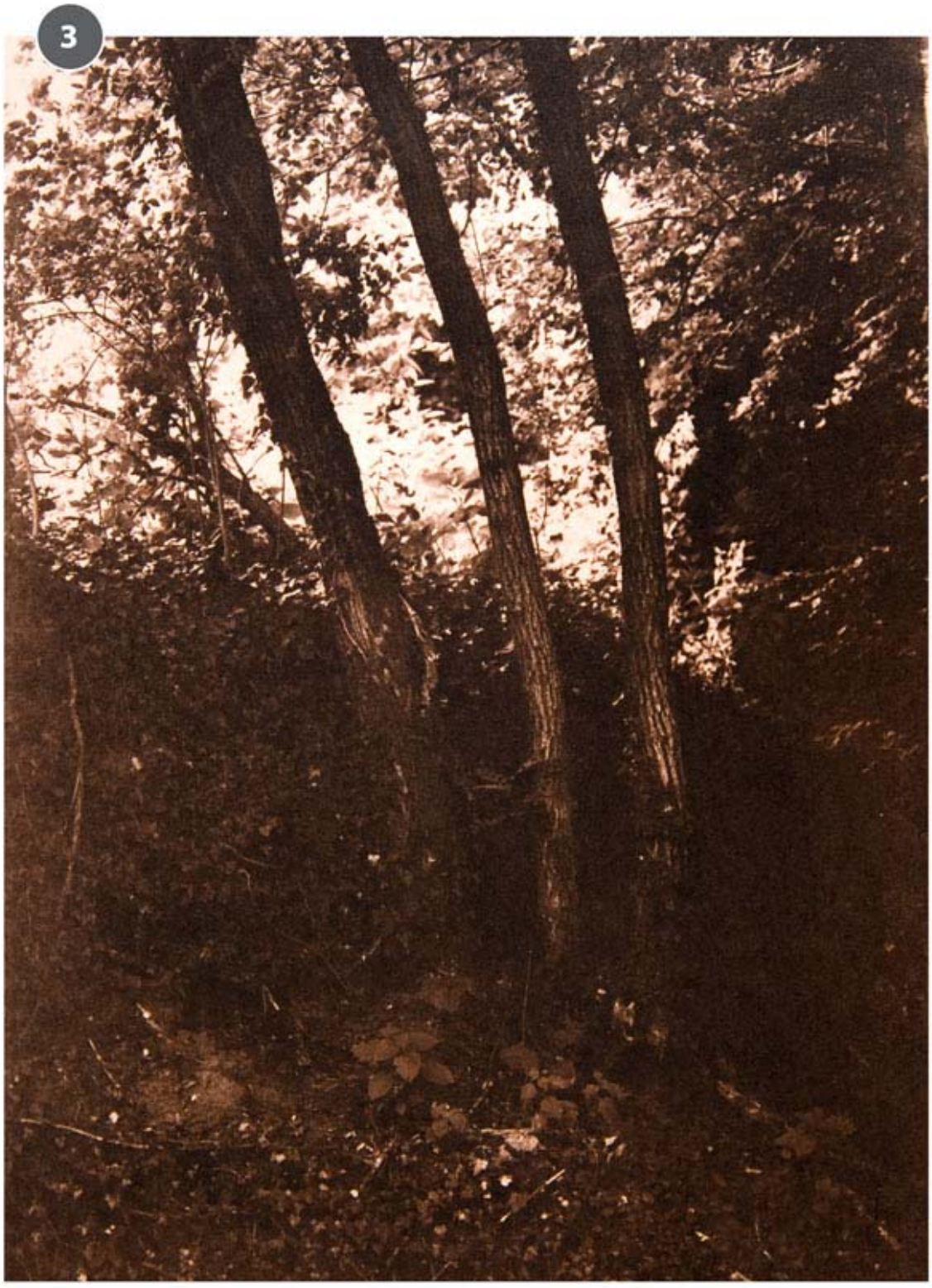
3

How to make brighter photos

A test sheet, i.e. the negative with a gray scale wedge, is usually added to photographs that are exposed in the sun. After the photograph is exposed and developed, the level of illumination is checked. If the test sheet is excessively exposed and is too dark after developing (1), the overexposed photo can be lightened (2) by development in a solution of potassium dichromate ($K_2Cr_2O_7$).

The amount of brightening depends on the amount of potassium dichromate in the water, whereby the rule applies that the higher the concentration of dichromate, the more lightened will be the photograph.

For the production of potassium dichromate solution, the following are needed:

- *3 g of potassium dichromate*
- *100 ml of distilled water*

A solution of potassium dichromate is made in the following manner:

1. 3 g of potassium dichromate is added to 100 ml of distilled water.
2. The content is thoroughly mixed.

A process to make water for the development of overly dark images is as follows:

1. 10 ml of 3% potassium dichromate is added to 1 liter of water, which is used for developing cyanotype.
2. The water is mixed and the photograph is developed using adequate protection.
3. When a photograph achieves the desired contrast, we take it out of the water and rinse it for 15 minutes under running water.

Warning. **Potassium dichromate is carcinogenic and toxic; it causes genetic defects, mutations, infertility, etc... In short, it is extremely dangerous. Be sure to read the warnings and use appropriate precautionary measures.**

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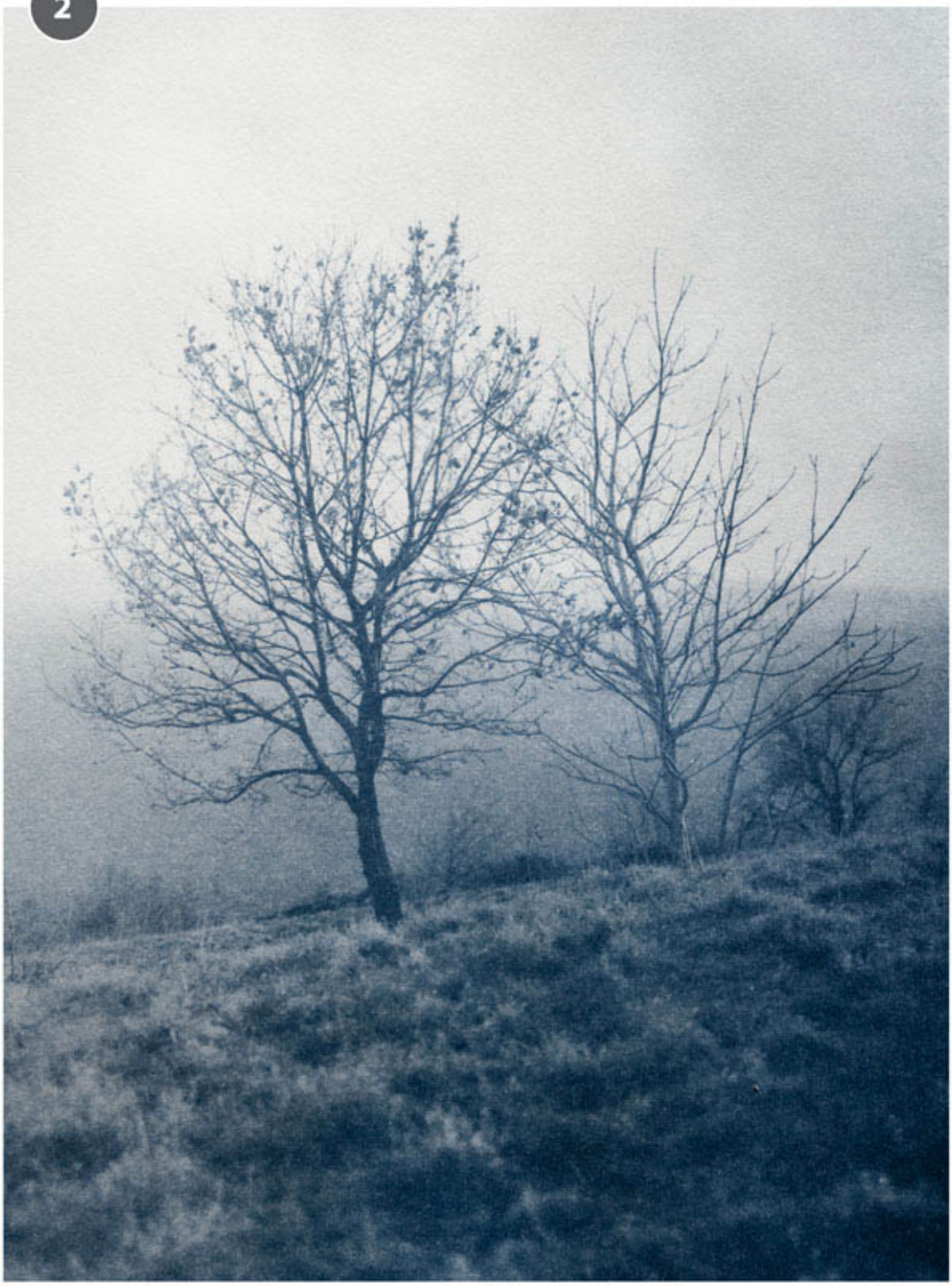


Making darker photos

If the photograph is underexposed (1), that is, if after development in water on a test sheet only white patches are seen instead of light grayscale values (2), the photograph can be darkened by developing it in acidic water. Darkening depends on the acidity of the water. The more acidic the water, the more lost bright tones will be recuperated (3). In doing so, we will soon notice that too much acidified water brings a loss of brighter tones, which gradually change into a single muddy spot (4).

Usually, plain white vinegar, citric acid, or glacial acetic acid (vinegar is substantially 5% glacial acetic acid) is used for acidification of water.

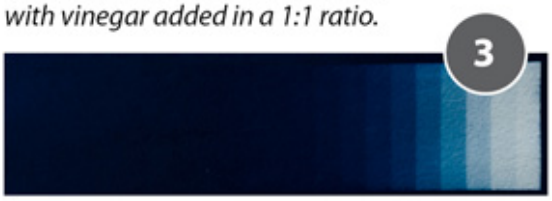
A method for developing pictures can be carried out by the procedure described below:

1. First, the acidic water is produced. Usually, we add 1 liter of vinegar (or 25 ml of acetic acid or 20 g of citric acid) into 1 liter of water.
2. The photograph is placed in the acidic water for as long as it takes for the desired values to be reached.
3. The photograph is washed thoroughly for 20 minutes in running water.

