Preparation of water soluble Cationic biodegradable starch as a flocculant

S.R.Bhatt[1], Prof.R.V.Patel[2] Ms. Mamta Saiyad[3]* & Nimish Shah[4]

1. *Sr. Deputy Director, Ahmedabad Textile Industry's Research Association (ATIRA), P.O. Ambavadi Vistar, Ahmedabad-380 015*
2. *Professor, Chemical Engg. Dept. Faculty of Technology & Engineering, M.S.University of Baroda, Kalabhavan, Vadodara- 390 002*
3. **Sr.Lecturer, Plastic Engg. Dept. Institute of Diploma Studies, Nirma University of Science &Technology, Gandhinagar- Sarkhej Highway, Post Chandlodia Via Gota, Ahmedabad-382 481*
4. *Lecturer, Chemical Engg. Dept. Institute of Diploma Studies, Nirma University of Science &Technology, Gandhinagar-Sarkhej Highway, Post Chandlodia Via Gota, Ahmedabad-382 481*

**Corresponding Author*

Abstract:

This work dealt with the synthesis of water-soluble cationic biodegradable starch as a flocculant. The reactive groups of the starch, i.e. hydroxyls, form a complex with cations present in reagent. The complex may dissociate, giving rise to free radical sites onto the polysaccharide backbone. The mechanism of free radical graft copolymerisation of Ethyl monomers onto starch is expected to proceed according to the proposed scheme discussed in the paper. In presence of molecular Nitrogen, H+ may be replaced by Reactive group R, i.e. CH2 CH2 N (Et3) in highly Alkaline medium.

The work has been carried out under dissertation work of M. E. Programme at Ahmedabad Textile Industries Research Association (ATIRA), Ahmedabad. During our work we have found that Developed cationic flocculant is considered to be a medium molecular weight, starch-based flocculant that exhibits a high degree of cationic charge. Developed Cationic flocculant is good in a liquid dispersion form. Also, is a fast acting and effective flocculant can be used in industrial wastewater treatment. It combines the low sludge production characteristics of organic flocculants with the economy of an inorganic.

The paper will discuss some important practical considerations to increase the %N2 by changing the reaction parameters of the polymer produced.

Key Words: Cationic, Biodegradable, Starch, Flocculant, Polymer

Introduction: Water is the lifeblood of the environment, essential to the survival of all living things - plant, animal and human - and everything must be done to maintain its quality for today and the future.

This project is a humble trial to develop the flocculant for the industrial wastewater and make our environment clean thereby. To gain both the advantage of natural as well as synthetic polymer, a grafted starch based biodegradable polymer is developed.

This work dealt with the synthesis of water-soluble cationic biodegradable starch as a flocculant. The reactive groups of the starch, i.e. hydroxyls, form a complex with cations present in reagent. The complex may dissociate, giving rise to free radical sites onto the polysaccharide backbone. The mechanism of free radical graft copolymerisation of Ethyl monomers onto starch is expected to proceed according to the proposed scheme discussed in the paper. In presence of molecular Nitrogen, H+ may be replaced by Reactive group R, i.e. CH2 CH2 N (Et3) in highly Alkaline medium.

Experimental Section:

Materials : All the chemicals employed in this work are analytical grade and used as received.

Solvents:

1**.** CH2 CH2 N (Et3) (Reagent):ATIRA made

2. Methanol :supplied by Meack Ltd., Mumbai

3. Iso Propyl Alcohol: supplied by S. D. Fine Chem. Ltd., Mumbai

Chemicals:
1.Starch: Anil Starch Products Ltd., Ahmedabad
2.NaOH: supplied by Merck Ltd., Mumbai
3 Na2CO3: supplied by Merck Ltd., Mumbai
4.Acetic Acid: S. D. Fine Chem. Ltd., Mumbai

Equipment: 3-necked RBF: Supplied by Durasil Glassware, Vadodara

Graft polymerization
Co polymerization of starch

1 150gm starch dispersed in 500ml water to make slurry in 3-necked RBF.
2 Placed it in water bath at 40°C. Add (1gm NaOH + 1gm $Na2CO_3$ in 20ml water) solution under stirring through funnel to the stirred slurry for ½ hr. duration.
3 Keep under stirring condition for ½ hr more.
4 Take 12gm Reagent (65%) in 18ml water (total 30ml). Add slowly for ½ hr to the alkylated starch.
5 Raise the bath temperature slowly to 55°C in two hours time.
6 Keep under stirring for 4 more hours and 55°C.
7 Check on the pH in between period.
8 Then cool down & filter and keep it for air-drying.

