pH in Iron Ore Slurry + NaOH solution

Industry: **Metal & Alloys (Steel)**
Product: **pH**

Introduction

In stable dispersion of fine particles is the pre-requisite for the selective flocculation technique involving separation of ultra-fine valuable particles from the gangue. Among mineral processing techniques selective flocculation technique is known to have outstanding potential of capturing the particles of particular mineral in slurry of mixed mineral system by selective adsorption of water soluble polymers known as flocculants. The critical barrier to success of selective flocculation is the design and optimization of dispersion parameters to obtain the stable dispersion of slurry prior to addition of flocculants.

The success achieved in stabilization of slurry of mixed mineral system is based on the judicial adjustment of pH and control of ionic strength, solid concentration, stirring speed, stirring time and selection of most selective dispersant. Manipulation of surface charge and surface hydroxyl groups with manoeuvring the pH and polymeric dispersants content are the key parameters that govern stability of slurry and minimize the tendency of hetracoagulation.

Effect of solid concentration and pH

Results of effect of solid concentration on sediment wt% and % entrapment of fine particles are plotted in Fig. 1 and Fig. 2 respectively. The data very clearly depict that settling rate of the 38µm slurry decreases with increasing the solid concentration and increases with the pH values. On the other hand decreasing trend in % entrapment of fine particles (10µm) is observed with increasing the solid concentration as well as the pH values.

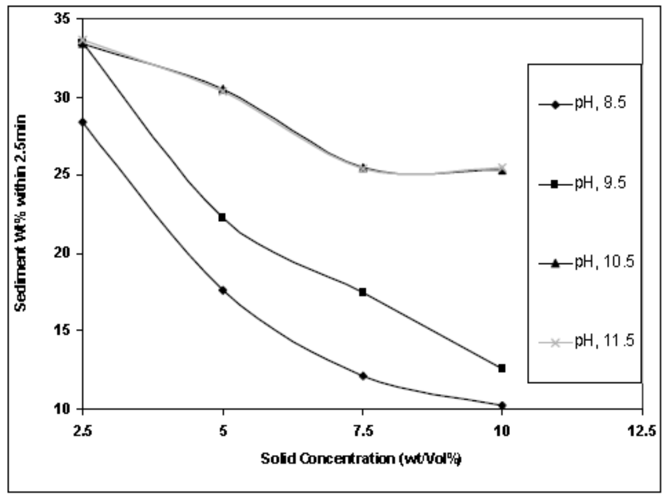

Figure 1: **Effect of pH and solid concentration on stabilization of -38 µm Iron ore slurry without dispersant addition.**

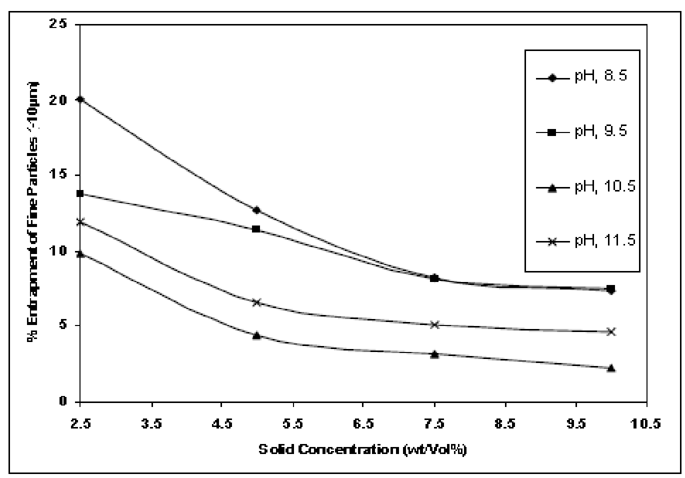

Figure 2. **Effect of pH and solid concentration on stabilization of -38 µm iron without dispersant.**

Hetrocoagulation at pH 10.5 and pH 11.5 where the mineral, present in the iron ore system, possesses similar charge cannot be avoided specially due to presence of polyvalent metal ions. Therefore in the light of theories and investigations pertaining to hetrocoagulation, increasing trend in sediment wt% at pH, 10.5 and pH, 11.5 could be attributed with occurrence of hetrocoagulation.

