

## Anthotypes: Printing with Light and Plant Dyes

Anthotype is a photographic image obtained by using plant dyes (photosensitive pigments in plants), without the need for cameras, lenses, inks, lasers and specialized equipment. Dyes of different colours can be obtained depending on which plant, flower, berry or plant-based spice is used. Due to the simplicity of the process, it only requires some common household items, sunlight and patience. In this activity, we will look at how to make anthotypes using two examples of plant-based dyes derived from turmeric and spinach.

### Example 1 – Turmeric

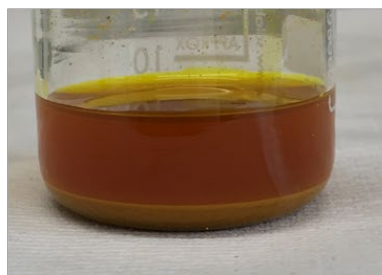
In this example, the only ingredients that you need is a ground turmeric powder (a common spice used to make curry), ethanol (or a cheap vodka) and bicarbonate of soda (baking soda), as shown in Figure 1.



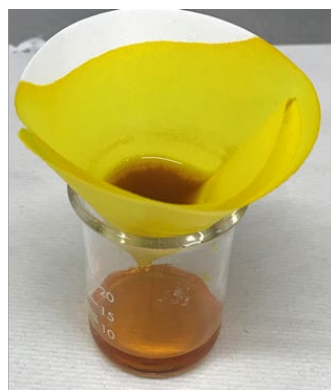
Figure 1: ingredients required to make an anthotype using turmeric.

### Step 1 – Preparation of plant dye

Add one teaspoon of turmeric into a container (can be a glass or a plastic cup) and thoroughly mix with 4 to 6 teaspoons of ethanol (or vodka). The photosensitive pigment in turmeric, called curcumin, dissolves really well in alcohol. Then filter out undissolved solid by using either coffee filter, cheesecloth or cotton cloth and pour the bright orange liquid into another cup, as shown in Figure 2.



Allow to stand for a few minutes until solid powder settles at the bottom

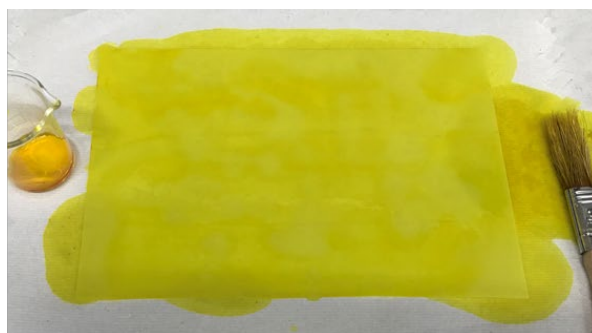


Filter out orange liquid from solid

**Figure 2: preparing a dye from turmeric.**

### Step 2 – Painting

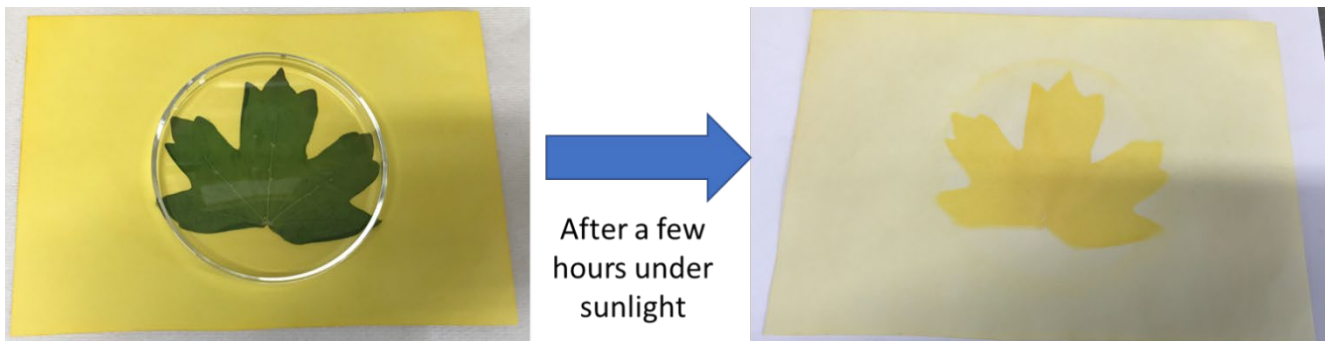
Apply the filtered dye from step 1 onto a piece of paper (photocopier, craft or watercolour paper) by using a brush or a sponge. You should get a vibrant yellow colour as shown in Figure 3. Make sure to put paper towel, newspaper or cardboard below the paper which will be used for painting to prevent staining of surfaces. After painting, place the coloured paper away from light (in a cupboard or a box) and let it dry.



