Sensing genetic disorders with fluorescence (preparation details for teachers and technicians)

SAFETY

Ethanol
H225 Highly flammable liquid and vapour
H319 Causes serious eye irritation

P210 Keep away from heat/sparks/open flames
P280 Wear eye protection

HCl conc.
H290 May be corrosive to metals
H314 Causes severe skin burns and eye damage
H335 May cause respiratory irritation

P261 Avoid breathing vapours
P280 Wear protective gloves/eye protection
P305+P351+P338 IF IN EYES: Rinse with water, remove contact lenses if present, and continue rinsing cautiously
P310 Immediately call a POISON CENTRE or doctor

NaOH
H314 Causes severe skin burns and eye damage

P280 Wear protective gloves/clothing/eye protection
P305+P351+P338 IF IN EYES: Rinse with water, remove contact lenses if present, and continue rinsing cautiously
P310 Immediately call a POISON CENTRE or doctor

UV Lamp
Do not shine directly into eyes
Do not expose skin to the light for excessive periods of time
Use with guidelines provided with the specific lamp/torch used

TO BUY

Spinach: Fresh spinach leaves can be purchased from a supermarket – they tend to last around a week in the fridge. If you decide to make up the chlorophyll solution before the experiment note that the ethanolic chlorophyll solution degrades rapidly – within 24 hours, and the green solution turns brown. A solution can be made up and kept for up to 48 hrs if wrapped in foil and kept in the fridge.

Washing powder: For the images used on the website we non-biological own brand washing powder purchased from a supermarket. Most washing powders contain ‘optical brighteners’, especially those which are specifically for white clothing.

Turmeric: Turmeric powder can be purchased from the supermarket for this experiment, or curcumin can be sourced from a chemical supplier. Supermarket turmeric was used for the photographs on the website.

Tonic water: Any tonic water contains quinine; cheap home-brand tonic water was used in the photographs on the website.
Vitamin B tablets: The tablets used for the demonstrations on the website were sourced online from Swanson (Riboflavin Vitamin B2 100 mg, 100 Capsules). Capsules are easy to open and pour the solid out of, and these work well. Be careful not to get mixed vitamin tablets, as other vitamins (such as B12) are also fluorescent, and will complicate this experiment.

UV Torch/Lamp: We purchased an inexpensive (<£10) UV LED Flashlight from Moobom for the photographs online. The fluorescence is much better to see in a dark room, although a setup can easily be made with a dark box and a viewing panel, or a TLC reader. Black bulbs could also be used; this just needs testing with the tonic water, to make sure that you can see the blue fluorescence.

TO PREPARE IN ADVANCE

1 M HCl (aq) solution
Dilute concentrated HCl down to form 500 mL of 1 M solution. 10 mL of 1 M acid will be enough per group for this activity. Always add the acid to water, NOT water to the concentrated acid. For example, add 40 mL 37% HCl to 300 mL of deionised water, and top this up to 500 mL with deionised water to make a 1 M solution. Do this dilution in a fumehood.

1 M NaOH (aq) solution
Dissolve 20 g of NaOH in 500 mL of deionised water. Always add the base to water.

UV Lamp
Set up a UV viewing station, either in a dark room, or within a dark box with a viewing hole. If a torch is used, clamp the torch with a retort stand pointing away from viewers eyes.

STUDENTS WILL NEED
- Glass beakers (*4 100 mL)
- Glass stirring rods
- Conical flasks (*5 50 mL)
- Measuring cylinder, to measure 25 mL ethanol, 50 mL deionised water, 5 mL deionised water and 1 mL riboflavin solution
- Filter papers and funnel (*4 per group)
- 5 g spinach leaves
- Turmeric (1 pot for the whole class, ~0.2 g per group)
- Washing powder (500 g will last ages)
- Tonic water (each group only needs a few mL to see under the UV lamp)
- Vitamin B2 capsules (1 per group)
- Spatulas (Weighing boats / paper) (although weighing is not really necessary)
- Ethanol (50 mL per group)
- 1 M HCl (aq) (~10 mL per group)
- 1 M NaOH (aq) (~10 mL per group)
- Universal indicator paper (to determine pH 0/7/14)
- Distilled water (110 mL per group)
- A UV viewing station