

Laura Garbštienė

Make a rainbow

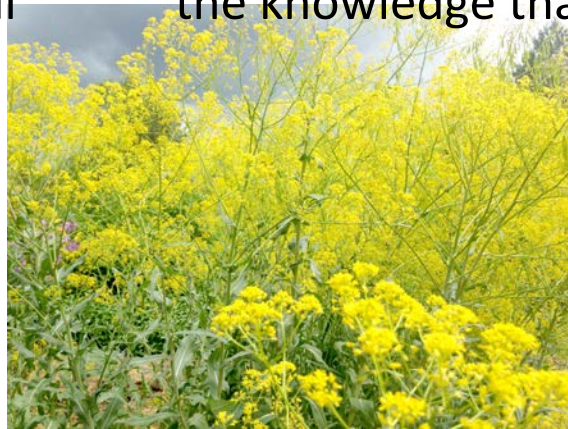
Support material 1

The Chemistry of Plants and Their Hidden Colours

Natural Dyes

There are plants with a number of chemical elements that change with the seasons. Every plant has its own variety of dye molecules that can be extracted to give pure, bright colours in a number of unique and beautiful shades.

Some plants have very little pigment so aren't considered useful dye plants, while others have pigments that are very unstable and ephemeral, so can only be used with the knowledge that they will fade.



Artist Laura Garbštienė

Laura Garbštienė's recent practice encompasses temporal art forms and reflections on natural phenomena, ecological awareness, domesticity, and the decline of rural life. Since 2013 Garbštienė has lived in Šklėriai, a small village near Dzūkija National Park, with a small herd of Skudde sheep, where she promotes spinning as an anti-capitalist movement to unite people from diverse cultural backgrounds.

In 2017 she started **Verpėjos** (The Spinners) – an artist-run initiative to research and discuss rural traditional lifestyle and nature preservation on a local and global scale. In summer 2021 NAC hosted Garbštienė's '**Shepherds' Residency**' project as part of the Neringa Forest Architecture programme.



Green is a common colour in plants due to **chlorophyll**—the molecules in plants that absorb sunlight and convert its energy into carbohydrates from carbon dioxide and water. This process is known as photosynthesis and is the basis for sustaining the life of all plants on earth.

In autumn some leaves become yellow and red because the chlorophyll molecules decay, revealing the colours of other molecules, such as carotene and quercetin. Unfortunately, we cannot use chlorophyll for dyeing because it is an unstable molecule.

Yellow pigment can be found hiding in many green plants and their flowers—despite the varied colours of the blossom. Different chemical molecules produce the colour yellow, but the main source of yellow colourants exists in the group known as **flavonoids**.

The most common source from this group is **apigenin**, which can be extracted from a number of wild and garden flowers, including: camomile, goldenrod, yarrow, tancy, cosmos, dahlia and ragwort.



There are also a number of other flavonoids found in different combinations in these plants. For example:

Luteolin is present in camomile, yarrow, broom and sage.

Quercetin is present in goldenrod, onion skin, broom, tansy, ragwort, heather, and buckthorn berries. **Rutin** is present in rue, buckwheat, goldenrod and camomile.



There is also a group of **alkaloids** that can be used as colourants. One of them is the yellow colourant berberine, named after barberries. Many tree leaves also have yellow colourants, including: apple, alder, birch, heather, hawthorn, ash, elm and willow.

Orange fruits and flowers (carrots, tomatoes, peppers, marigolds, etc.) often contain **carotenoids** that are only soluble in oils and can therefore be used as food colourants, but not for dyeing textiles.





Red pigment is hidden in the roots of docks, rhubarb and sorrel, while fermented alder and buckthorn bark, when added to an alkaline solution, can produce a reddish brown colour. The colourants present in these plants are from a group of **anthraquinones**: chrysophanol, emodin, physcion, etc.

Another important colourant from the anthraquinone group is **alizarin**, which is present in lady's bedstraw.

All blue berries and purple leaves produce ephemeral blue or purple pigments. This group of pigments are called **anthocyanins**. They have low chemical and thermal stability and therefore change in appearance over time when exposed to light, high temperatures and humidity.

There are several plants in different parts of the world that provide the blue pigment called **indigo**.

Woad in Europe and indigo in India, were cultivated for a long time as a result of their precious, clear blue colour. However, it is not a direct dye as the precursors, **indican** and **isatan**, are insoluble in their blue form. Therefore, they need to be converted by **enzymatic hydrolysis** to colourless indoxyl and sugars. Then, indigotin (the main colouring matter) is formed by the combination of two indoxyl molecules via air oxidation.

Thank you!

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