Suitable for 3-7 years

- Solo
- Pairs
- Groups

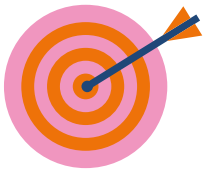
Farnaz's activity

Painting with natural dyes

How to guide

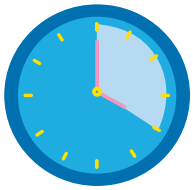
Farnaz's activity

Painting with natural dyes



Aim

In this activity, children will take on the role of a biochemical Engineer to explore the plant and algae pigments. They will investigate the use of plants and algae to create natural dyes, experimenting with different dyeing methods and a variety of materials.



Time required

This activity is designed for small groups working independently or collaboratively. It's expected the activity might last from 30 minutes, but it can be extended as needed depending on your group.

Materials and equipment

- Red cabbage or blue berries (blue/purple), Beetroot or cranberries (red), Turmeric or pumpkin (yellow/orange), Spirulina algae (green).
- Cotton wool and papers.
- White or distilled malt vinegar.
- Basic painting brushes.
- Various plant leaves or flower petals for print artwork.
- Small pots to use as paint containers.
- Napkins or old towels to clean the brushes.
- Sieve in two sizes (with different holes)

Health and safety

You know your class better than anyone and are the best judge as to whether they can complete this activity. We have highlighted a few safety areas that you might like to think about when planning this activity:

- Slipping hazard: If the water or liquid from the plant dyes spill on the floor it can be a slipping hazard.
- Consumption of materials: please ensure the dyes are not tasted

Instructions

Prepare the day before

Cut the red cabbage finely and leave them overnight in vinegar before the experiment.

1. Set out the materials and the plant and algae images in a suitable space in the classroom and invite a group.
2. Explain that the children will be Biochemical Engineers and their challenge is to extract colours from the plants and algae.
3. Push berries or other soft fruit through a sieve to extract your pigment, then mix with just a small splash of water!
4. Mix powders like spirulina or turmeric powder in water, being careful to add a little at a time until it becomes like a dense liquid.
5. Pause the activity and ask the children some of the questions below. Encourage the children to share their ideas:
   - Why do you think plants have different colours?
   - Which natural paint do you like the most? Why?
6. Resume the activity

7. As the activity draws to an end, ask the children to think about what they needed to do to be a good biochemical engineer.

Questions and Discussion Prompts

Use these prompts throughout your activity:

- What do you think is the difference between plants and algae?
- Why do you think plants have distinct colours?
- What are these colours useful for?

- Which health benefits do these colourful plants have for us?
- Is there a more efficient way to get more colours extracted?
- What would we do if we needed to scale-up the process? i.e. if we needed large volumes of a colour.

Answers:

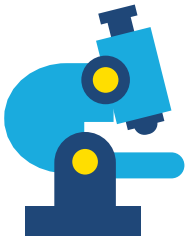
Algae and plants are both photosynthetic organisms but algae can be found in nature as unicellular whilst plants are multicellular. Algae can grow much faster than plants!

Each plant or algae species have their specific pigments which help them capture light and perform photosynthesis. They capture the visible light which contains different colours (wavelengths). Some pigments absorb blue light, some others yellow, orange or red...

Some pigments help the plants and algae to grow more and perform photosynthesis. Some pigments protect the plants from getting too much or too little sunlight!

Most pigments have numerous health benefits such as being strong antioxidants to help you boost your immune system! They can also make the colour of food and medicine more appealing!

We can explore different ways of disrupting the cells or tissue of the plants to extract more pigments. Crushing, filtering (through a sieve or a finer filter) and trying different liquids. In this experiment we could see the difference between using water or vinegar (acidic). You can also try olive oil at home to see if some pigments are soluble in oil!



How does it work?

Nutrition: Colour makes things more appealing, including food and medicine. Most food and pharmaceutical industries are trying to reach out to the wider public by making the products more colourful. Before synthetic food colours were available, most food colour additives were derived from natural sources such as edible berries, flowers, and even medicinal lichens. Despite the general appeal and convenience of using synthetic food colours there have been debates about their widespread use.

People are nowadays more drawn to consume natural and organic food products and the source of food additives matter more than ever. This activity can help the children explore food colouring. They can investigate ingredient labels at home to find out whether natural food colourants were used in those products. Examples are turmeric, saffron, beet powder, extracts of carrots (beta-carotene), fruit juices, paprika, and hibiscus flowers. Older students may want to research and debate the use of synthetic food colour versus natural additives.

The other interesting point is about the green colour! Algae can appear in nature in many colours and most of them contain chlorophylls. Chlorophyll is the dominant pigment in most algae and plants. This is the pigment which helps them extract energy from the sun.

Biochemical engineers work on how to extract colours from plants and algae at a large scale for use in various industries. They use the same processes that you have done today, disrupting the plant or algae cells to get the pigments out. Using the right solvent to extract the pigments and then removing that solvent from the product remains a challenge. Also how to make the final product have a longer shelf life is a challenge!

Table below include some suggestions to explore more colours and extract them with water or vinegar based solutions:

Colour	Plant
Blue	**Leaves**: red cabbage **Fruit:** elderberries **Leaves & stems**: tomato plants
Yellow	**Leaves:** alder, mint, parsley, birch **Flowers:** aster, calendula, chamomile, dandelion, golden marguerite, marigolds, zinnias **Leaves & stems:** bindweed, mullein, wild mustard

Colour	Plant
Green	**Leaves:** carrots, golden marguerite **Flowers:** black-eyed Susan **Leaves & stems:** spinach
Orange	**Flowers:** dyer's coreopsis **Spice:** turmeric
Gold/Brass	**Flowers:** sunflower **Leaves & stems:** cocklebur, dock, goldenrod, redroot pigweed **Seeds:** sunflower
Tan/Brown	**Leaves:** birch **Fruit:** hawthorn **Other:** coffee grounds
Pink	**Leaves:** red cabbage
Purple	**Fruit:** wild grapes, mulberries
Red	**Roots:** madder
Black	Black walnut hulls