

Invisible Writing

Introduction

There are many recipes for invisible ink. Unfortunately, most do not produce ink that is colourless, or convincingly 'invisible'. The following recipe uses everyday household chemicals and has the advantage over the more commonly touted versions in that the 'ink' really is invisible.

It is an excellent visual and fun demonstration for S2 Earth & Space – Changing Materials Level F.

For the chemistry courses, it can be used to show a colour change in a chemical reaction in Unit 1(ii) of the Intermediate 2 course, Unit 1(b) of the Access 3/Intermediate 1 course and in Unit 1 of the Standard Grade course.

Due to the toxic nature of aspirin and iron tablets (see below), the solutions should be made up by a technician. The bottles should be labelled as 'Ink solution' and 'Developer solution'. Dispense the 'ink' in quantities of 4-5 cm³ (equivalent to approximately one dissolved aspirin tablet).

Equipment

measuring cylinder, 100 cm³
 beaker, 100 cm³
 beaker, 250 cm³
 mortar and pestle
 filter paper
 atomising bottles, 60 cm³ - available from Scientific Chemicals - code BDP160020 at a cost of £21.85 pk10)
 small 60 cm³ screw top bottle
 stirring rod
 small paintbrushes
 balance

Chemicals

Aspirin 'ink' solution

washing soda crystals (or sodium carbonate)
 aspirin tablets, 300 mg
 deionised water

Iron 'developer' solution

iron supplement tablets (must be ferrous sulphate type, 200 mg).
 white vinegar
 thin household bleach

The aspirin and iron tablets were purchased from Boots at a cost of £0.75 and £1.69 respectively. Washing soda and vinegar were purchased from Asda at a cost of £0.51/g and £0.47/500 cm³ respectively.

Preparation of solutions

Aspirin ink

Add 2 g of aspirin capsules (about 7) and 5 g of washing soda to 30 cm³ of de-ionised water.

Dissolve, with stirring, for approximately 1 hour and transfer to a jar. It can be used immediately. It lasts for up to a week.

Iron developer

Mix 2 g crushed iron capsules (about 10) with 125 cm³ of white vinegar and stir to dissolve. Wearing rubber or plastic gloves and indirect vent goggles add 2.5 cm³ of household bleach (Irritant). The solution should turn dark orange.

Transfer to an atomising spray bottle. This will keep for at least 2 months.

Pupil Experiment

Using a paintbrush write a message onto a piece of filter paper and leave to dry. A hairdryer can be used to speed up the drying process.

Place a newspaper behind the filter paper to absorb any excess solution. Spray the dried filter paper **lightly** with the developer solution and watch the message appear. Do not over soak the filter paper, as the message will blur.

Additional Safety Notes

Aspirin - The medical use of aspirin is already banned for under-12s, and guidance by the National Pharmacy Association in 2002¹ further advised that aspirin should NOT be given to children under 16 years, unless specifically on the advice of a doctor. This is due to a risk of Reye's syndrome, a rare condition that causes brain swelling and damage to the liver.

Iron supplement - Swallowing of iron tablets by children can be toxic if taken in large enough quantities². The 10 tablets mentioned above could contain 600 mg of elemental iron. A lethal dose is estimated at between 180 and 300 mg per kg of body weight although serious effects³ can occur at dosages over 60 mg per kg. The effects of iron toxicity are more severe in younger children but are dangerous to all age groups⁴.

References

1. National Pharmacy Association press release, 2002.
www.npa.co.uk/publications/pressreleases/2002/nov.html
2. www.portfolio.mvm.ed.ac.uk/studentwebs/session2/group29/irontox.htm
3. Iron (pp133-137), Lithium (pp141-143), Mercury (pp148-149). In: Proudfoot AT. Acute poisoning: diagnosis and management. 2nd ed. Oxford: Butterworth-Heinemann; 1993.
4. Chapter 16: Acute metallic poisonings. In: Matthew J, Lawson AAH. Treatment of common acute poisonings. 4th ed. Edinburgh: Churchill Livingstone; 1979. pp129-138.



Figure 1 Equipment and chemicals for invisible writing

Substance	Hazard	Control Measures
Household Bleach	Irritant solution. In contact with acids, or on heating, the toxic gas chlorine is evolved. Inhalation of chlorine is destructive to all mucous tissue.	Wear rubber or plastic gloves and indirect vent goggles. Open carefully as pressure may have built up. Do not warm.

Table 1 Hazard and control measures