ENVIRONMENTAL SOLUTION FOR EFFLUENT OF TILE INDUSTRY

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ABSTRACT

Ceramic Tile manufacturing industry is one of the most popular industry around the globe. Ceramic tile manufacturing has different process like Calibration, polishing, sizing etc. Maximum water is utilized in polishing and sizing of tiles nearly 4.5 lakhs liters per day water is used in ceramic tile polishing. It is found from literature that ceramic wastewater contains high concentration of TSS and turbidity. Few studies reported in the literature gives investigation of coagulation, flocculation and settling properties of ceramic wastewaters. As maximum water is utilized in tile polishing if reused huge amount of water saving can be done. In polishing process water contaminated with TSS and Turbidity thus solid-liquid separation process is most effective for reuse of water. Study is done using different coagulants for solid-liquid separation processes. Importance of this study is to reduce of water consume and reduce a quantity of Chemical for separation processes. The experiment was conducted using jar tests to determine the optimum doses of Alum, $Fecl_3$, Polyelectrolyte and Lime. The results showed that the optimal operating pH was 7-8 achieved by adding Alum, $Fecl_3$, Polyelectrolyte and Lime dosages in the range of 4-48 mg/L, 0.2-1.2 mg/l, 0.1-0.6 mg/l and 10-60 mg/L, respectively. Alum, Fecl3, Polyelectrolyte and Lime dosing resulted in significant removal of turbidity and TSS which could lead to water and cost is saving. This study concluded that coagulation and flocculation may be a useful primary wastewater treatment process for the ceramic industry.

Keyword: - *Ceramic tile wastewater, Coagulants, Coagulation and flocculation, Solid-liquid separation, turbidity, TSS*

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1. INTRODUCTION

Ceramic Tile manufacturing industry is one of the most popular industry around the globe. Ceramic tile manufacturing industry is one of the major industries in Gujarat, India. Ceramic tile manufacturing has different process storage gravels, weighing break, grinding, drying pulp, storage, formation, drying, glazing, design-firing, and selection-packing.[1] In addition, a huge amount of groundwater is used as the fresh water source for ceramic tile industry. However as the groundwater resource becomes more and more limited. Water management has become an increasingly critical issue in ceramic tile industrial sectors, owing to the large quantities of wastewater they produce, most of the wastewater arises in the polishing and sizing operations of the facilities used for the preparation and application of glazes and other coatings. Ceramic industry has to find solution to lower its groundwater consumption. One possibility is, for instance, to use recycled water in glazing operations. [1]

Ceramic tile effluent contains significant concentrations of very fine suspended particles of clay minerals and dyestuffs or glazes resulting in colored wastewater and high concentrations of turbidity and suspended solids. Thus solid-liquid separation process is most effective for reuse of water Thus; chemical coagulants are often added to the industrial effluents to remove the substances producing turbidity before discharge or recycle. Consequently, the efficiency of treatment plant in removing suspended particles and increasing recycle water quality can be improved through the jar test experiment. Therefore the objective of this study is to determine the optimal dosages of Alum, $Fecl_3$, Polyelectrolyte and Lime for clarification that will lead to an increased utilization of water for recycling. The *aim of this experiment is to vary coagulant dosages in a wide range in order to achieve the maximum removal efficiency of contaminants using minimum dosages. [3]*