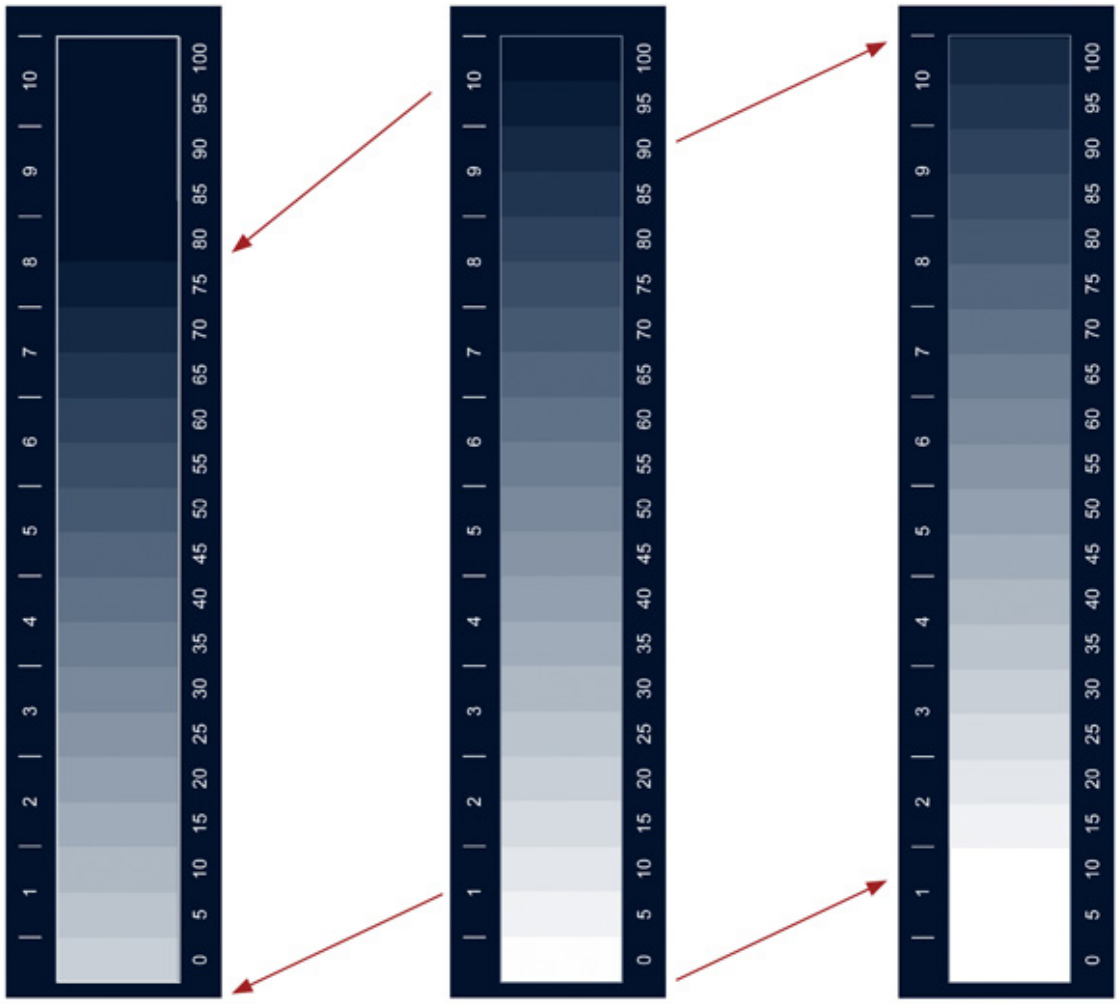
If the grayscale wedge is underexposed, it is better to continue exposure rather than developing the image in acidic water. Developing with acid water is preferable when a slightly deeper, softer line is desired on the photograph, or when we want to shorten the time of exposure.

A photograph developed in pure water.

A photograph developed in water with vinegar added in a 1:1 ratio.



A photograph developed in undiluted vinegar.



A photograph developed in undiluted vinegar.

A photograph developed in water.

A photograph developed in potassium dichromate.

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Toning cyanotype

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Toning cyanotype

Toning refers to the replacement of the basic color of the photograph with another color. The basic, blue color of cyanotype is most frequently replaced with brown, black or green.

Old cyanotype masters used a variety of solutions, ranging from highly aggressive and toxic acids to natural dyes. Today, natural dyes are most commonly used and in particular herbal tea and coffee that contains tannin.

Toning of cyanotype can be performed in two ways: either the photograph is toned without bleaching, or the photograph is first bleached and then immersed in the dye (examples).

With the first procedure (toning without bleaching) a variety of bi-colored or almost black hues can be achieved. For example, an image with a combination of brown and blue hues can be made. On the other hand, toning on a pre-bleached photograph (to the extent that the cyanotype blue color disappears almost completely) fully replaces the basic color with that of the toner (example).

Toning can also be carried out on a photograph that is entirely or only partially immersed in the toning bath (see also Creative toning processes). The toner can be applied by brush only locally, on any parts of the photograph (see also Local toning). With such a toning and a little more sense for art, you can achieve a very interesting multi-colored effect.

Photographs can also be toned immediately after rinsing in water. Thus, the photograph is still wet when placed in the desired toner, but it can also be dried and then toned after a few days. In the latter case, it is best to previously soak the photograph for a few minutes in the water, since toner on wet paper is distributed much more evenly.

Sometimes a photograph can be toned in a larger number of toners. The photograph on this page was at first fully bleached with a washing soda, then toned with oak tannin, then washed, and finally immersed in coffee for a few minutes.

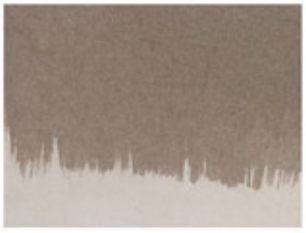
The photograph above was bleached then toned in potassium permanganate (but only for a short time). The lower part of the

photograph was immersed for several minutes in the coffee, and at last, the grass, flowers and stems were brushed with a toner of oak bark.

Note. The quality of toning largely depends on the paper. Some papers bind the color very well, while others less. On the latter, a brighter tone is much easier maintained, as the toner can be quickly washed away.

The possibilities of toning are extremely varied, especially when the different properties of toners are combined. The information below shows only a few basic color values that can be achieved with different toners.

A photograph toned with **coffee** after previous bleaching with washing soda.

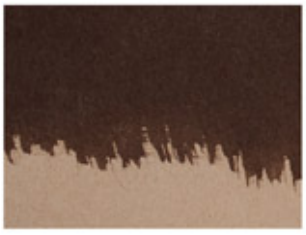


Cyanotype blue color in black **coffee** creates a cold, black tone.

Image toned with **black tea** after previous total bleaching.

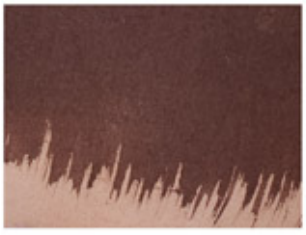
Black tea on a blue image creates rich black tones.

A photograph toned with **tea of oak bark** with previous bleaching.



Oak bark on a blue drawing.

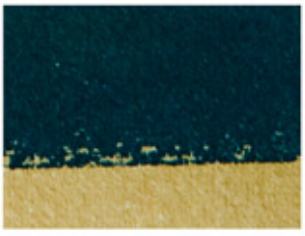
A photograph pre-bleached and toned with **oak tannin**.



Oak tannin on a blue drawing retains much of the brighter tones.

A blue photograph toned first with **coffee and** then with **vinegar**.

Potassium permanganate on a blue photograph is used for green hues.



Bleaches and formulas

Bleaches have two functions in cyanotype. In the first, during bleaching the blue cyanotype color on the image (1) is gradually changed into gray (2), brown (3) and yellow tones (4), which after washing can be a final image. Bleach in this case was used for light toning.

In the second function, a bleached photograph can also be used for further toning. The colors on a totally bleached photograph (4) have much higher purity than those applied on blue cyanotype. And sometimes, especially where there is a need to achieve a neutral, almost black color, the photograph can be only partially bleached (2) and then toned.

Bleaching can be done using a wide range of compounds, so the opportunities are almost limitless. Bleaching can be done with glass cleaners, cleaners for ceramic surfaces, washing powder for textiles, powders for dish washing, etc...

Bleach (sodium hypochlorite - NaOCl) or washing soda (sodium carbonate - Na_2CO_3) are most often used in cyanotype. Bleach and washing soda can be bought in any supermarket or drugstore.

The concentrations of bleach presented below are of medium strength, which means that it will work after a few minutes. If you want to perform bleaching more slowly, simply reduce the concentration of the solution. It is preferable to avoid more concentrated solutions because it is harder to monitor rapid reaction than slower.

After each bleaching, the photograph must be thoroughly rinsed in water because the bleaching is carried out also in the toner.

Bleaching with household ammonia and household bleach

Household ammonia and bleach are easily accessible, but they have two disadvantages - they are toxic and have a rather unpleasant smell.

For the production of this kind of bleach, the following is needed:

- *50 ml of household ammonia (bleach)*
- *1 l of water*

The bleach is made by pouring 50 ml of household ammonia or bleach into 1 liter of water and the two are mixed together completely.

Bleaching with washing soda

Making this bleach is extremely simple. 8 g of washing soda is dissolved in one liter of water. We will need:

- *8 g of washing soda*
- *1 l of water*

Bleaching process

Bleaching is quite a simple process. After development, the photograph is immersed in the prepared bleach with the image facing upward in the tray. When the image in the photograph completely (or partially) disappears, the photo is transferred to clean water for at least 20 minutes.

Warning. Bleaches are quite toxic, so it is best to read all warnings and instructions on how to work with them. Always use protective gloves and all required equipment.

Black toner from coffee

Toning with strong coffee (and tea, of course), is one of the most popular techniques among practitioners of cyanotype. The reasons for such popularity are many. Toner made from black coffee is non-toxic, can be found in every household and, sometimes most importantly, the cost of such toning is negligible. Toner from black coffee reaches nearly cold blacks, especially in the case of a slightly pre-bleached photograph.

Toner made from black coffee is nothing more than a very strong black coffee. For production of it, we need:

- *5 large spoons of black (or instant) coffee*
- *1 l of boiling water*

Manufacturing of toner from instant coffee is easy. Coffee is just mixed in warm water. Black coffee toner could be made as follows:

1. 1 liter of water is boiled and 5 tablespoons of black coffee are mixed into it.
2. Once the coffee has cooled, it is strained through a paper coffee filter or some dense fabric.

The photograph above was partially bleached and then toned in black coffee for 30 minutes.

This photograph was printed on a highly absorbent paper for graphic arts and was toned in black coffee for 15 minutes, without bleaching.

Brownish-black toner from tea

Toning with black or green tea turns the cyanotype blue color into a gentle, somewhat warm, brown and black color. Unlike toning with coffee, tea retains a somewhat brighter tonal value.