**Figure 3: painting a piece of paper with turmeric dye.**

### Step 3 – Printing anthotype

After the paper is completely dry, position any object you want to print on top of the paper and make sure that it is tightly held in place, by either placing glass on top or sandwiching in the picture frame. Place it on a flat surface that is exposed to the sun (in the garden or on the windowsill) and leave to expose. If you are lucky and it is a sunny day, the process should take 3 or 4 hours, otherwise leave it on the windowsill for a day. The exposed parts showed bleach under the ultraviolet (UV) light from the sun and fade in colour, whilst the part of the paper that was covered by the object should still have a bright yellow colour, as shown in Figure 4.



**Figure 4: printing anthotype with turmeric dye.**

#### **Step 4 – Developing anthotype**

The final step involves developing anthotype to enhance the colour and contrast. Add two teaspoons of baking soda to half a cup of warm water and mix thoroughly. Slowly pour this solution over the printed image until you see the image turn from bright yellow to brown as shown in Figure 5. After you can rinse the picture with water to wash-off baking soda. Let it dry in a dark place (cupboard or shoebox). Over time, under the sunlight the dye will begin to fade, so you may want to store it in a photo-album or coat it with wax to preserve the image by blocking the UV light.



**Figure 5: developed anthotype printed with turmeric dye.**

## Example 2 – Spinach

A second example shows how to extract green pigment, called chlorophyll, from spinach. Compared to turmeric it takes longer to expose the image in the sunlight, when using the dye extracted from spinach, however this process does not require the use of alcohol, neither the development step. The only ingredients required are the spinach leaves.

### Step 1 – Preparation of plant dye

You can either use a blender or mortar and pestle to crush spinach leaves. The crushed chunks of spinach can then be placed on a cheesecloth, towel or old item of clothing, which is used to squeeze the green juice into a cup, as shown in Figure 6.

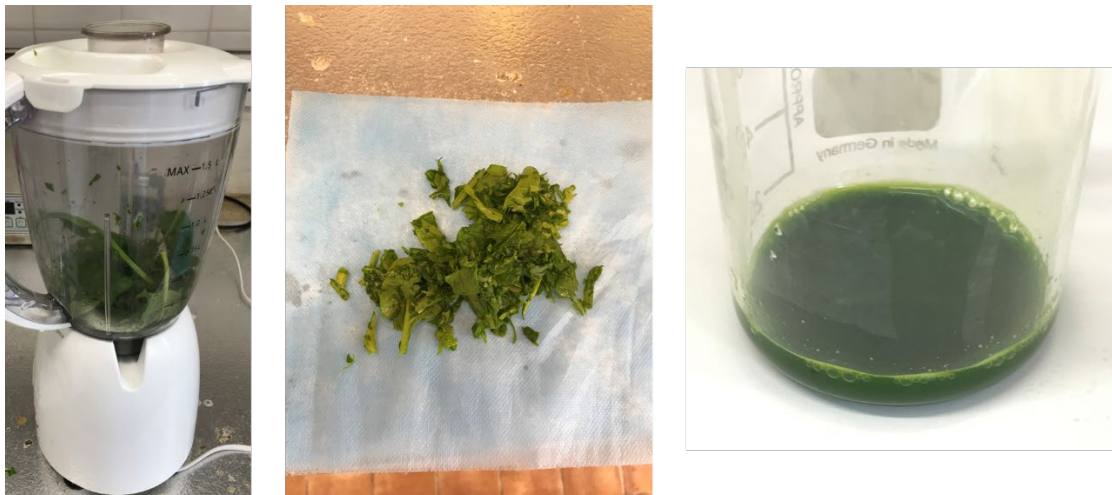


Figure 6: preparing a dye from spinach.

### Step 2 – Painting

Similarly, to the turmeric example use a brush or a sponge to apply the green dye from step 1 onto a piece of paper, as shown in Figure 7. Depending on how saturated you want the colour to be, you can apply multiple layers of coating (the more saturated it is, the longer time it will need to be exposed in the sunlight. After painting, place the coloured paper away from light (in a cupboard or a box) and let it dry.



Figure 7: painting a piece of paper with a spinach dye.

### Step 3 – Printing anthotype

This step is exactly the same as in the turmeric example. The exposure time needs to be longer and could range from 4 to 6 hours on a sunny day to several days.



**Figure 8: developed anthotype printed a spinach dye.**

#### **For information:**

This activity was developed by Dr. Adilet Zhakeyev and Assistant Prof Jose Marques-Hueso from the School of Engineering and Physical Sciences. They work in the Institute of Sensors, Signals and Systems (ISSS) and his research focuses on the use of light for manufacturing.

This activity is in the frame of the Engineering and Physical Sciences Research Council (EPSRC) MUSCLE project (EP/T013680/1), where novel sensitizers are used for 3D printing.

Find out more about ISSS research here: <https://www.hw.ac.uk/uk/schools/engineering-physical-sciences/institutes/sensors-signals-systems.htm>