Vol 3 Issue 8 Sept 2013 ISSN No : 2230-7850

Monthly Multidisciplinary
Research Journal

Indian Streams Research Journal

Welcome to ISRJ

RNI MAHMUL/2011/38595 **ISSN No.2230-7850**

Indian Streams Research Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial Board readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.isrj.net

Indian Streams Research Journal
Volume-3, Issue-8, Sept-2013
ISSN 2230-7850
Available online at www.isrj.net

Studies On Settling, And Filtration Of Iron Ore Slime By Magnafloc(1011) Commercial Flocculant At Different Ph

S.R Pandey
Jaypee University of Engg. And Technology,GUNA (M.P)

Abstract:The suspension pH has considerable effect on the settling behaviour of iron ore particles. The settling rate decreases substantially in the alkaline condition compared to the acidic or neutral pH region. The suspension is stabilized at pH 10 when no flocculent is used. The role of increasing zeta potential with the increase in suspension pH in affection the inter-particle repulsion as well as varying degree of ionization of the polymers with pH in settling of the particles are discussed. . Water from slime ponds overflow remains contaminated with very fine particles which are difficult to settle and cause environmental pollution. The above problem necessitate to study foculation settling and filtration behaviour with flocculants.Generally Homopolymers are used as flocculants in treatment of industrial effluents

Keywords: Settling,filtration,flocculants,flocculation.

INTRODUCTION:

The processing of fine grained ores frequently results in the production of ultra fine particles, commonly called slimes. These account for a major material loss, particularly for iron ore in view of large tonnage treated in India or elsewhere in the world. Safe disposal of slimes followed by some subsequent treatment and recycling of water need solid-liquid separation(1). Besides it has drawn considerable attention to the industry during the recent years in view of reducing pollution of down stream water.

Fine particles in fluid suspension tend to follow the motion of the fluid rather than moving relative to it, under the influence of any external force applied to achieve a separation. The formation of larger units by aggregation is thus a promising way to overcome this hydrodynamic limitation. Certain water soluble synthetic and natural polymers are added as flocculating agents in order to achieve this. Polyacrylamide based products come under the first category and are available in non-ionic, anionic and cationic forms and vary in average molecular weight from 1 million to 20 million. The flocculation induced by these dissolved polymer molecules has been attributed to charge neutralization or inter particle bridging(2-5).

The adsorption and configuration of the polymer are influenced by properties of the solids, polymer chemistry, and the aqueous environment.

The effect of suspension pH has considerable effect on the settling and filtration of particles as well as on choice of flocculants. While non-ionic and anionic products predominate in the mineral processing industry, medium anionic and high molecular weight polyacrylamides are used in iron ores. Magnafioc(1011) manufactured by Allied Colloids is one of such polymers which has been tested in the present investigation.

One would expect however that pH should have minimal effect on non-ionic polyacrylamide. Besides the change in configuration of the polymer chain when adsorbed, the suspension pH affects the zeta potential of the particles and hence the inter-particle repulsion/attraction.

In the present investigation, the effect of pH on the settling and filtration of Joda slimes has been reported.

EXPERIMENTAL

The following materials has been used in the present investigation.

MATERIALS:

Iron ore: Iron ore was collected from Joda mines of M/s TISCO Ltd., situated in Singhbhum district of Jharkhand (India). It was deslimed in a concrete mixer using sufficient water followed by agitation. The slime was dried and kept for the study. Magnafloc(1011) was used in settling and filtration studies. It was procured from M/s Allied Colloids Ltd., U.K. It is a high molecular weight anionic polyacry lamide.

CHARACTERISATION

Particle Size Analysis: The particle size distribution of iron ore slime was measured by Malvern particle size analyser using gravity mode. Its average particle size is 38.80 micron (fig. 4.1)

SETTLING TEST:

The settling test following the flocculation of the particles was carried out in a 100 ml graduated cylinder by recording the movement of the suspension-liquid interface as function of time (7,8). The effects of varying pH, solid concentration and flocculant dose were studied.

FILTRATION TEST:

The filtration subsequent to flocculation was studied by observing the amount of filtrate passing through a membrane as function of time. The effects of varying pH, solids concentration and flocculant dose were studied. The same flocculants as used for the sedimentation tests were used as flocculants for filtration tests.

RESULTS AND DISCUSSIONS

Settling Test: The pH value of the suspension is perhaps the most important factor which affects the settling in two ways.

(a)The surface charge of the particles in suspension changes with pH level affecting the inter-particle repulsion attraction (depending upon the point of zero charge, pzc, of the particular mineral) and thus the settling rate is affected.
(b)The pH controls the degree of ionisation of the polymer, and therefore the amount of charge on the polymer chain gets varied. This determines the degree of extension of the polymer molecules. Fig. 6.1 show the height of interface against time at varying pH levels of suspension. A pulp density of 10% and flocculant dose of 30 ppm is selected for comparision because settling is largely affected in this range. Fig.1 shows that the settling rate decreases with increasing pH while a change in pH from 5 to 7.5 (neutral) has marginal effect on the settling rate, a substantial decrease in the settling rate at pH 10 is observed.

The pzc of hematite particle is around 6.8 to 7.2. Therefore, an increase in the pH level increases the inter-particle repulsion, thus adversely affecting the settling. Apparently the settling rate decreases without any flocculant addition in the alkaline condition compared to the acidic or normal pH region. A substantial decrease in the settling rate at 10 pH is due to the combined effect of the above mentioned phenomena.