Changing different parameters, such as-Reaction Time, Reaction Tempearture, % Reagent and % Alkalinity by keeping three of them constant and one parameter changing did experiments.

Sample test of produced polymers was done by
1. % N2 content
2.Application of flocculant

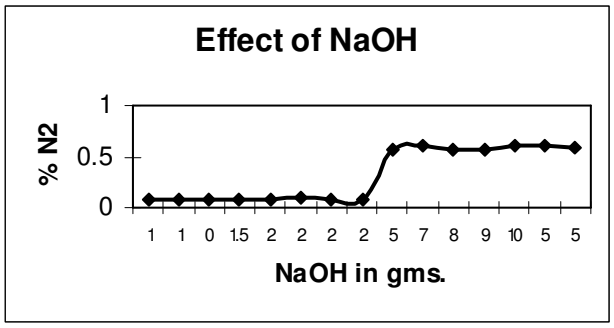
Polymer characterization:

1. % N2 content:
A sample of mixture is dried and weighted. The nitrogen content of the mixture is determined and from this and the known of assumed nitrogen contents of the two components, the proportion of each component is calculated.

2.Application of flocculant
A sample of produced polymer is flocculated with 3 different types of Industrial wastewaters collected from 3 CETPs

Four different types of treatments were given to them, such as Lime - alum, Lime – Ferrous Sulfate, Lime – Ferric Chloride and without any treatment (raw waste water).
And after flocculation it was allowed to settle down for 24 Hrs and then different parameters were tested, like COD, TDS, TSS, Colour and pH for 3 different effluents by giving 4 different types of treatments to each and using 8 different types of flocculants.

Results and discussion



1.The N2 content increase drastically by increasing Alkalinity.
2.The effect of Time, Temperature and Reagent is very negligible compare to Alkalinity and after certain limit there will be no further effect of Alkalinity.
3.Best result is found with 5gms of NaOH.

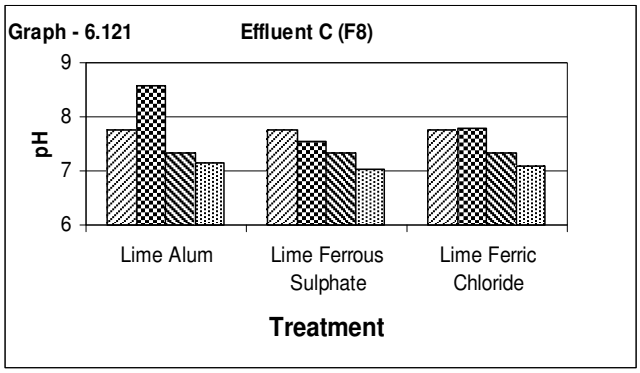
Conclusion:
Developed cationic flocculant is considered to be a medium molecular weight, starch-based flocculant that exhibits a high degree of cationic charge. Once inverted and hydrated in water, react readily to proved floc formation performance in a solids/liquids separation processes. Developed Cationic flocculant is good in a liquid dispersion form.

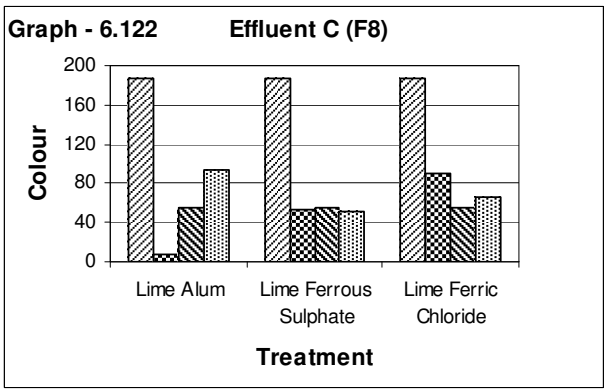
Developed cationic flocculant is a fast acting and effective coagulant used in industrial wastewater treatment. It combines the low sludge production characteristics of organic flocculants with the economy of an inorganic.

