Neutralization and chemical precipitation of wastewater from Copper Smelters

INTREAT
Integrated treatment of industrial wastes towards prevention of regional water resources contamination

Research Project within the 6th Framework Programme of the European Commission INCO-CT-2003-509167

Problem
120 m^3/**day of wastewaters flows** from the electrolysis plant, "Copper Smelting" (RTB-Bor) flows to river Timok and Danube (production on full capacity). Loss of copper up to 200 t/year.

Participants
TMF-Belgrade/IME- Aachen: Experiments with synthetic wastewaters
RTB-Bor: Testing of the optimized process with real wastewaters

Target
- Removing the heavy metals from wastewater
- Development of cascade line of three reactors each of 10 l for the continuous precipitation, capacity of 1 kg/h solid residue
- Verification of lab test parameters in the cascade line (temperature, concentration of neutralization agent, pH solution)

Laboratory test

thermometer
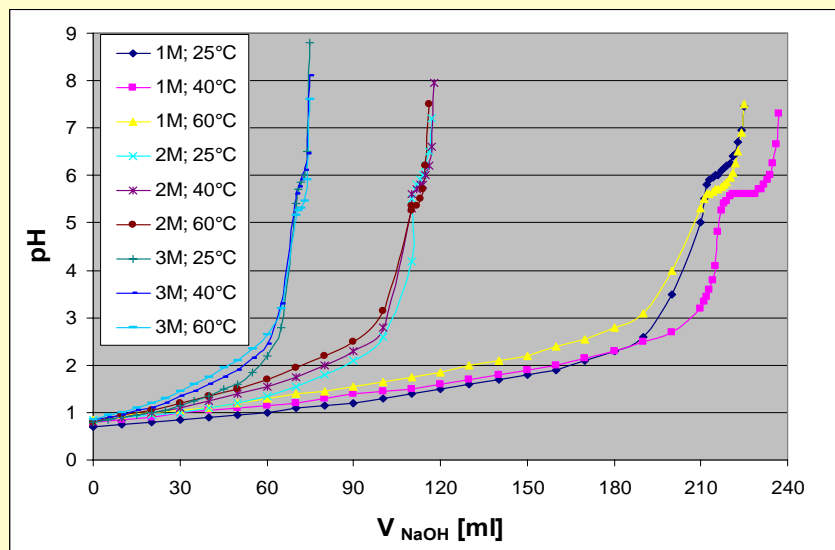stirrer
pH-electrode
reactor

Parameters in the laboratory test
- temperature: 25 - 60°C
- pH- values: 0.9 – 8.9
- concentration of NaOH: 1.0 – 3.0 mol/l
- stirring rate: 300 - 500 rpm

Conclusions
- Temperature had no influence on the neutralization process.
- Increase of concentration of NaOH decreases time for neutralization

Legend:
- 1M; 25°C
- 1M; 40°C
- 1M; 60°C
- 2M; 25°C
- 2M; 40°C
- 2M; 60°C
- 3M; 25°C
- 3M; 40°C
- 3M; 60°C

pH vs V_{NaOH} [ml]

Cascade line at IME, Aachen

Main features of cascade line
- System for feeding wastewaters
- System for injection of neutralization agents
- System for pH measurment and control
- Removal the process gases

The chemical composition of the Serbian wastewaters
1. Saraka stream (mg/l) with 2.65 g/l H_2SO_4
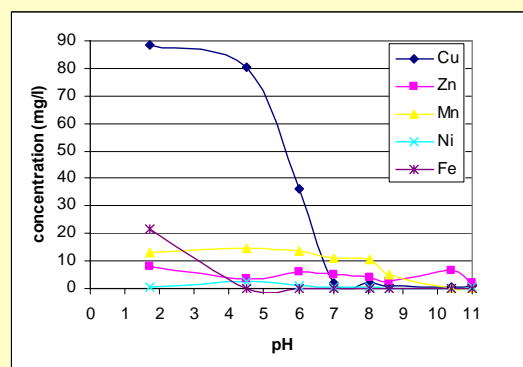88.3 Cu, 7.87 Zn, 13.1 Mn, 0.31 Ni, 21.5 Fe

2. Industrial wastewater (g/l)
6.0 Cu, 0.6 Ni, 0.003 Pb, 0.15 Fe, 0.02 Zn, 0.51 As, 0.01 Sb, 0.04 Bi, 0.03 Al, *83 H_2SO_4*

Parameters in cascade line
- temperature (20°C – 27°C)
- pH- values of 3 reactors: 4.0, 7.0, 9.5
- concentration of NaOH (1.0 mol/l)
- stirring rate: 300 - 500 rpm
- flow rate of wastewater (10 l/h)

Removal of metals from Saraka stream

Legend: Cu, Zn, Mn, Ni, Fe
concentration (mg/l) vs pH

Solid residue from the first reactor (removal of Fe at pH= 4)

IME
Metallurgie
Prozesstechnik
Recycling
DIE METALLURGEN

RWTH