Tea toner is basically a very strong green or black tea. To produce this toner, the following items are needed:

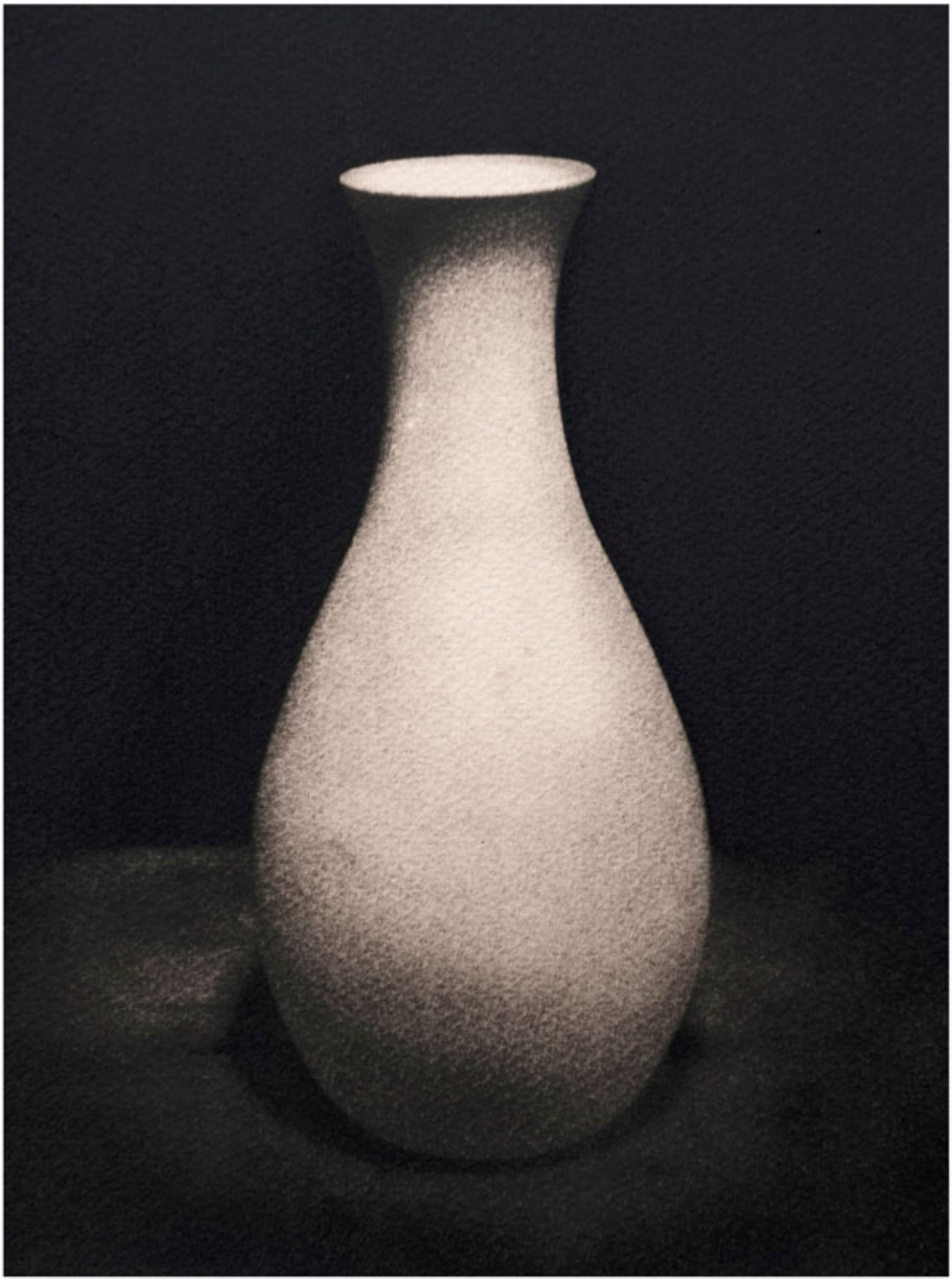
- *5 large spoons (or 5 bags) of tea leaves*
- *1 l of boiling water*

Preparation of this toner is not troublesome work:

1. Five tea bags or five tablespoons of tea leaves are placed in 1 liter of boiling water in a teapot.
2. The teapot is taken from the heat and left to cool for an hour.
3. Tea which is not in filter bags must be strained before use.

When the greater emphasis of watercolor drawings is desired, the surface of the paper can be rubbed with the fingers a few times during the rinsing in water. With this method, some extra color is removed at the peaks of the rough paper texture.

Note. The lifetime of organic toner can be extended if we add a few drops of formalin into it. This effectively prevents the formation of mold.



Brown toner from oak bark

Oak bark, although extremely saturated with tannins, is less well-known among fans of Cyanotype, can be compared with industrially-produced tannin. This can be easily noticed at the time of an initial toning procedure - color from the oak bark toner is extremely strong and dark, and light tones are almost untouched. Oak bark can be bought in almost any pharmacy.

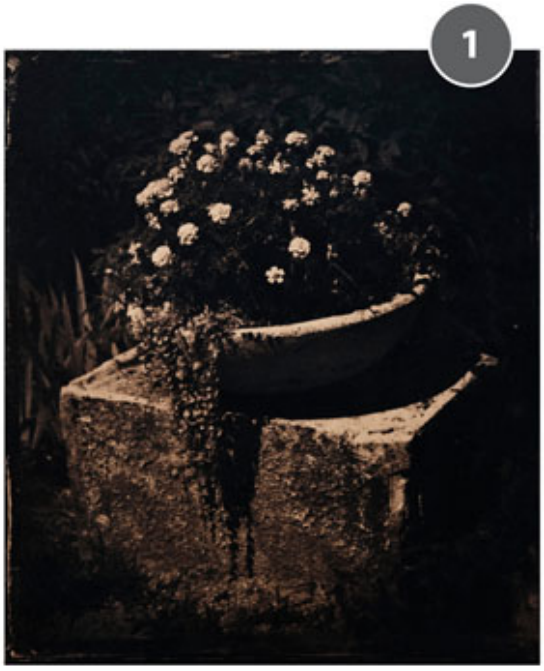
Toner from the bark is prepared in the form of saturated tea. To produce one liter of toner we need the following:

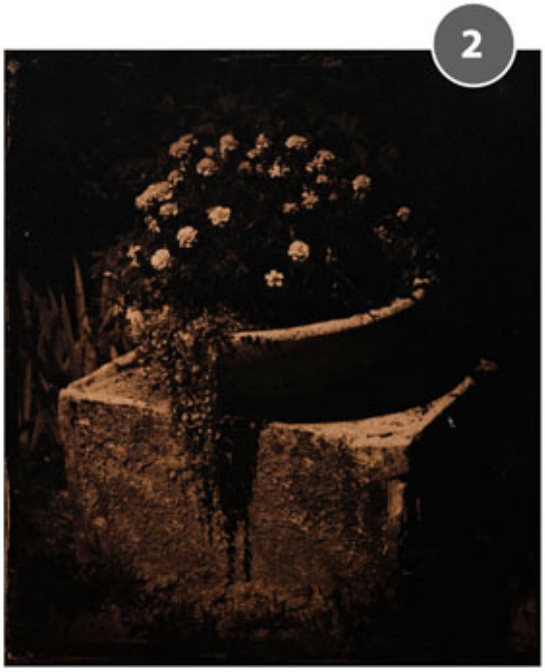
- *150 g of oak bark*
- *1 liter of water*

The process for the preparation of oak bark tea is somewhat time-consuming and is explained below:

1. 200 grams of oak bark are added to 1 liter of boiling water and further boiled for 20 minutes.
2. After one hour, the resulting tea is strained through a paper coffee filter.

The color generated by various toners is largely related to the choice of paper. Both photos shown below were developed with the same procedure, and dipped for 20 minutes in oak bark toner without bleaching. The only difference is in the paper. The first photo is printed on Arches Aquarelle Grain Satin paper (1) and the other on Arches Watercolor Cold Press (2).


1


2

This photo, which was printed on paper Fabraino Artistico, was completely bleached and immersed for 20 minutes in oak bark tea.

Purple toner

The hues that toner from pure tannin gives to the photograph are dependent on the material from which the tannin was made. Tannin made from chestnut or oak is the most commonly used in cyanotype.

In the example below, oak tannin was used, giving a gentle touch of purple to the photograph.

Tannins are unfortunately somewhat difficult to procure, and of course they are more expensive than tea, but regardless of this they are very popular in cyanotype. With tannins, toned photographs show extremely rich, deep tones that the other toners cannot achieve.

In a similar manner to tannin, tannic acid can also be used. This is essentially refined tannin. Unlike with tannins, toning with acid produces slightly more blackish tones.

For the manufacture of toner from the tannin we need:

- *40 g of tannin*
- *1 l of water*

Tannin dye is prepared in the following way:

1. 40 g of tannin is dissolved in 1 liter of water, but we have to be persistent, since tannins (unlike tannic acid) do not dissolve very well in water.
2. Once the tannin is well dissolved, it must be strained through a coffee filter or through a clean, tightly woven cloth.

Since tannins have a very strong effect on the photograph, it is recommended that photographs are tinted with multiple intermediate rinses in water. In this way, we can control the action of the toner. Slightly redder tones are obtained when the image is further bleached in household ammonia.

Note. **Small pieces of unstrained tannins on rough watercolor paper will create interesting similarity to watercolor paintings.**

This photo was first bleached and then toned in oak tannin for 15 minutes.

Green-blue toner

When a gentle touch of green color on a photograph is desired, the old masters used ferrous sulfate (formally ferrous sulfate heptahydrate - $FeSO_4$ $7H_2O$). This toner behaves somewhat capriciously, not always giving the same results, but it is very effective in short and rapid toning sequences.

Since the photograph in this toning becomes brighter, it is imperative that the initial photo is somewhat overexposed or darker than usual. White tones will appear later, after toning. This toning technique produces a beautiful look on slightly more highly contrasted images.

Ferrous sulfate may be acquired in the better-stocked shops selling agricultural products because the chemical is also known as iron fertilizer or green copperas.

For the manufacture of toner, we need:

- *100 g of ferrous sulfate*
- *1 l of water*

Toning is carried out as follows:

1. A finished, blue photograph is first immersed in a mild solution of bleach.
2. When the image loses its bluish tone, the photograph (without washing in water) is immersed for a few moments in ferric sulfate.
3. The photograph changes color nearly instantly.
4. If the first toning does not give a satisfactory result immediately, the procedure can be repeated. The photograph, without being rinsed in water, is placed in a solution of bleach for a few seconds and again immersed in ferric sulfate for a few seconds.
5. Once the result is pleasing, the photograph is transferred into water, where it is washed several times.

6. At the end of toning, we wash the photograph for at least 15 minutes under running water.

Note. For toning with ferrous sulfate, it is recommended that we put on gloves, as this solution generates black stains that are very difficult to remove around the finger nails.

The photograph was bleached for 5 seconds and tinted for 5 seconds with iron sulfate five times alternately.

Green toner

Common salt mixed with potassium permanganate ($KMnO_4$) color can be used to turn cyanotype into green. After toning, a strong yellow color will be visible on the paper.

Similar to toning with ferric sulfate, which we described on the previous page, toning with potassium permanganate is also quite unreliable and capricious. If the paper is left for too much time in the toner, destruction of tonal values of the photograph, or so-called posterization, may occur.

Potassium permanganate is a chemical of black color, and when dissolved in water it is visible as a distinct reddish material in the water. Since permanganate is one of the most useful disinfectants used both to disinfect wounds and water, it may be acquired in almost any pharmacy.