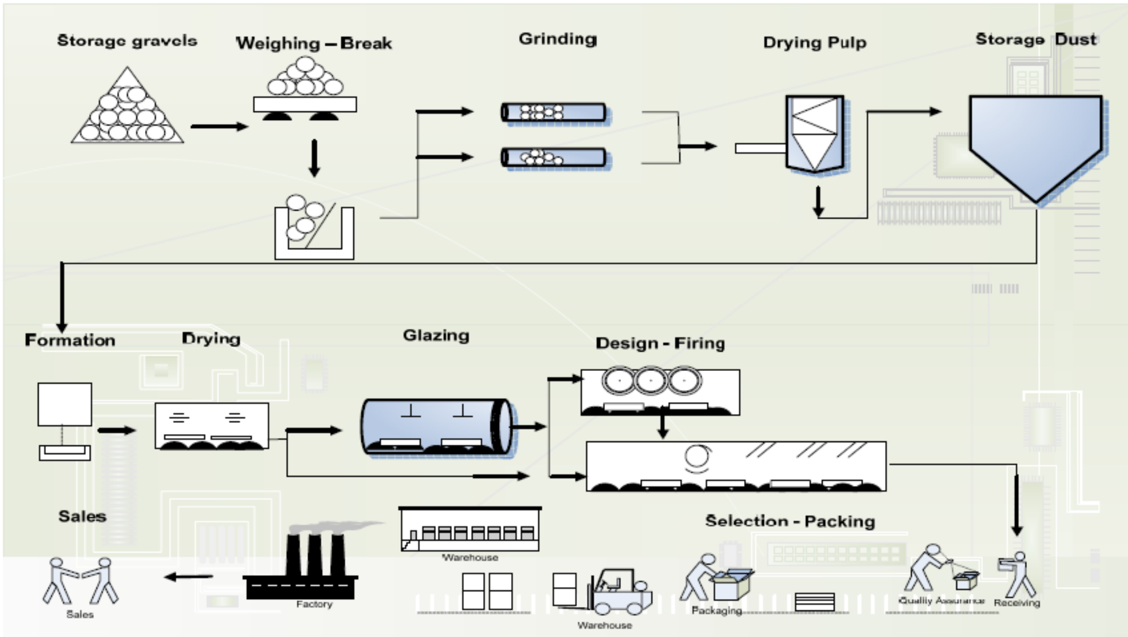

Figure 1: Production process of Ceramics Tiles[1]

2. MATERIAL AND METHODS

2.1 Material

The ceramic wastewater sample was collected from one of ceramic tiles industry at morvi, Gujarat, India and used for laboratory scale tests. In different concentration of Alum, $fecl_3$ and lime used in present study was obtained from laboratory of BVM engineering college and Polyelectrolyte was obtained from Cosa ceramic tile industry, Morvi, Gujarat. Total amount of samples used in the laboratory tests were about 100 liters. The sample had been stored in the refrigerator in order to minimize the changes in the characteristics of wastewater sample since it may vary from day to day.

Before used of Alum, $Fecl_3$, Polyelectrolyte and Lime in experiment process, All coagulants was diluted in distill water. Alum and Lime was diluted in concentration of 1gm in 100ml distill water. $Fecl_3$ was diluted in concentration of 1ml in 100ml distill water. Polyelectrolyte was diluted in concentration of 50mg in 100ml distill water.

2.2 Methods

To optimize the Solid-liquid separation process a series of jar tests were conducted in 1 L flask containing 500ml wastewater (pH in the range of 7.5 to 7.7). Then the coagulants ($FeCl_3$, Alum, Lime, and Polyelectrolyte) were added to the sample in different doses and were stirred first at 200 rpm for two minutes (destabilization phase of colloid particles), followed by stirring at 20 rpm for 20 minutes (flocculation phase). Finally settling was allowed for 30 minutes to form flock by precipitation. Measurements of turbidity content were carried out with turbidity meter.

3. RESULTS AND DISCUSSION

3.1 Wastewater characteristics

The ceramic tile wastewater contained very high concentration of suspended, dissolved solids and turbidity as reported in Table 1.

