



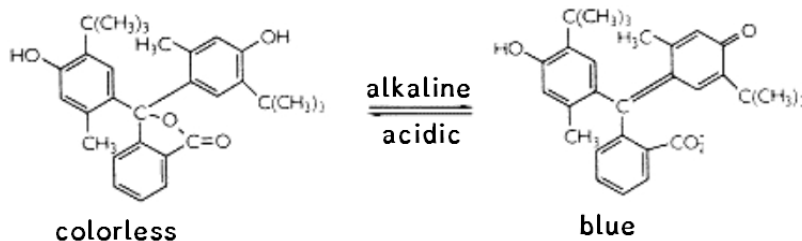
Invisible ink

The book begins with a quote from the encyclopaedia: 'A leprechaun is a mostly invisible familiar spirit. An old belief.' But can something sometimes be visible and sometimes invisible? Today we prove that it is possible. Even if you can't or won't see any leprechauns today, you can make invisible ink and use it to write secret messages or draw your own leprechaun!

1) Thymolphthalein indicator

(Blue above pH 10, colourless below pH 10.)

Dissolve thymolphthalein in alcohol and adjust the pH to just above 10 with a little NaOH. The blue 'ink' is used to write the message. The alcohol evaporates quickly and the ink dries. The carbon dioxide in the air reacts with the sodium hydroxide, neutralises it and the writing disappears. The colour change can be reversed. If the paper is soaked with ammonia or sprayed with a diluted NaOH solution, the blue colour returns.

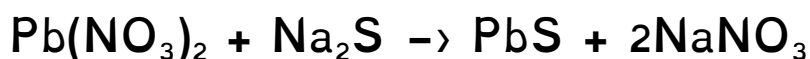




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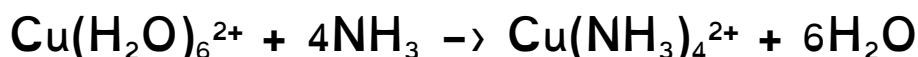
2) Lead nitrate solution

Colourless when dry or heated, can be developed with a sodium sulphide solution. The resulting lead sulphide makes the writing appear black. It cannot be reversed.

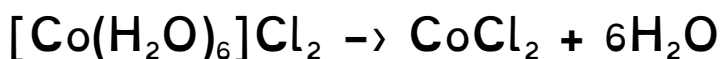


3) Copper sulphate

The pale colour of the thin copper sulphate solution disappears completely on drying and does not appear when heated. Here too, the ammonia colours the writing dark blue.



4) The cobalt chloride solution is barely or not at all visible on the paper. When the paper is heated over a flame, it loses its water content and turns into a dark blue CoCl_2 salt. The moisture content of the air quickly displaces the crystallwater and it loses its colour again.





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5) Lemon juice or milk

It is colourless when dry, but breaks down into brown carbon compounds when heated. The colour cannot be reversed.

6) Diluted sugar solution

The sugar solution is also invisible when dry but turns black when heated (caramellisation).

7) Potassium hexacyanoferrate

The potassium hexacyanoferrate solution is colourless but can be developed with copper sulphate solution: the writing appears brown.

8) Ferric chloride

The solution of ferric chloride also becomes colourless after drying. It can be decolourised again with a solution of potassium or ammonium rhodanide.

9) Phenolphthalein

The phenolphthalein indicator turns red in ammonia solution, the colour disappears after drying. However, the colour becomes visible again when exposed to ammonia.

Source: https://en.wikipedia.org/wiki/Invisible_ink