For the manufacturing of toner, we need:

- *1 l of water*
- *5 g of common salt*
- *2 g of potassium permanganate*

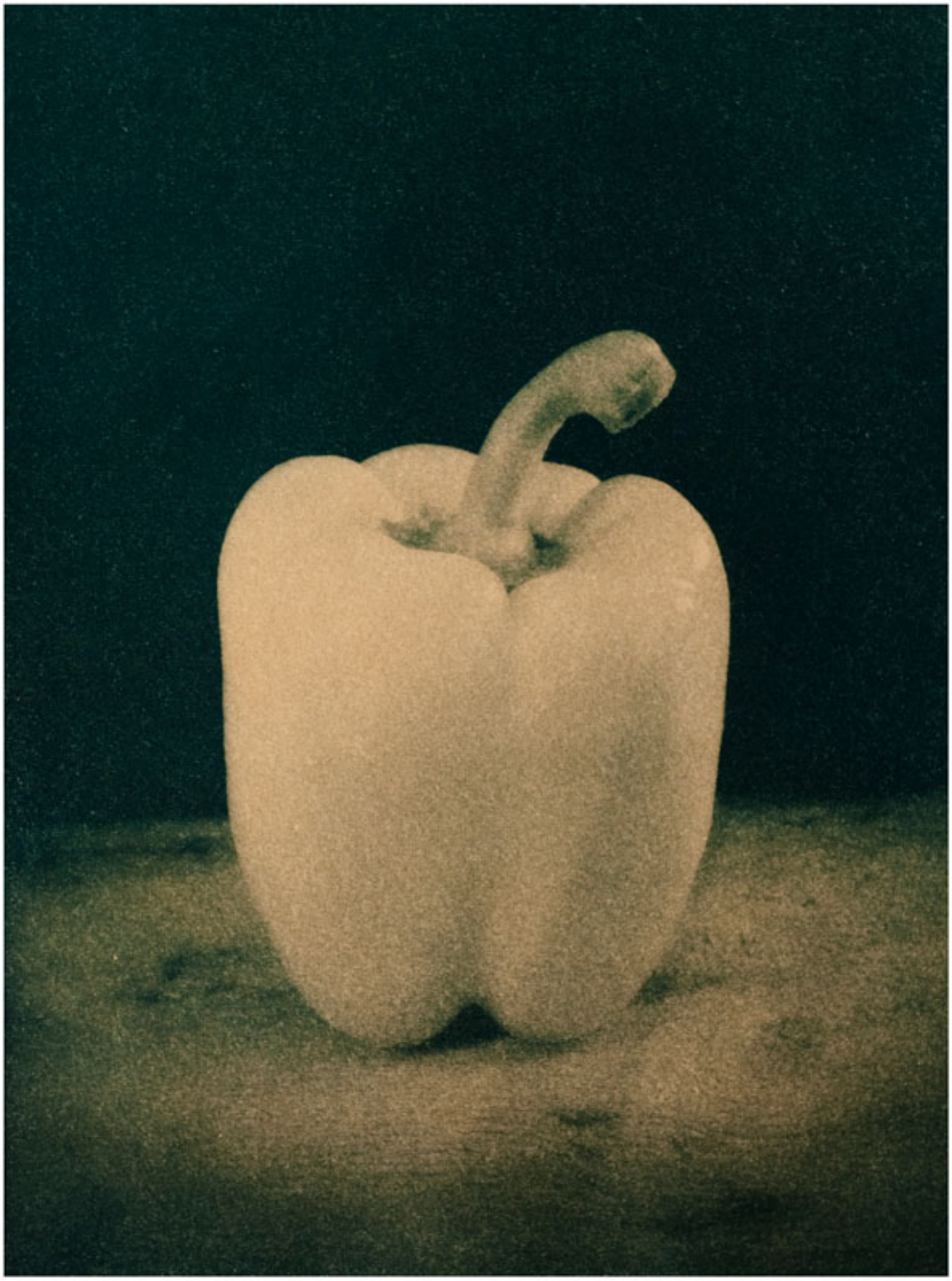
The process of preparation is very easy, as follows:

1. 5 g of common salt is poured into 1 liter of water.
2. Then we add 2 g of potassium permanganate and mix everything well.

Toning with disinfectant is performed only on finished, blue photographs.

1. The photograph is immersed for a few seconds in permanganate and quickly washed in water.
2. The procedure is usually performed only once or twice, since excessive toning will destroy the photograph.
3. After dyeing, the photograph is washed for 15 minutes in pure water.

Warning. **Potassium permanganate diluted in water is a common disinfectant, but, undiluted, it is toxic by ingestion and accelerates combustion. Therefore, great caution is necessary.**



This photograph was developed without any bleaching, then immersed for 5 seconds in permanganate, and finally thoroughly washed. The

whole process was repeated once again.

Toning in vinegar

A touch of green can be added to cyanotype by alternating toning of the cyanotype in coffee and vinegar (or any similar equivalent acid, such as 5% diluted acetic acid, lemon juice, or citric acid - see also Making darker photos).

In this technique, toning should be constantly repeated, since the beautiful tones that are observed when the photograph is in vinegar will disappear in water. Instead of these beautiful green values, greenish hues will appear during the rinsing in water, as seen in the photograph on the next page.

Toning is quite long, usually taking several to 10 minutes, as explained below:

1. The photograph is first slightly bleached in household bleach, ammonia, or in washing soda (see also Bleaches and formulas).
2. The first step is toning in coffee. This should take about 15 seconds.
3. Once the photograph is toned in the coffee, the cyanotype is briefly washed in water and immersed in vinegar for 15 seconds.
4. The photograph is then toned in coffee again, then washed, immersed in vinegar, washed, tinted in coffee, etc...
5. Regardless of any beautiful green color that is seen in vinegar, the process must be repeated for some 10 minutes, or the green color will disappear during rinsing in water.
6. After the final toning in coffee, the photograph is again immersed in vinegar and rinsed in tap water for 25 minutes. Flushing should be longer than usual because all the acid in the paper should be washed away.

Warning. Glacial acetic acid accelerates combustion and causes skin burns and eye damage. Eye protection must be

worn and care taken when using other mild acids, too.

This photo wasn't bleached, but it was immediately transferred to a coffee toner, then it was washed, transferred to vinegar and washed again. Each part of the cycle lasted for about 15 seconds, while the entire process of toning lasted 30 minutes. Finally, the photograph was immersed in vinegar for a few minutes and washed. The photograph was printed on CANSON Edition paper.

Creative toning processes

Up to this point, only simple cyanotype toning processes have been described, in which the entire paper was immersed in toner. In this section, some other, slightly more interesting and creative techniques that give, at times, quite amazing results will be described.

Partial toning in the tray

Partial toning in the tray is done when we desire one part of the photograph to be colored with a first color and a second part with another color (1). The process of such toning is as follows:

1. The photograph is developed by any of the aforementioned procedures and then totally or partially bleached. Of course, the photograph can also be toned without bleaching (see also Bleaches and formulas).
2. The wet photograph is immersed to the selected height in the tray with the desired toner and left in it until the target result is reached.
3. After the first toning, the image is washed in water.
4. Then the second half of image is immersed in a tray with the second toner.
5. Once the photo is properly toned, it can be removed from the toner and rinsed for 15 minutes in water.

Local toning

Local toning is used when we want to change the hue just in a selected area of the photograph. In this case, the toner is applied on the dry or wet photograph with a brush. If the image is dry, it is less likely that toner will spill out from the desired area. On the contrary, if we wish to create soft gradient tones, the toner is applied to a wet or damp photograph.

In local toning, different parts of the image can be simultaneously toned with the same or with different toners.

Local toning can also be carried out in such a way that some portions of the picture are bleached before toning with bleach or washing soda. In this case, we will get an interesting two-toned photo (2).

In the example below, the desired parts of a blue cyanotype image (3) was completely bleached with a brush and undiluted household bleach (4). Then the whole photograph was immersed in oak bark tea. In the photograph, therefore, there are whitened parts which appeared in

distinctly brown tones, and on un-whitened parts some original, noticeably blue color can be seen (2).

Once the desired effect of toning is achieved, the photograph must be thoroughly washed; this will stop further bleaching of the photograph.

Double toning

Double or multiple toning is useful for additional changes of the basic color, or to add a bit more saturated hues to the photograph. The process is very simple. The photograph is developed, toned, washed, and toned a second time with toner of a different color.

The photograph at this location was fully bleached with washing soda first, then toned with oak tannin, washed, and finally immersed in coffee for a few minutes. In this way, slightly darker tones were achieved.

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Favorite creative techniques

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Versatility of cyanotype

Cyanotype is one of the most versatile photographic techniques, and in this chapter just a fraction of the possibilities that it offers are described.

One of the simplest techniques is to develop cyanotype photographs on colored paper.

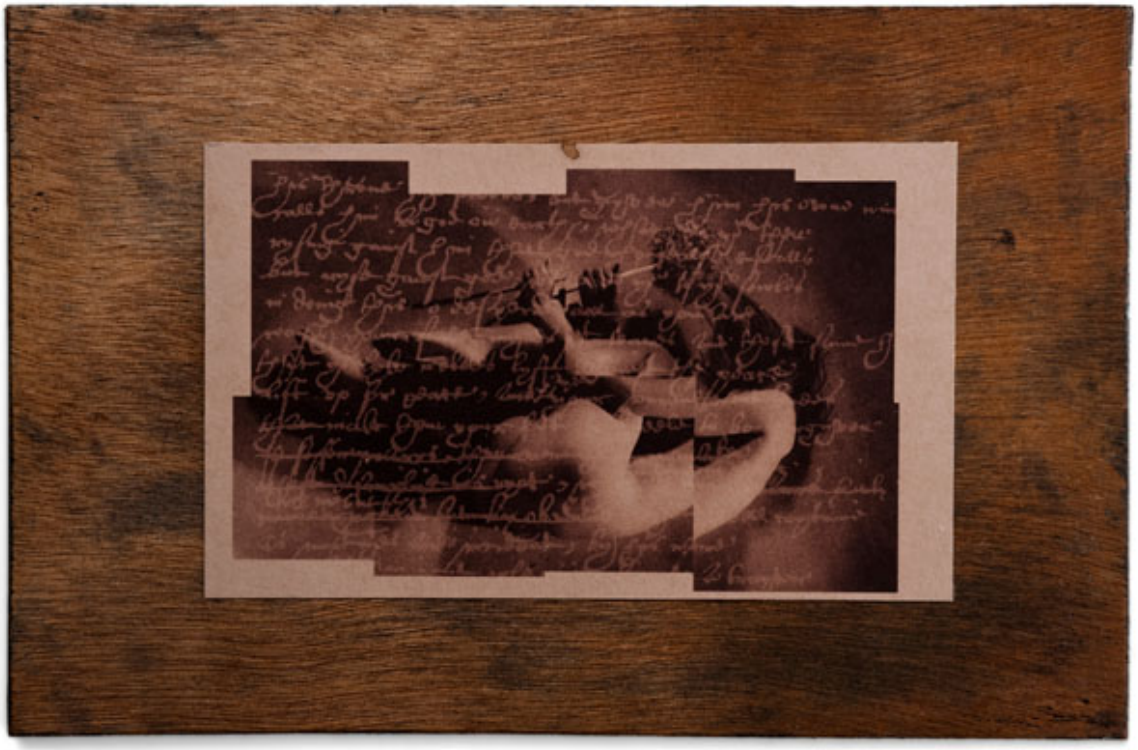
In the photography workshops, photograms are very popular because the participants can learn the basics of photographic chemistry in a few minutes.

