Separation of copper and iron: Precipitation and leaching

A. Main topics

- The selective precipitation and leaching of metals from mixtures or ores is a versatile tool in purification processes.
- Leaching with cyanides is a key step in gold mining operations.

B. Targeted audience

Beginning with 16 years old students

C. Key concepts

1. Metals can be separated one from another due to their different and often specific behaviour when treated with proper reagents.
2. Copper is used as an example for a precipitation and leaching process with ammonia.
3. Precipitation and leaching can be explained with a non-toxic example

D. Experimental activity:

The students will be provided with a copper(II)-sulphate solution, ammonium hydroxide solution and sodium hydroxide solution. On addition of NaOH to the copper solution, precipitation of a light blue solid can be observed. On addition of ammonium hydroxide to this mixture, the solid dissolves and the solution turns deep blue.

E. Toolkit material

- Copper(II)-sulphate solution.
- Sodium hydroxide solution.
- Ammonium hydroxide solution.
- A set of glassware.
- Protocol with the description of the experiments.

F. For information on the toolkit

Jochen Brinkmann M. A.
brinkmann@we.tu-clausthal.de

Separation of Copper and Iron: Utilization of anion exchangers in solvent extraction

A. Main topics

- Introducing to the technique of solvent extraction in purification of primary and secondary raw materials.
- An example is given on how two metals can be separated from another, utilizing their different chemical behaviour.
- The very same concept shown in this experiment is used to separate rare earth elements.

B. Targeted audience

Beginning with 16 years old students

C. Key concepts

1. By addition of an anion exchanger to kerosene, the migration of ionic species into an organic, aprotic phase is made possible.
2. The two elements iron and copper can be separated by solvent extraction.
3. The actual separation of the metals is made visible with specific detection reactions.

D. Experimental activity:

The students will separate a mixture of iron and copper, dissolved in hydrochloric acid. This mixture is placed in a separatory funnel with a prepared solution of the anion exchanger in kerosene. After the first extraction, the aqueous layer is separated and the remaining organic layer is combined with distilled water. After a second extraction, the aqueous layer is separated again.

E. Toolkit material

- Copper(II)-sulphate and iron(III)-chloride, dissolved in hydrochloric acid.
- Solution of the anion exchanger in kerosene.
- Protocol with the description of the experiments.
- Slideshow with graphics and additional information.
- Video

F. For information on the toolkit

Jochen Brinkmann M. A.
brinkmann@we.tu-clausthal.de