

Demonstration corner

Colour mixing



Figure 1 - Lightsticks-lanyards are just visible (image taken from <http://www.glow.co.uk/six-inch-glowstick.html>).

A number of methods are available to demonstrate mixing of different colours of light. One of the more intriguing methods that we have come across involves the use of so-called Lightsticks [1]. In order to try this demonstration out we purchased a range of different coloured lightsticks (also known as glow sticks) from The Glow Company (www.TheGlowCompany.co.uk).

Each of the lightsticks comes with a lanyard which can easily be removed leaving a convenient hole which allows lightsticks to be joined together. We have adopted the approach previously suggested [1]; using a combination of washers, nuts and a bolt it is possible to create an arrangement similar to that shown in Figure 2.

Once the lightsticks have been assembled as shown in Figure 2 they can be mounted in the chuck



Figure 2 - Joining the light sticks together. The angle between the sticks is set to be approximately 120°.

of a hand-held electric drill as shown in Figure 3. It is important to make sure that the sticks are firmly held in the drill.

Once the lightsticks have been 'activated' the drill can be switched on and its speed slowly increased. As the speed increases the colours of the lightsticks will blend together and eventually will appear 'white' in colour as shown in Figure 4.

Clearly different combinations of lightsticks could be used and observed colours compared with those predicted.

The chemistry of lightsticks has been explored on a number of occasions (for example see [2]). Briefly a dilute solution of hydrogen peroxide is mixed with a solution which itself contains a phenyl oxalate ester and a fluorescent dye. The peroxide and ester react to produce phenol and virtually all of the energy released is produced in the form of light.

Curriculum links

CfE

By exploring reflections, the formation of shadows and the mixing of coloured lights, I can use my knowledge of the properties of light to show how it can be used in a creative way - *SCN 2-11b*.

Physics - National 3

Colour - By exploring reflections, the formation of shadows and the mixing of coloured lights, I can use my knowledge of the properties of light to show how it can be used in a creative way.

Higher Chemistry

Periodicity, Polarity and Properties - Oxidising and reducing agents.
(b) Molecules and group ions can act as oxidising and reducing agents.

References

- [1] Shakhashiri, B.Z. (2011), Additive Color Mixing in *Chemical Demonstrations: A Handbook for Teachers of Chemistry Volume 5*, pp 181-191, University of Wisconsin Press, Madison.
- [2] Shakhashiri, B.Z. (1983), Lightsticks in *Chemical Demonstrations: A Handbook for Teachers of Chemistry Volume 1*, pp 146-152, University of Wisconsin Press, Madison.



Figure 3 - Lightsticks mounted in the drill assembly.



Figure 4 - Light mixing using 3 lightsticks.

Safety considerations

In the unlikely event of the lightsticks being released during the activity it is important that the drill chuck points towards an audience and that both the 'operator' and audience wear appropriate eye protection. The drill should only be operated at speeds sufficient to generate 'mixed' colour.