Below are described some popular techniques of printing on different materials. The simplest technique is printing on fabric. This is followed by printing on the glass, which is much less known among fans of cyanotype, and because of this even more interesting. This printing technique is slightly more difficult, but the results are worth the effort.

Printing on stone is becoming increasingly popular in all alternative printing techniques, as merging the selected motif with the structure of the material quickly leads to an extraordinary and very beautiful aesthetic effect.

Finally, ink which is used to write on cyanotype photographs is described. Such ink is generally used for signing works.

In short, the techniques of cyanotype are as numerous as the artists who practice them.



Using colored paper

Developing cyanotype on colored paper can create interesting color combinations that can never occur on plain paper. On a different colored paper, the cyanotype blue color gives very noticeable color changes on the photograph as a whole.

Photographs on colored paper are developed in the same way as was previously described.

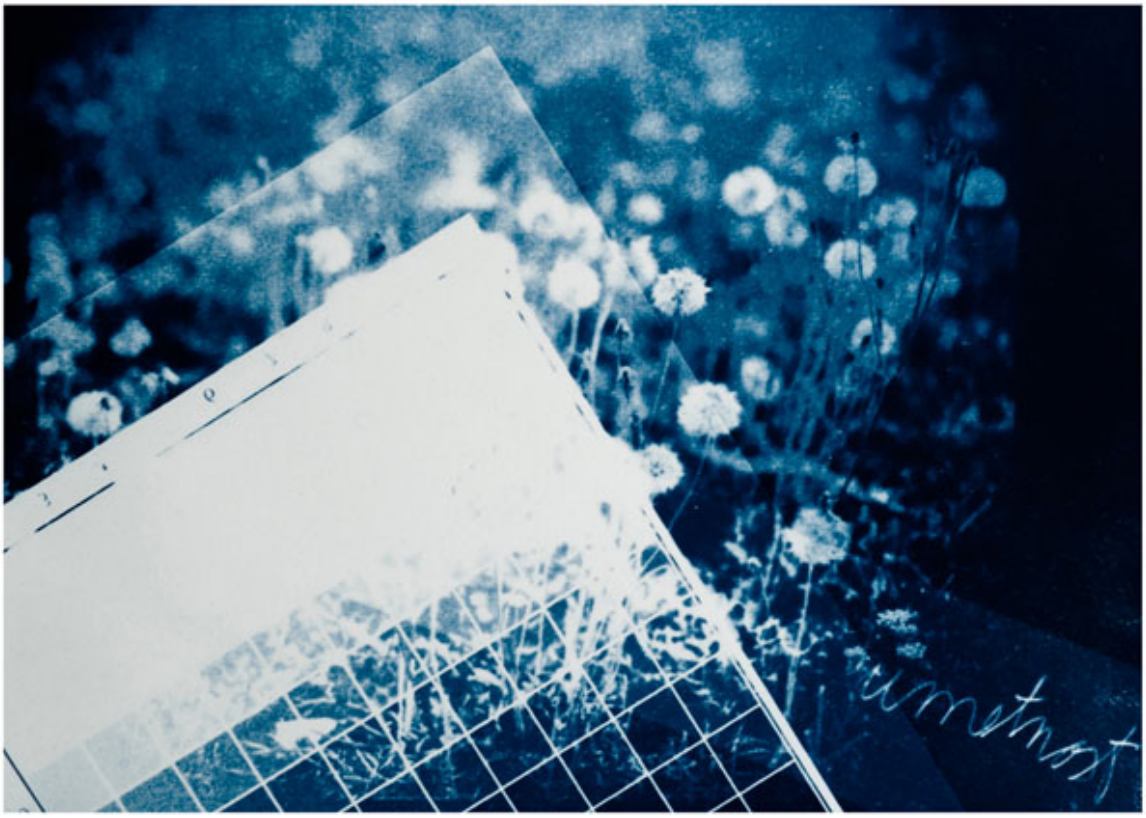
The problem of such printing is sustainability of cyanotype photography, since the photograph on plain paper can fade relatively quickly.

Photograms

Photograms are photographs resulting from placing various objects on a light-sensitive surface of paper. When the surface is illuminated, the objects in the photograph are plotted as white contours, while the illuminated area is completely dark.

The beauty of a photogram can be further improved when various, partially transparent objects are placed on the light-sensitive surface. These objects give some new interesting tonality, in addition to black and white drawings. Making a photogram requires a very simple technique that, with a proper sense of aesthetics, can quickly lead to true works of art. The procedure is as follows:

1. Paper is brushed with cyanotype emulsion, dried, and placed on a firm, flat surface.
2. In a darkened room, a few objects are placed on the paper. When the composition is finished, the paper and objects are exposed to the sun or under an UV lamp.
3. Thinner objects can be covered by a glass plate, while thicker ones are often wrapped in transparent film for wrapping food.
4. After a chosen time (see also Exposure time for a photogram), exposure is stopped, the objects are removed, and the paper is developed by one of the techniques described earlier.
5. The photogram may be optionally toned or otherwise manipulated.



Printing on fabric

Cyanotype can be printed on a variety of fabrics, but, similar to paper printing, it is better to use a textile made of natural materials, for example, 100% cotton, linen or silk. Natural materials are used because of their good binding properties, while pictures on artificial materials are usually washed away already during development.

Adherence to the fabric can be increased by adding a few drops of hot gelatin to the solution of cyanotype. The technique of printing on fabric is the same as printing on paper. You can choose to use negatives, but you can also print photograms.

The procedure is as follows (see also the printing process on T-Shirts):

1. Since fabric is much more porous than the paper, the cyanotype solution will almost instantly appear on the other side of the cloth. Therefore, cardboard or newsprint is always placed under the fabric.
2. The fabric is smoothed out flat and, if necessary, fastened to the pad with pins or clamps. Thus, the fabric will not move too much during application of the emulsion.
3. Cyanotype emulsion is applied on the fabric in a properly lit, dimmed area.
4. When the fabric is completely dry, it is flattened and placed on a flat plate.
5. A negative, or objects for a photogram, is placed on the fabric and everything is covered with a heavier sheet of glass. Such a "sandwich" is usually fixed with clamps.
6. In the next step, the panel with the fabric is taken out in the sun or placed under a UV lamp.
7. Once the optimum exposure time has elapsed (see also Exposure time for a photogram and Exposure time for negatives), the fabric is developed and washed in the same manner as a paper photograph.

Sometimes it is better to thoroughly wash the fabric before printing. Some fabrics are, in fact, imbued with various chemicals that can completely or partially brighten the cyanotype image.

The photograph of the tree was printed on fairly coarse linen textile. After the development of the photograph, it was immersed briefly in

bleach, washed, and toned in oak tannin.

Note. Washing powder should not be used for washing fabrics with a cyanotype photograph on it, as the photo will be bleached. It is best to wash it by hand in ordinary, somewhat lukewarm water.

Making a picture on glass

Cyanotype on glass is very beautiful because a lot of details and a very gentle tone which are not visible on paper can be shown.

Making cyanotype on glass is a bit more complicated than the above-mentioned technique of printing on paper, as it requires many more steps and manual skills. First, the glass has to be prepared. Then we have to make a gelatin solution which has to be mixed with chemicals.

For the less skilled practitioner, it will be a bit tricky to do coating with a gelatin solution because it has to be applied to the surface at least twice. However, mastering the techniques quickly pays off. They can be used for printing cyanotype on stone and other materials and, at the same time, the technique of cyanotype on glass is also a good exercise for those who want to master the technique of wet collodion.

For printing cyanotype on glass, there are quite a few known formulas, but the author has not been satisfied with any of them. The following formula is an adaptation of various procedures and formulas. It provides constant, very good results, free from impurities, lift of emulsion, etc...

For making cyanotype on glass using this method we need the following:

- *20% gelatin*
- *96% alcohol*
- *formalin*
- *modern cyanotype formula solution (see also Making a modern formula emulsion).*

Gelatin

The gelatin used in this technique is a simple kitchen gelatin. A 20% solution of gelatin is needed, which is made according to the

manufacturer's instructions or according to the following procedure. We need:

- *20 g of gelatin*
- *100 ml of water*

Most often gelatin is made as follows:

1. In a bowl filled with 1 dl of water, slowly pour in 20 g of gelatin.
2. Wait 15 minutes for the gelatin to swell.
3. Place the bowl with gelatin in a pot of water heated to about 45C.
4. When the gelatin liquefies, stir it slowly for a few minutes. We have to be very careful to avoid bubbles.
5. Bubbles generated during mixing can be removed with the edge of the paper towels.
6. At the end, the gelatin is slowly poured into a small bottle, sealed tightly, and stored in the refrigerator. Thus, stored gelatin can be used for a few months.

Preparation of glass

The glass used for the application of gelatin must be completely clean, as otherwise the photograph will be full of dirt and unusable. In the presence of dirt particles on the glass, they will be seen as different points and islands, and if the glass is greasy, the gelatin layer will peel off from the surface of the glass.

For cleaning glass, devices for the production of glass plates in a wet collodion technique can be used, but the glass can also easily be placed on a clean cloth, so that it won't move during the cleaning.

1. Since our hands are wet and in part oily, it is best to put on clean latex or rubber gloves (1).
2. Then we have to put the glass on the glass cleaning tool (2) or on a soft, clean cloth.
3. The glass can be cleaned with various traditional chemicals, but the simplest way is that the glass, first on one part and then on the

other part, is purified using a paper towel (3) and cleaned with a glass cleaner (4).

4. When the glass is dry, it is advisable to clean it again, this time with alcohol (5). After that, we have to wipe it with a new clean towel.
5. The glass is stored in a clean place. The best, of course, is on the special drying racks used in wet collodion (6).

Application of emulsion

The application of emulsion on a sheet of glass requires some practice, but it can be learned very quickly.

At first, all the needed material should be prepared: gloves, cleaned glass, hair dryer or a small cooker, a cup for mixing the emulsion, heated gelatin, alcohol, cyanotype solution, and a bottle of formaldehyde or chrome alum.

