

Chemistry of special effects - educational classes

Safety:

We need to bear in mind that safety is the most essential while carrying out the experiments described below. It is vital to get to know the information about the substances used in experiments and provide individual safety precautions.

Introduction:

Special effects in films are based on chemistry. A proper example here is the scene from the film “Harry Potter and the Chamber of Secrets” where the sentence written in blood appears on the wall.

Film: <https://www.youtube.com/watch?v=bjNHWwelxN4>

Source: <http://images2.fanpop.com/images/photos/6500000/Harry-Potter-and-the-Chamber-of->



Secrets-the-chamber-of-secrets-6579083-580-326.jpg

Is it possible to achieve such an effect in school conditions?

Yes it is, thanks to Chemistry. Below I am presenting this experiment and some others which might appear striking as well. There are also some suggestions how to use them together with the list of necessary agents.

Experiment no 1 - fake blood

Agents:

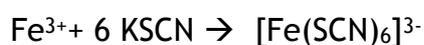
Distilled water - H₂O,

thiocyanate potassium (rhodanate potassium) - KSCN (or other salt with ions SCN⁻)

chloride of iron (tIII) - FeCl₃ (or different salt which can dissolve with ions Fe³⁺)

It is necessary to prepare a hydrous solution of thiocyanate potassium KSCN and chloride of

iron (III). Thiocyanate potassium (rhodanate potassium) together with iron ions form a complex union,



which changes the colour of solution into blood-red:



This chemical reaction can be used to make fake blood but also as invisible ink. To achieve it, you need to take a strip of paper or any other absorbent surface and write words using colourless solution KSCN and then dry it. In order to make these words visible, you need to atomise yellowish solution FeCl₃ over the surface which has been prepared beforehand. It can be done by using an atomizer. This activity will let people see the blood-red letters.



Invisible ink can be made by using the reaction of identifying phenols. Instead of ink you can use salicyl or cosmetic alcohol in which salicylic acid is dissolved. A piece of paper with a writing on, needs to be dried; the substance which identifies the writing might be the solution of ions Fe^{3+} , for example, FeCl_3 .

Experiment no 2 - colourful fire

Agents:

ethanol - $\text{C}_2\text{H}_5\text{OH}$,
nitrate of strontium (V) - $\text{Sr}(\text{NO}_3)_2$ (or different salt of strontium)
barium nitrate (V) - $\text{Ba}(\text{NO}_3)_2$ (or different salt of barium)
sodium nitrate (V) - NaNO_3 (or different salt of sodium)
chlorate of potassium - KClO_3
powdered sugar - ground sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$)

To get colourful fire you need to burn mixture of salt of metal. This forms characteristic colouration of fire and it is used in so called flame analysis.

Red flame:

Red colour of flame can be achieved by burning strontium (Sr). You need to prepare alcoholic/spirituous solution of strontium salt which should be placed in a vessel and then burned.



Green flame:

Green colour of flame can be achieved by burning barium (Ba). You can do it as it is described above or prepare a mixture of KClO_3 , powdered sugar and salt of barium in the mass ratio of 1:1:2. You need to stir everything and then burn.



Yellow flame:

You need to follow the same procedures as described above using salt of sodium (Na).



Experiment no 3 - sudden flash and smoke

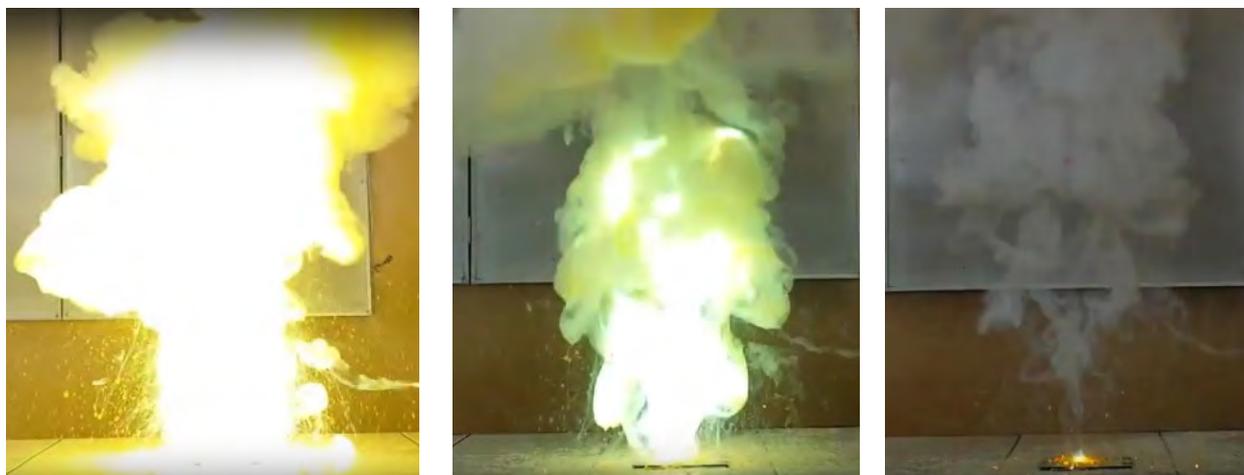
Agents:

Ground sulphur - S
zinc dust - Zn

In a simple synthesis of zinc sulphide performed in accordance with the scheme: $\text{Zn} + \text{S} \rightarrow \text{ZnS}$

we can achieve effective bright flash and rising smoke. The reaction is initiated with

flame. To carry out the synthesis of zinc sulphide you need to weigh zinc dust and ground sulphur in the ratio of 2:1. Substrates need to be mixed and then piled up into a shape of a small cone on a fireproof surface and in the end burned with a blazing torch.



Experiment no 4 - colourful solutions

Agents:

Distilled water - H_2O ,

P h e n o l p h t a l e i n
hydrous solution of caustic potash - KOH (or different alkali solution)
manganian of potassium (VII) - $KMnO_4$

Nitrate of lead (V) - $Pb(NO_3)_2$ (or different easily dissoluble salt which contains ions Pb^{2+})

Potassium iodide - KI (or different easily dissoluble salt which contains ions I^-)

Chemistry gives almost unlimited possibilities to get various colours not only by using colorants but also by using pH rating or precipitating sediment when two colourless and clear liquid substances are mixed.

Pink colour:

In order to achieve pink solution it is enough to use phenolphthalein which shows pH value of the solution. In liquid substances which have neutral or acid pH it stays colourless. However, when there is alkaline pH, it changes into intense pink (raspberry) colour.

You need to pour a few drops of phenolphthalein solution into a vessel filled with hydrous alkaline solution and observe the immediate change of colour.



Violet



colour:

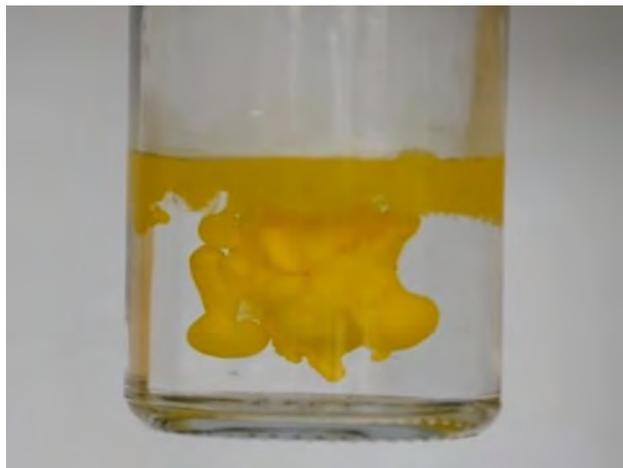
Intense violet taint of solution can be got by dissolving crystals of potassium permanganate (KMnO_4) in water. Depending on the amount of the used substance, the intensity of colour will be bigger or smaller. The more the substance you use, the darker the colour becomes.

Navy blue colour:

In order to achieve intense navy blue solution you need to use pH rating - thymol blue. This rating dissolved in ethanol becomes yellow; in solutions which have acid pH it turns red whereas in solutions with alkaline pH it changes into blue or navy blue.

By using different acid or alkaline solutions we can change pH of a solution adding thymol blue and observing the change of colour of a solution. Distilled water has to be basified by adding KOH solution and then pour a few drops of thymol blue and observe immediate change of colour.





Yellow colour:

Using the properties of some salt we can carry out the reaction of precipitating the sediment, which very often have intensive colour. A proper example here is iodide of lead which has yellow colour. In order to get the anticipated effect you need to mix two colourless solutions of well dissoluble salt $\text{Pb}(\text{NO}_3)_2$ and KI . In the moment of mixing of the liquid substances there is a reaction which forms intensive yellow sediment that

gradually settles at the bottom of a vessel.

Conclusion:

Chemistry gives loads of possibilities to achieve visual effects, which are used in making films. Using the reactions described above we can teach students important chemical topics like reactions of ions, pH of liquid/hydrous solutions and the methods of its research, chemical synthesis, dissolubility or flame analysis and at the same time we are able to create a unique and not necessarily amateur film production.

Some of the above experiments were used while making a film in/for the Booktrailer Film Festival Project → <https://www.youtube.com/watch?v=WOYOV7ar-Ag>

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