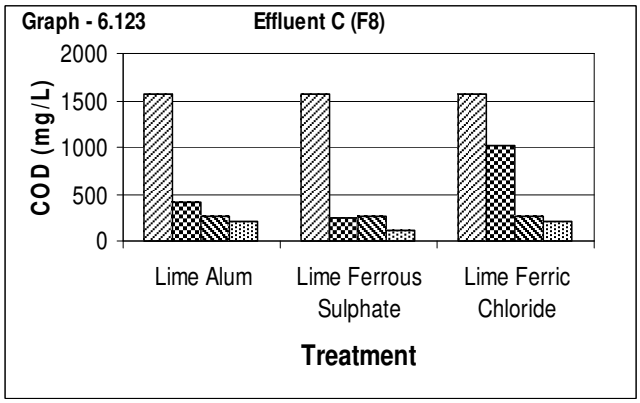
List of Tables:

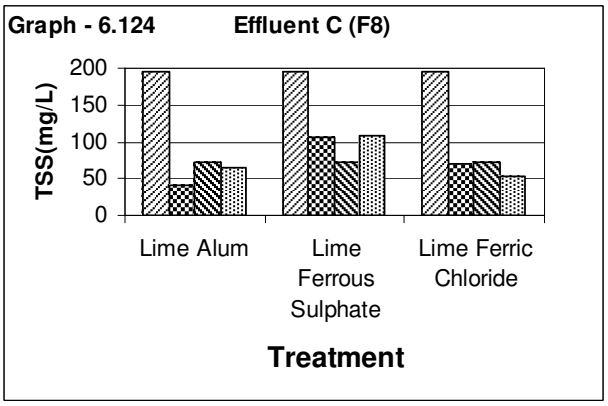
Table I.: Effect of Developed flocculant on parameters of Effluent C

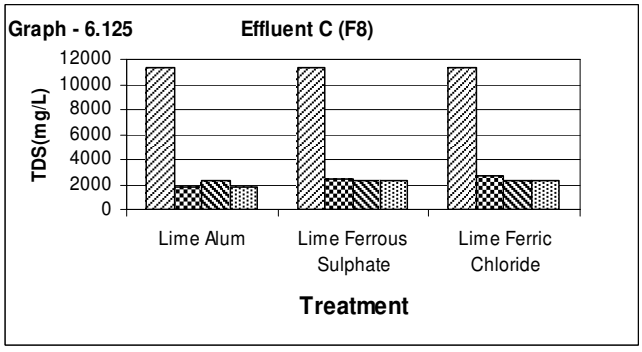
Effluent C								Developed
	W/O Floc	Lime Alum	Lime Ferrous Sulphate	Lime Ferric Chloride	T1F	T2F	T3F	T4F
pH	7.77	8.58	7.56	7.79	7.32	7.15	7.04	7.08
Colour	187.00	7.48	52.94	90.37	54.55	93.05	51.87	66.31
COD(mg/L)	1560.00	411.00	251.00	1016.00	262.82	210.26	120.51	203.53
TSS(mg/L)	196.00	39.80	105.61	70.41	72.45	65.31	109.18	54.08
TDS(mg/L)	11322.00	1757.23	2434.61	2711.71	2371.54	1852.57	2294.75	2386.38











Remark :

pH	Appreciable
Colour	Excellent for Lime – Alum
COD	Excellent
TSS	Outstanding
TDS	Excellent

T_1 – Without Treatment, T2 - Lime - Alum, T3 – Lime - Ferrous Sulphate, T4Lime - Ferric Chloride

F – Developed flocculant

Table II. %N2 content in different batches

Batch No.	%N2
1	0.07
2	0.08
3	0.07
4	0.07
5	0.07
6	0.10
7	0.07
8	0.07
9	0.57
10	0.60
11	0.56
12	0.57
13	0.60
14	0.60
15	0.59

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