The quantities of chemicals to prepare emulsions for application in two layers on a sheet of glass of size 9 x 15 cm are as follows:

- *1 ml of ammonium iron citrate*
- *1 ml of potassium ferricyanide*
- *2 ml of 20% gelatin*
- *2 ml of 96% alcohol*
- *2 drops of formalin or chrome alum*

The application process is as follows:

1. 2 ml of cyanotype solution, i.e. 1 ml of ammonium iron citrate and 1 ml of potassium ferricyanide, are measured into the cup.
2. Into this are added 2 ml of gelatin, pre-warmed to 45C.
3. 2 drops of formalin or chrome alum are added in the cup, which results in the gelatin being completely hardened after drying. Thus treated, the emulsion does not dissolve in water and does not fall off from the glass (1).
4. 2 ml of alcohol are added to the cup.
5. Part of the gelatin will instantaneously coagulate on the surface and will appear like a sticky foam (2). The foam can be removed with a glass stirring rod. The rod (3) is then washed and wiped.
6. Prior to the use of the glass, it must be slightly warmed with a hairdryer (or a small cooker), since gelatin is easier to spread over a heated glass surface.
7. Almost the entire content of gelatin is poured onto the glass (4).
8. And now the tricky part. The upper right corner of the plate is tilted (5) down (**a**), so that the gelatin reaches this edge. After that, the plate is tilted in the opposite direction, in a way that liquid flows into the lower right corner (**b**). Then the upper left corner is tilted down, so the emulsion moves to this part of the glass (**c**) and finally, the left bottom corner is tilted down in such a way that liquid begins to move against the leftmost lower corner (**d**).
9. The plate is then placed with its bottom left corner on the cup's edge and any excess liquid is discarded. The plate is moved forward and backward, as is shown in the drawing (6).
10. When all of the excess emulsion has been drained from the glass, the plate is put in a horizontal position and shaken violently several times in the directions of forward-backward and left-right (7).

11. We put the glass plate on a flat surface and let it dry in the dark for 1 hour. Once the glass panel is slightly dry, it could be dried with a hairdryer.

12. Then a second layer of the emulsion is applied. There will be enough fluid left after the first application for this. Gelatin is therefore reheated and the entire procedure is repeated as described above, from point 6 to point 10. If the emulsion does not spread completely over the entire surface, it is best to spread it out with our fingers.
13. When the second layer is completely dry, we can expose the newly prepared glass plate. Cyanotype with two layers of emulsion is slightly lighter, but very pleasant to the sight (8), while a glass plate with three layers of emulsion reaches slightly deeper tones. But we will soon notice that there are also quite dark bright tones in the photograph (9).
14. The cyanotype on glass is developed and washed in the same way as the photograph on paper. If we have added enough formalin or chrome alum to the emulsion and had properly cleaned the glass, then the gelatin will be maintained on the plate, even if it is left in the water for several days.

Toning cyanotype on glass is most commonly avoided, since it will ruin bright tones.

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Cyanotype on stone

The procedure for making cyanotype on stone is quite similar to making cyanotype on glass, and in this section we will explain only the few differences.

The procedure is somewhat time-consuming.

1. First, we have to sand the surface of the stone, as we have to obtain as flat a surface as possible. The reasons for polishing are two. Due to the negative distance from the base, the photograph can become blurry, and second, on an uneven surface puddles of emulsion may accumulate, and this will cause an uneven exposure.
2. In the second step, we have to lacquer the surface of the stone. For this purpose, we can use any of the lacquers which are insoluble in water and will not peel off from the surface of the stone. The surface is lacquered twice. The first reason for coating the stone with lacquer is the chemical composition of the stone, which has a negative impact on the sustainability of cyanotype, and the other reason is the porosity of the material. With a layer of varnish, leakage of emulsion into the depth of stone, causing uneven exposure, is prevented.
3. Once the surface of the stone has been prepared, we can brush on a light-sensitive emulsion to the stone. Since this is equal to the emulsion application in the cyanotype on glass process, it will not be described again here. But nevertheless, it is better to slightly warm the stone before the application of emulsion on it. In this way, the gelatin will be smoother, and we'll gain some more time.
4. Most commonly, three coats of emulsion are applied. In this way, the picture will be somewhat darker, but more visible on the uneven texture of the stone.
5. Once the emulsion is completely dry, the negative is pressed against the surface of the stone.
6. The cyanotype is then exposed, developed,
7. and washed following the previously described procedures.

The toning of cyanotype on stone should be avoided, as it will darken the whole photograph.

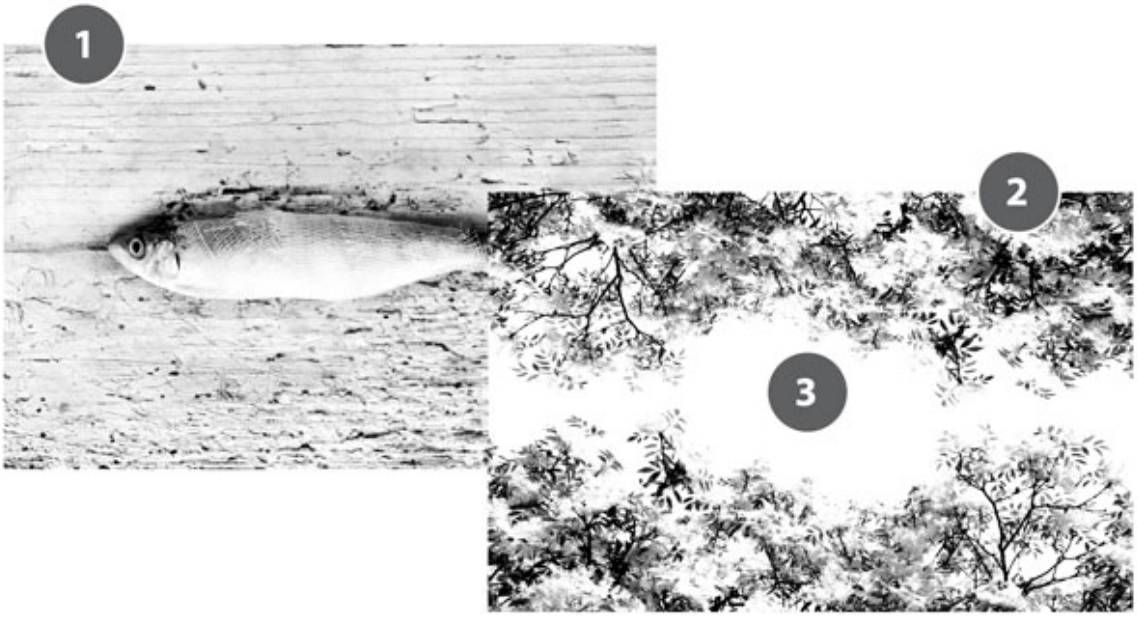
Sometimes, however, the surface of the stone is whitened. This is done by adding a few drops of white color in the first layer of the paint.

Note. When choosing a stone for making cyanotype, we most often opt for very light, almost white stones. Photographs on such stones will be much more pronounced than on dark or speckled stones.

Double exposure

Multiple exposure of a photograph with two or more different negatives is a very interesting technique, which often leads to surprising results. Cyanotype photographs produced in this way are usually made of two colors.

1. For the production of the photograph shown below, we used two negatives. The first was the image of the fish (1) and on the other of trees (2). Here, we have to pay attention to two things. Firstly, the second negative should include at least some white space (3), through which the first image will be visible. Secondly, both photos must be of high contrast, as otherwise the final image will be quite darkened by the second exposure.
2. After the desired manipulation of the photograph, we applied a curve to each photograph (see also Adding curves),
3. converted them into negatives,
4. mirrored them,
5. and printed them on a transparent material.
6. In our case, we first made an exposure of the photograph with the fish.
7. The image was developed and toned, in this case, with oak tannin (4).
8. When the first photograph was completely dry, a second layer of solution was applied.
9. When this emulsion was dried, we used the second negative with the motif of trees (5).
10. The photograph was exposed, developed, and dried.
11. The second layer was never toned.


1
2
3


5
4

Bicolor print

In a bicolor print of the cyanotype process, we are somewhat limited by the number of colors that can be used. We can use only a first color which is achieved by toning (brown, green, yellow, and the like) and the second, blue color, with which we cover the first layer.

The first layer in cyanotype is most commonly colored with one of the "red" toners, and the other is an un-toned blue cyanotype layer.

Of course, we should not expect that we will make a full-color photograph in this way because for that we would need at least three different colors. However, the result of such a bi-color photograph is rather interesting.

Making negatives for two-color printing

A method of making the negatives for the above-mentioned combination - let's call them warm and cool colors - may be the following:

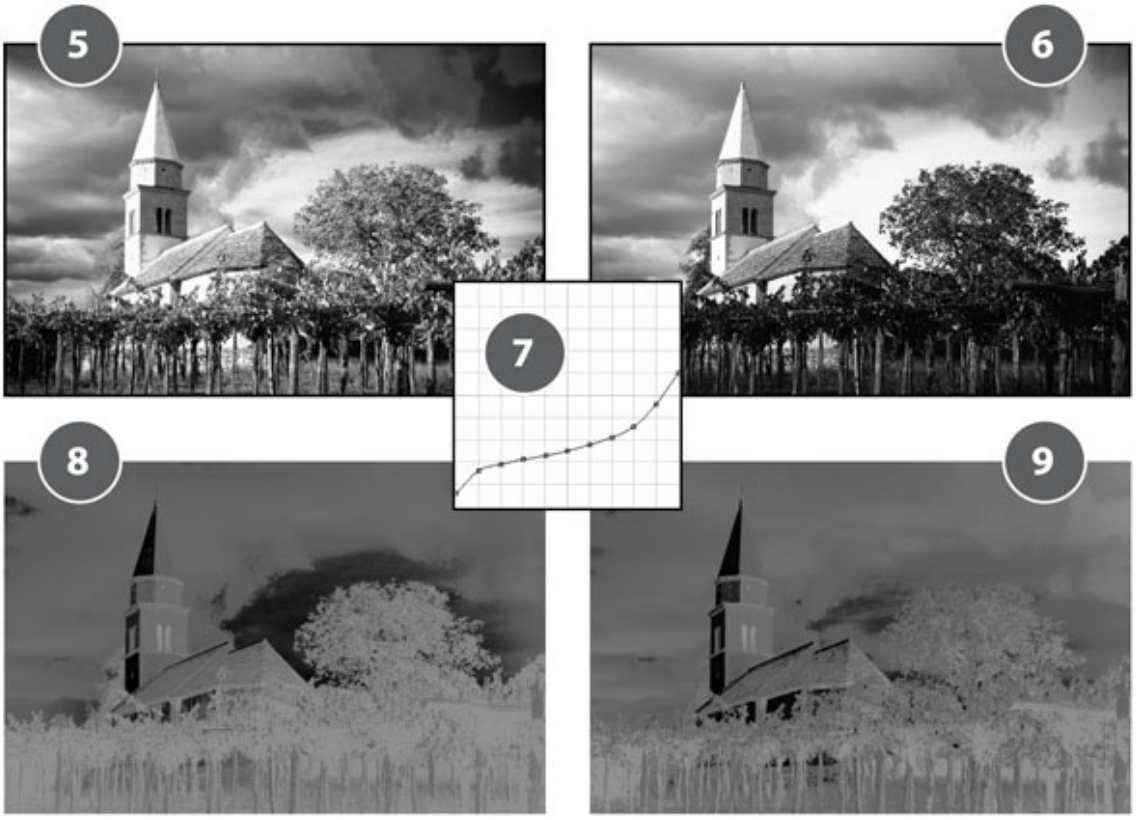
1. In the program for digital photograph editing (here we will focus on Adobe Photoshop), we open any color photograph (1).