Magnafloc(1011) is an anionic flocculant.In Polyacrylamide chains, in alkaline condition, amide groups are converted to -Coo- groups which cause straightening of chains and also repulsion between negatively charged particles and chains. At pH 10 high surface charge repels extended polymer from particles resulting in large loops of tails which reach far out into the solution for varying very large but fragile loops and consequently poor flocculation. Both factors are contributing for decrement in flocculation efficiency. The settling rates fall substantially in alkaline range due to shift from the point of zero charge of the iron ore slimes and possibly due to adverse decoiling of macro-molecular chains.

FILTRATION TEST:

It is observed that at 10% pulp density and at 10 ppm flocculant dose the initial filtration rate is higher at acidic pH values and the same is much lower at higher pH value(fig..2,.3). This could be explained in terms of change in zeta potential of the system and degree of ionization of the polymer chain resulting in restabilization of the fines by repulsive forces of the ionised groups in the branches of the polymer chain. The pzc of iron ore slime in 6.8. Therefore an increase in the pH level increases the inter-particle repulsion, thus adversely affecting the flocculation. Apparently the filtration rate decreases substantially in the alkaline condition, compared to the acidic or neutral pH region.

CONCLUSIONS

· The suspension pH has considerable effect on the settling behaviour of iron ore particles. The settling rate decreases substantially in the alkaline condition compared to the acidic or neutral pH region. The suspension is stabilized at pH 10 when no flocculent is used. The role of increasing zeta potential with the increase in suspension pH in affection the inter-particle repulsion as well as varying degree of ionization of the polymers with pH in settling of the particles are discussed.

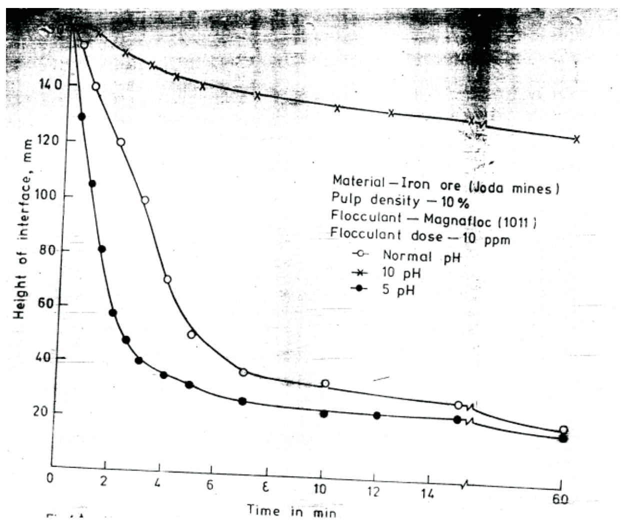

Fig..1

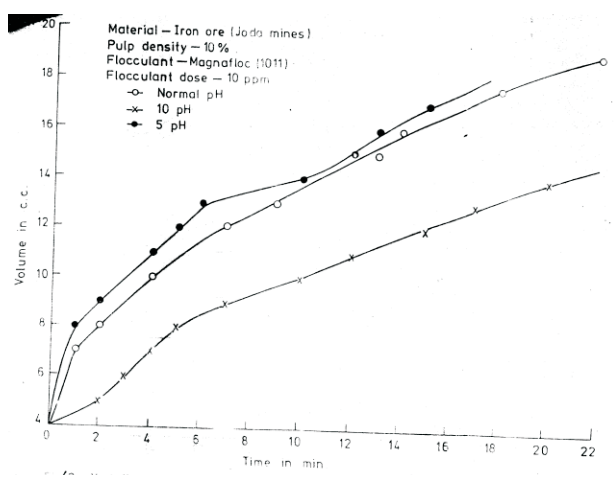

Fig..2

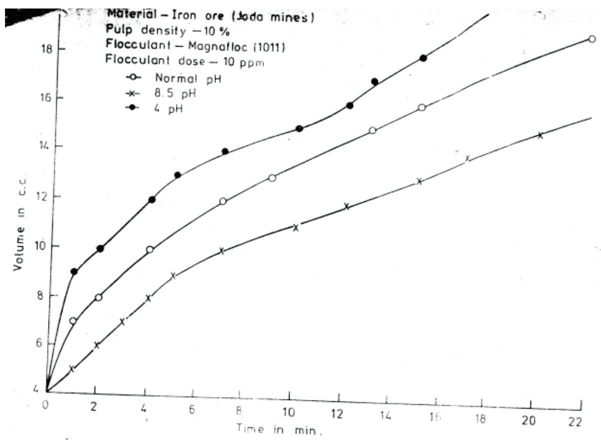

Fig..3

REFERENCES

1.Gregory J. Flocculation by polymers and polyelectrolytes, in: Th.F. Tadros(Ed), solid-liquid dispersions academic press-London, 1987.p.163

2.Singh R.P. Advanced drag reducing and flocculating materials based on polysaccharides, in P.N. Prasad, J.E. Mark, T.J. Fai (Eds), Polymers and other Advanced materials: Emerging Technologies and Business opportunities, Plenum, New York, 1995, p227

3.Pradip, Miner. Proc. Extract. Metall. Rev. 10(1992) 121

4.Karmakar G.P. , flocculation and rheological properties of grafted polysaccharides Ph.D Thesis, IIT Kharagpur 1994

5.Karmakar G.P, Bhagat R.P, Chakarborty D.M., Singh R.P. (194) in I.S. Bhardwaj (Ed) Polymer Science Recent Advances Vol-II, Allied publishers, New Delhi P. 1990