On the other hand decreasing trend in % entrapment of fine particles (-10μm) with increasing pH Fig. 2 does not attest the occurrence of hetrocoagulation hypothesis, but indicates that jostling interaction would have been taken at low pH values. Therefore with increasing the pH the rejection of fine particles from the vicinity of falling solids taken place thereby jostling interaction is reduced and increase in settling rate resulted. The decrease in % entrapment of fine particles at higher pH values is an evidence of gel formation at lower pH values. Zeta potential of iron ore slurry measured at different pH values Fig. 3 further confirms the gel formation assumption at low pHvalues. On the basis of zeta potential values hetrocoagulation/ coagulation could be attributed the cause of gel formation at low pH values. Therefore increase in zeta potential with increasing pH results in hindrance of the fine particles to hetrocoagulate, and hence reduced gel formation and jostling interaction of the particles. Thus increase in settling rate concomitantly resulted.

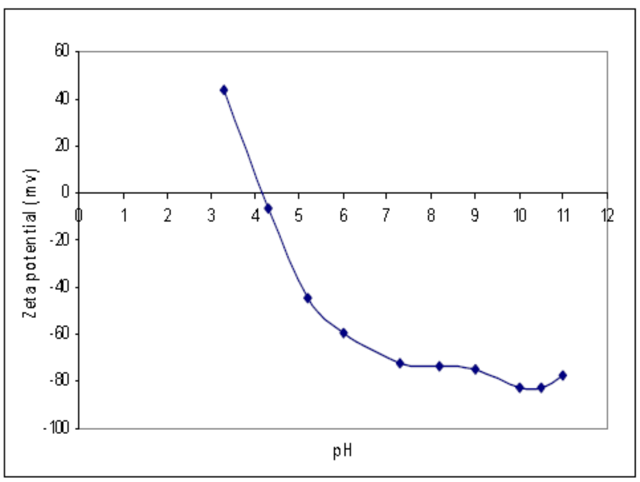

Figure 3. **Effect of pH on zeta potential of Dilband iron ore.**

Conclusion

The general conclusions drawn from dispersion tests are that:

- Slurry stabilization increases with increasing solid concentration and pH.
- Presence of polyvalent metal ions played detrimental effect in destabilization via hetracoagulation mechanism.
- Agitation at high stirring speed improved the slurry stability via particle disintegration mechanism. Maximum stability of about 80% was achieved at 7.5% solid concentration, 2000 rpm stirring speed, 5min stirring time, and slurry pH of 10.5 in DD water.

Typical Process Details

Process liquid: Iron ore slurry + NaOH solution

- Solids (Iron Ore): 25%
- Water: 70%
- NaOH: 5%
- Density: 1.55 gm/cc
- Temperature: 40 degC
- Pressure: 0 to 5 bar (Max. 8 bar)
- pH range: 9 to 10.5

Summary

Typical problems:

- Coating on the sensor.

Remedies:

Coating can be cleaned off by diluted acid
Use appropriate sensor with suitable fitting.

Product Recommendations

Sensor Selection

Option1: Retractable fitting PR10 with SC25V sensor

Features SC25V

- External titanium Liquid Earth
- CIP and Steam cleaning possible
- Large internal KCl volume giving the sensor a longer life time

Option #2: FU20 sensor with dome membrane. This one is stronger than the flat membrane.

Alternatively, SENCOM sensor can be used. (FU20F, SC25F)

Features:

- With the body made of Ryton, a strong engineering plastic, which is comparable to Teflon in terms of corrosion resistance and heat resistance, it allows for a wide range of applications.
- The integrated-sensor design simplifies calibration with standard solutions and maintenance.

Analyzer/Transmitter Selection

Option #1: 4 wire pH converter

Type: 4 wire type

Features

- Easy touchscreen operation
- Trending display up to 2 weeks

Option #2: 2 wire pH transmitter

Type: 2 wire type

Features

- Dual sensor measurement on 2-wire type analyzer;

Tangible benefit: More reliable and accurate analysis of pH which helps to improve end product quality.