2. Then we open the *Channels panel* (2) and in its menu (3) we select the command *Split channels* (4).

3. As the program window closes the original picture, three tabs are displayed with black-and-white photographs of three channels. The

tabs are named after the original photo with the color name prefix: _R represents the red channel, _G green color and _B blue. In our case we will use only the red (_R) (5) and blue channels (_B) (6). The blue channel is used for printing the warm (red) colors, and red for printing blue colors.

4. We have to apply the curve (7) to both channels (see also Adding curves), convert both to negatives, and mirror them (8).
5. We mustn't forget to label the negatives with the names of the printed channels.



Shrinkage of paper for bicolor prints

As good paper is made from cotton, like fabric, it will shrink after the first extended immersion in water and subsequent drying. We notice this as soon as we want to put the second negative on the first printed layer. This, of course, is impossible.

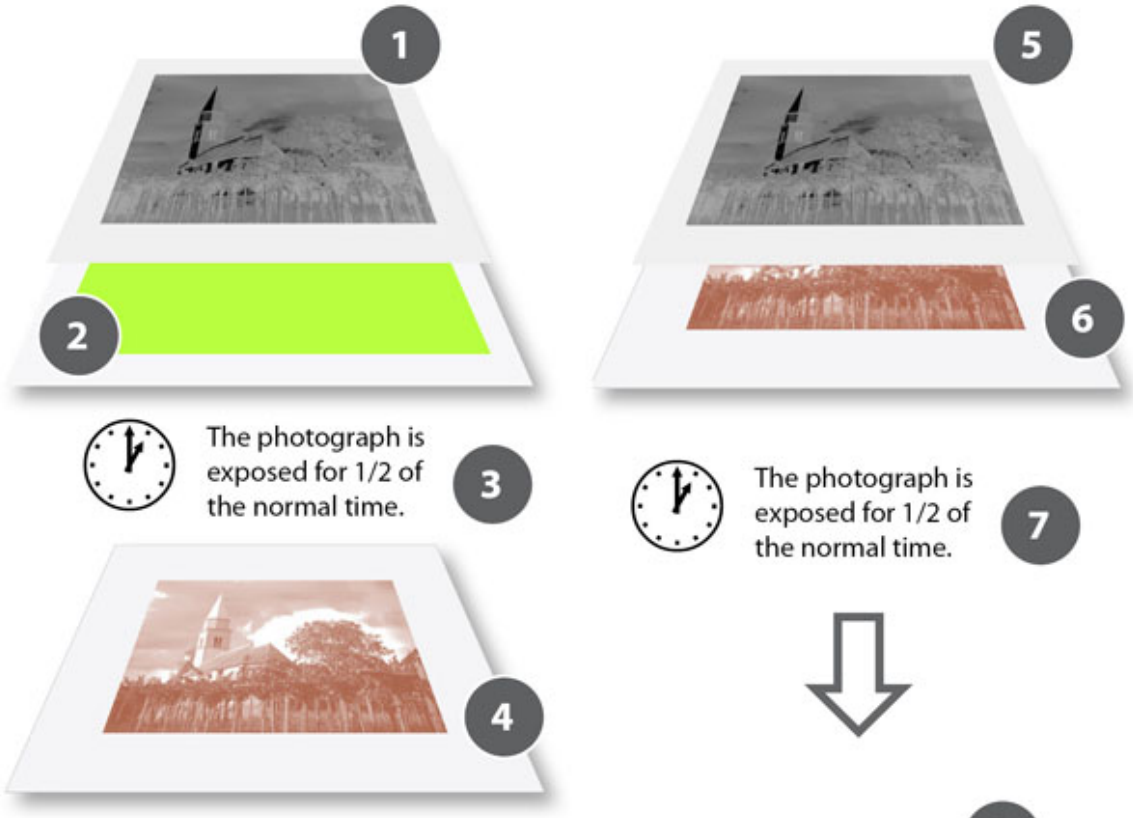
The process of shrinking is very simple.

1. In a somewhat larger tray than the sheet of paper, we heat water to 50C and immerse the paper in it.
2. The soaking of the paper lasts 20 minutes.
3. When the paper is dried and optionally leveled, it will always be the same size from then on.

Two-color process

Once we have prepared the negatives and shrunk the paper, printing can begin.

1. As we begin with the printing of red color, we first use the negative of the blue channel (1).
2. The paper is first coated with the emulsion (2), dried, and prepared for exposure. It should again be noted that the exposure time of each negative is only half the time of normal exposure (3). Complete tonal range will be gained later, by half exposure with the second negative.
3. When the photo is developed, it is usually completely bleached (see also Bleaches and formulas) to get as much pure color as possible, without blue values. Most often, we color the image with one of the toners, which gives the image a warm (4), reddish color.
4. When the photograph is thoroughly dried, another layer of cyanotype solution is applied.
5. When the new layer is completely dry, we put the negative with the red channel on it (5). In doing so, we have to be as careful as possible because the position of the second negative must perfectly match the layout of the first layer (6).
6. When the negative is successfully aligned, we fix it to the paper with four pieces of adhesive tape. In this way, it will not move during the transfer to the printing frame.
7. As we have mentioned, the second negative is exposed for half of the time which is intended for the exposure of normal cyanotype (7).
8. Finally, the image is developed, washed, and dried (8).


1
2
5
6
The photograph is exposed for 1/2 of the normal time.
3
The photograph is exposed for 1/2 of the normal time.
7
4


8

Bleaching ink for cyanotype

Potassium hydroxide (KOH) is one of the strongest bases, so we have to handle it with extreme caution. For the technique of cyanotype, this is also one of the best bleachers, in combination with oxalic acid ($H_2C_2O_4$). Without any problem, we can erase the cyanotype color, so that on its surface appears a distinct, slightly yellowish or pure white line.

This bleaching ink is often used for signing photos, or to add any text.

Bleach unfortunately does not work on toned cyanotype, so it's best to use it before toning.

We have to take all safety precautions in preparing bleaching ink.

For the production of 50 ml of bleach, we need:

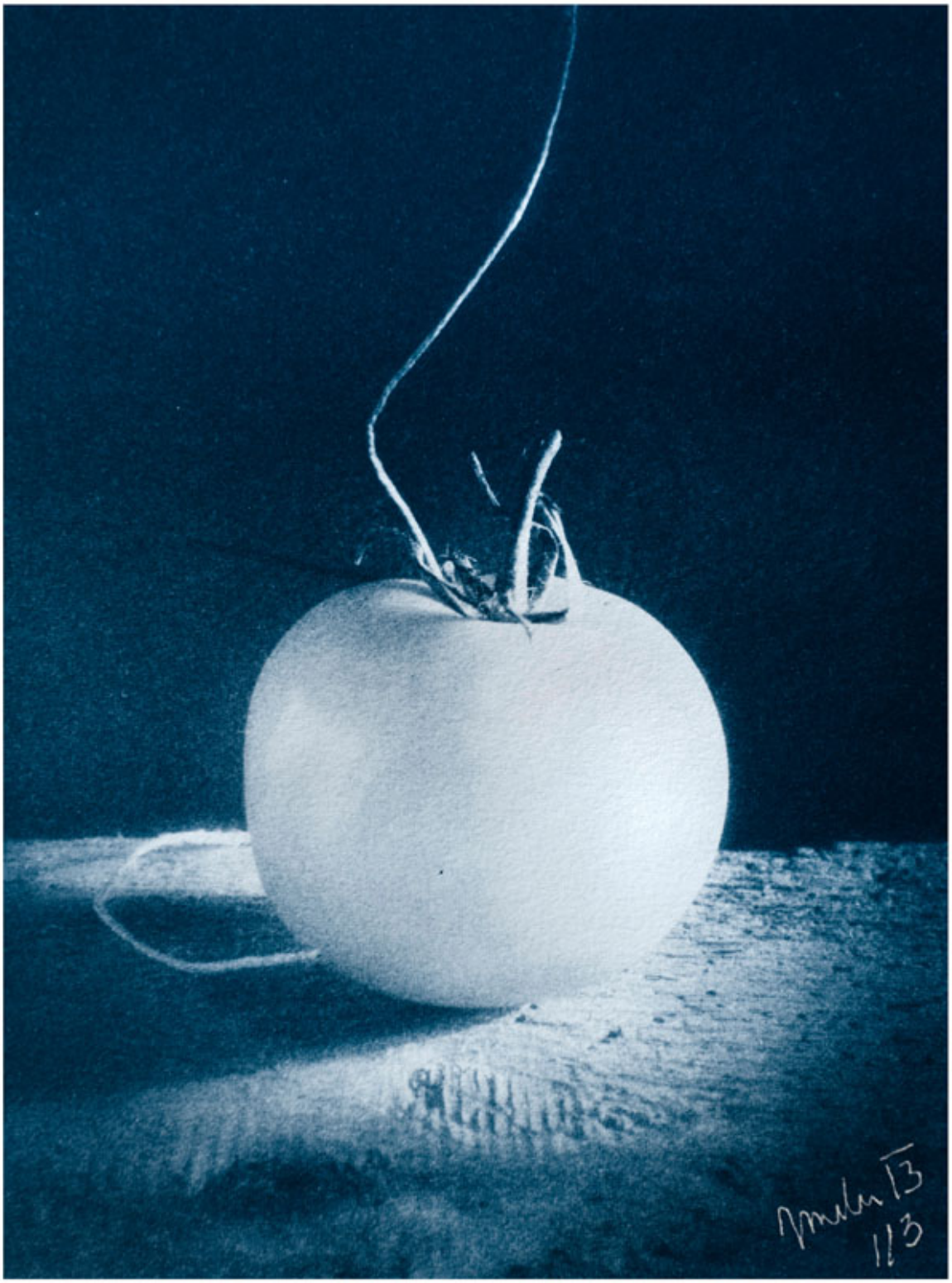
- *2,5 g of oxalic acid*
- *3 g of potassium hydroxide*
- *50 ml of distilled water*

The preparation procedure is as follows:

1. We measure out 25 ml of distilled water and pour 2.5 g of oxalic acid into it.
2. The solution must be completely mixed.
3. In another container, 25 ml of distilled water is measured and 3 g of potassium hydroxide are poured into it.
4. We have to dissolve and mix it well.
5. Finally, the solutions of oxalic acid and potassium hydroxide are poured into a small bottle, and this content is mixed well.
6. A label with appropriate information about the content is glued on the bottle.

A calligraphic pen is most useful for writing on a cyanotype photograph.

