making ionic compounds

Posted by Anonymous on Fri, 2015-05-08 14:40

Making ionic compounds: I need help to understand the products we ended up with when we ran this practical.

Fresh solutions of sodium sulphide 0.1M and copper (II) chloride -0.1M were made up and 10 ml of each were mixed together as described in the practical.

The precipitate formed was black, but when filtered, the filtrate was yellow! Once the filtrate was evaporated off, the crystals remaining in the watch glass were sodium chloride.

What would the yellow colour be due to? The expected products of the reaction are copper sulfide crystals and sodium chloride solution i.e. not a yellow solution.

I would apprecate any help. Thanks.

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9
10
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making ionic compounds prac from Pearson Science 9 p19

Submitted by sat on 27 May 2015

Summary Answer

This reaction is a typical example of a double displacement reaction whereby an aqueous solution of sodium sulfide reacts with an aqueous solution of copper (II) chloride to give copper (II) sulfide (black shiny crystals) and aqueous sodium chloride (a colourless solution). Sometimes, instead of a colourless filtrate, a yellow solution may be obtained, which occurs because of the decomposition of solid sodium sulfide to hydrogen sulfide.

Sodium sulfide is a yellow, yellow–pink or white solid flake with a sulfurous (rotten egg) smell which contains at least 30% water. Crystalline sodium sulfide is hydroscopic and absorbs moisture from air to form hydrogen sulfide. Discolouration of the solid occurs with time. When sodium sulfide is dissolved in water, hydrolysis occurs and the sulfide solution develops the characteristic rotten-egg odour. Dissolving an ageing sodium sulfide solid in water will result in more hydrolysis of the anion compared to a fresh sample. Instead of colourless, a yellow aqueous solution of sodium sulfide is observed. This solution has a strong sulfurous smell and the yellow colour fades with time.

When this sodium sulfide solution is made to react with copper (II) chloride solution, a black precipitate (copper (II) sulfide) in a yellow solution is formed. Filtration results in a yellow filtrate, which contains aqueous sodium chloride and sulfide/polysulfide ions in equilibrium.

Recommendations

Science ASSIST strongly recommends precipitating out the sulfide ions from the filtrate before performing evaporation. These ions can be removed through reaction with aqueous silver nitrate solution:

To the filtrate, add 0.1 M silver nitrate solution drop wise, until no further black precipitate is formed, filter the mixture and evaporate the filtrate to get the sodium chloride crystals.

Warning: If the filtrate containing sulfide ions is heated, the sulfide ions will be oxidized to sulfur dioxide, a very toxic and corrosive gas.

Science ASSIST also recommends:

- using a fume hood and appropriate PPE while preparing the copper (II) chloride and sodium sulfide solution,
- storing sodium sulfide in a tightly closed secondary containment container in the fridge,
- ensuring proper disposal of all chemicals involved in this experiment, and
- using the Risk Assessment Template for schools developed by Science ASSIST (see Risk Assessment Template).

Disposal of waste chemicals

- The sulfides of copper and silver should be kept in the heavy metal wastes (solid) disposal bottle, which then should be disposed of by a licensed waste disposal contractor.
- Old degradable samples of solid sodium sulfide should also be disposed of by a licensed waste disposal contractor.
- Waste sodium sulfide solution should be treated with dilute ferric chloride solution to precipitate the sulfide ions as ferric sulfide, and then neutralized with sodium carbonate solution.
- The solid ferric sulfide is collected by either Buchner or gravity filtration, and when dry, placed in the heavy metal waste disposal bottle. The filtrate can be disposed of down the sink.

Alternative reactions

Due to the toxic and corrosive nature of sodium sulfide, other safer chemicals can be used to illustrate “Making Ionic compounds” such as:

- Reaction between aqueous solutions of copper (II) chloride and sodium phosphate.
- Reaction between aqueous solution of copper (II) chloride and sodium hydroxide.
- Reaction between aqueous copper (II) chloride and potassium carbonate.

References

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