For Teachers

Separation of copper and iron – two approaches

Module 2

Objective: Ion exchange

Necessities

Reagents	Formula	!	Quantity (g) or Concentration (M)
Iron (II) sulfate heptahydrate	$FeSO_4 \times 7\ H_2O$	GHS 07	c = 0,02 mol x L^{-1}
Copper (II) sulphate pentahydrate	$Cu\ (II)\ SO_4 \times 5\ H_2O$	GHS 07, GHS 09	c = 0,03 mol x L^{-1}
Lewatit TP 207		none	ca. 50 g
Water demin.	H_2O		
Potassium ferrocyanide (III)	$K_3\ [(CN)_6\ ]$	none	Some crystals
Ammonium solution	NH_4OH	GHS 05, GHS 07, GHS 09	c = ca. 25 %
Sulfuric acid	H_2SO_4	GHS 07	c = 1 mol x L^{-1}

List of materials/tools

- Separator column
- Dropping funnel
- Stand with clamps
- Different beakers
- Materials set from “Precipitation and leaching

Experimental Procedure

Preparation of stock solutions

- Please prepare a stock solution of the metal salts to be separated as described below.
- Therefore please weigh 0,03 mol $CuSO_4 \cdot 5H_2O$ and 0,04 mol $FeSO_4 \cdot 7\ H_2O$ and place both in a 1L volumetric flask. Add approximately half of the flask’s volume of diluted sulfuric acid (pH = 3) and shake well. Now add more diluted sulfuric acid to the clear solution until the flask’s marking is reached. Mix well again.

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Separation

The 150 ml of the make-up solution is poured into the dropping funnel attached to the stand above the chromatography column. Then allow the solution to drip slowly (approx. 2 drops per second) into the column, adjusting the outlet so that the liquid level in the column remains constant and the inlet front is parallel to the surface. The eluate is collected in a beaker.

The column is then rinsed with 500 ml of demineralised water.

The ion exchanger is regenerated by rinsing with 2 mol x L^{-1} sulphuric acid until the ion exchanger shows no colouration, this eluate also being collected in a beaker.

The column is then rinsed with deionized water until pH neutral.

Detection reactions

1. Eluate

Add a few drops of NH_4OH solution to a sample of about 2 ml of the first eluate.

A second sample is mixed with a few crystals of potassium ferricyanide (III).

2. Eluate

Proceed in the same way with samples of the second eluate.

Conclusions

- Law of mass action
- Acid – base reactions
- Equilibria