Warning. **Potassium hydroxide and oxalic acid are harmful if swallowed; they cause serious burns and eye damage. Before use, we have to adequately protect ourselves.**



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Practical uses of cyanotype

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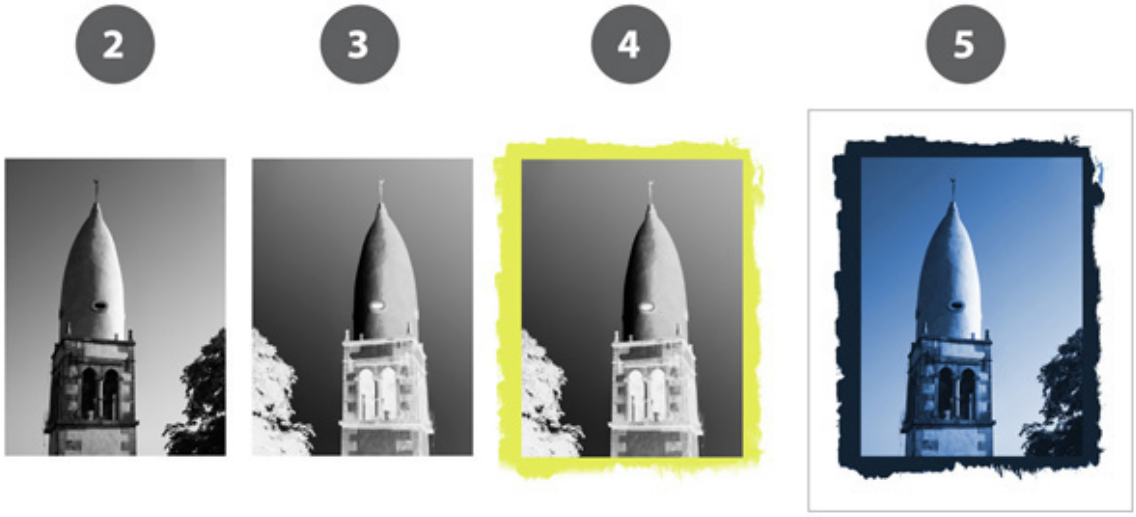
Postcards and Greeting Cards

Making postcards and greeting cards is almost the same as the production of photographs, with the exception that a black edge is often left on a photograph, while postcards and greeting cards are commonly decorated with a white frame (1).

A black edge is shown in the case that the digital image (2) is simply inverted into negative (3), so that the area around it remains a

transparent, unprinted area (4). This area is converted into a black edge on a cyanotype positive (5).

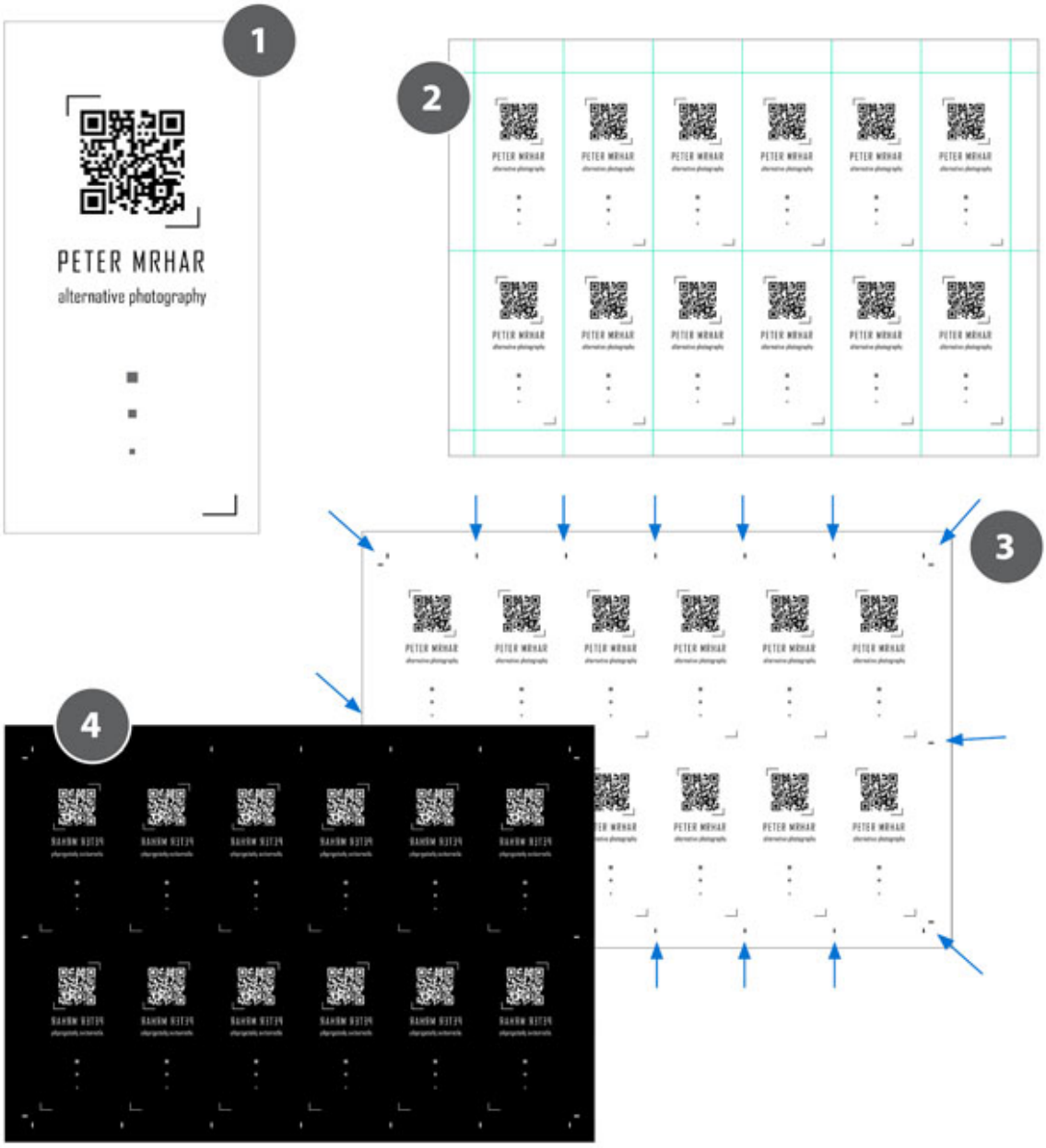


A white frame on a postcard is created by drawing a black edge around the negative (7) after inversion of the photograph to the negative (6). The aim of this is to block all the light during exposure (8). In the Adobe Photoshop program, we generally use the command *Image > Canvas Size*, where we select the black background color.

Business cards and book markers

This method for making business cards and bookmarks is fairly easy.

1. First, we have to make a single business card or book marker in any graphics program (1).
2. Then we copy that to the entire format of paper that is available to us (2).
3. We draw lines for cutting at all four corners and at the boundaries between cards (3).
4. After the negative is printed (4), we expose it, dry it, and cut off tiles with the help of the marked lines.


1
PETER MRHAR
alternative photography
2
3
4


PETER MRHAR
alternative photography
cyanotype
Peter Mrhar
My book

T-Shirts

Printing photos on fabric is especially popular for making T-shirts with arbitrary motifs. As mentioned in the chapter on printing on fabrics, we must be sure to select a material that is suitable for printing cyanotype (see also Printing on fabric), most often cotton or silk.

1. First we have to wash the shirts, as they are sometimes impregnated with various chemicals that bleach the cyanotype image.
2. A piece of plastic or a piece of cardboard wrapped in nylon is inserted inside the T-shirt (1). In this way, the surface of the T-shirt will be flat and, at the same time, the chemicals brushed on the front of the T-shirt will not be absorbed by the back.
3. Then we stretch the fabric and attach it to the board with pincers or clamps (2).
4. After that, the T-shirt is coated with chemicals (3) and is allowed to dry thoroughly in the dark. We can also accelerate drying using a hairdryer.
5. We put the negative on the emulsion, and cover it with a thicker glass (4), preferably the same size as the board, since in this way the glass can be rigidly clamped.

6. The cyanotype is then exposed and, after an appropriate time, washed several times in water (5).

Note. **For washing cyanotype on fabrics, washing powder should not be used, as the photograph will bleached. It is best to wash it by hand in ordinary, somewhat lukewarm water.**

Literature and resources on Cyanotype

Some online resources in English language

Alternative photography

This web site is dedicated to fans of old and alternative photographic techniques. Here can be found articles, including those on cyanotype.

Anna Atkins on Wikipedia.

APUG (Analog Photography Users Group.)

APUG is one of the most popular forums about classic analog and "old" photos.

Cyanotype on Wikipedia.

Cyanotype on Unblinking Eye.

A collection of cyanotype formulas from old and modern books can be found on this site.

Photogram on Wikipedia

John Herschel on Wikipedia.

Mike Ware's The New Cyanotype Process.

Some notes about the new cyanotype process.

Old, full preview books

Brown, G. E. Ferric and heliographic processes. London, Dawbarn.

Another very old book which is unlike others, dedicated entirely to cyanotype process. Available on Internet Archive.

Duchochois, P. C. (1891). Photographic reproduction processes. A practical treatise of the photo-impressions without silver salts. New York: The Scovill & Adams Company.

The first part of the book talks about cyanotype and techniques derived from it, with descriptions of various practical methods from the late 19th century. Interesting reading. Available on Internet Archive.

Fisher, G.T., Peabody F. (1843). Photogenic Manipulation: Containing Plain Instructions in the Theory and Practice of the Arts of Photography, Calotype, Cyanotype, Ferrotype, Chrysotype, Anthotype, Daguerreotype, Thermography. London: George Knight.

One of the first books on photographic techniques, with a brief mention of a two-part cyanotype printing process (see also Herschel process). Available on Google Books.

Estabrooke, E.M. (1887). Photography in the studio and in the field : a practical manual designed as a companion alike to the professional and the amateur photographer. New York : E. & H.T. Anthony.

Very good book about wet collodion, with some chapters on cyanotype. Available on Internet Archive.

Hunt, R. (1857). A manual of photography. Glasgow: R. Griffin.

Old book with descriptions of various photographic processes, including a brief description of cyanotype. Available on Google Books.

Towler, J. (1866). The silver sunbeam: a practical and theoretical text-book on sun drawing and photographic printing. J.H. Ladd, 1866 New York.

Descriptions of many old photographic processes, with an emphasis on wet collodion. Available on Google Books.

Some popular contemporary books

Barnier, J. (2000). Coming into focus : a step-by-step guide to alternative photographic printing processes. San Francisco, CA: Chronicle Books.

A collection of historical and alternative photographic processes, with a brief description of each. The reader is led to reliable results.

Enfield, J. (2013). Jill Enfield's guide to photographic alternative processes : popular historical and contemporary techniques. Burlington, MA: Focal Press.

A collection of historic and alternative photographic processes with a more artistic approach. Worth reading.

Fabbri, M., Fabbri G. (2006). Blueprint to Cyanotypes: Exploring a Historical Alternative Photographic Process. CreateSpace Independent Publishing Platform.

A booklet about cyanotype, suitable for beginners.

Hirsch, R. (2009). Photographic possibilities the expressive use of equipment, ideas, materials, and processes. Amsterdam Boston: Focal Press/Elsevier.

This book is more focused on creative ideas than detailed description of alternative processes. It's worth reading, but do not expect detailed descriptions of the procedures.

James, C. (2009). The book of alternative photographic processes. Clifton Park, NY: Delmar Cengage Learning.

Very comprehensive book of more than 600 pages, deals with a huge number of historic and alternative photographic processes. The book is quite technical.