ABSTRACT

"Factors Affecting Precipitation Efficiency
in the Bayer Process:
The Effects of Low Molecular Weight
Organic Acids on Alumina Trihydrate Precipitation
in the Bayer Process

Encile Roy Brown

In the extraction of alumina from bauxite, the organic constituents of the bauxite and organic components added as flocculants of the red mud residue are known to have an effect on precipitation efficiency.

Low and intermediate molecular weight organic molecules have been extracted, identified and quantified using GC and GC/MS. Several organic molecules were tentatively identified for the first time in Bayer liquors, while their concentrations (except for ethanoic acid which was approximately the same) were higher than those previously determined.

Degradation studies on representative intermediate molecular weight organic molecules (methylbutanedioic acid, hexadecanoic acid, 1,2

benzenedicarboxylic acid and 0-hydroxybenzoic acid) showed:

a) the stability of benzene carboxylic acid during Bayer digestion;

b) that phenolic acids, instead of degrading to form low molecular weight species, form polymers which destabilize the supersaturated liquor; and

c) aliphatic acids degrade to form low molecular weight molecules.

The precipitation unit used in these experiments was designed by us and its efficiency was similar to industrial precipitators. The presence of low molecular weight organic acids during Bayer precipitation caused:

a) increased gibbsite precipitation rates and total precipitate;

b) decreased +200 sized particles;

c) increased +325 and -325 sized particles; and

d) activation correlations did not fit.

The extent to which they affected the precipitation process is shown below:

organic acid mixture = ethanoic acid > methanoic acid, organic mixture + sodium carbonate, butyric acid, propanoic acid > hydroxypropanoic acid > control.

Extrapolating the above results to industrial Bayer precipitation circuits, the presence of organic acids would cause increased fines generation and low product yields and thus less efficient precipitation circuits.