Table 1: Wastewater characteristics at the treatment plant of Ceramic tile Industrial

SR. NO.	PARAMETERS	RESULTS			RANGE	STANDARD	UNITS
		S-1	S-2	S-3			
91.	pH	7.70	7.58	7.60	7.5-7.7	5.5-9.0	-
2.	Total Dissolved Solids (TDS)	3750	3000	3500	3000-3750	-	Mg/l
3.	Total Suspended Solids (TSS)	3500	3750	4250	3500-4250	100	Mg/l
4.	Turbidity	405	399	402	399-405	-	NTU

3.2 Performance of alum on removal of turbidity at different dose

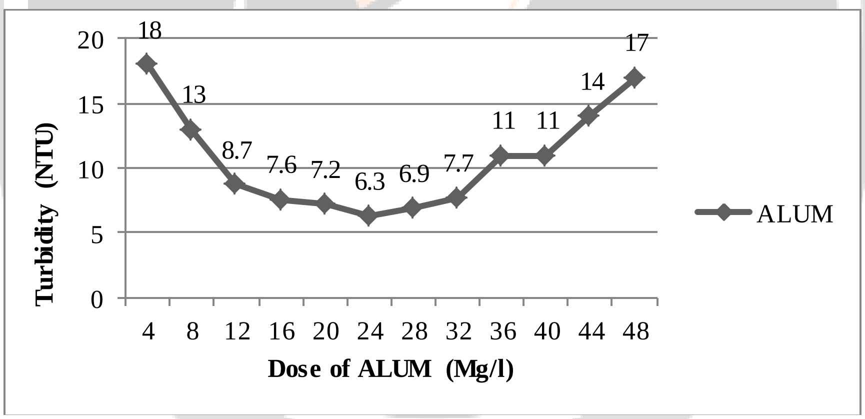

Figure 2: Performance of Alum on removal of turbidity at different dose

Above graph show that alum dose applies from 4 to 48Mg/l. While alum dosing is increase, turbidity is decrease but after dose of 24Mg/l of alum turbidity is increase. We conclude that the optimum dose is 20Mg/l.

3.3 Performance of $Fecl_3$ on removal of turbidity at different dose

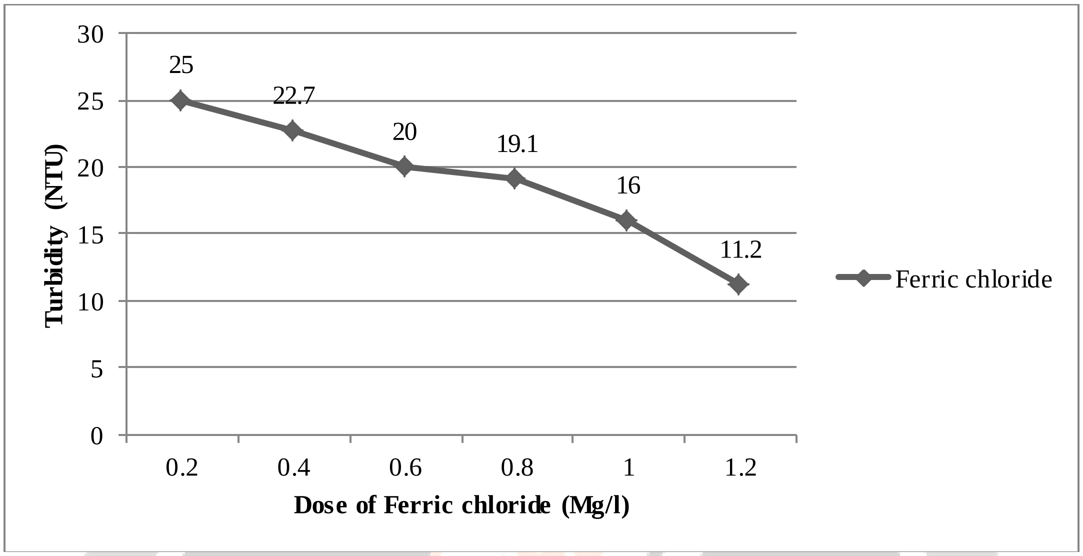

Figure 3: Performance of $Fecl_3$ on removal of turbidity at different dose

Above graph show that $Fecl_3$ dose applies from 0.2 to 1.2Mg/l. While $Fecl_3$ dosing is increase, turbidity is decrease. We conclude that the optimum dose is 1.2Mg/l.

3.4 Performance of Polyelectrolyte on removal of turbidity at different dose

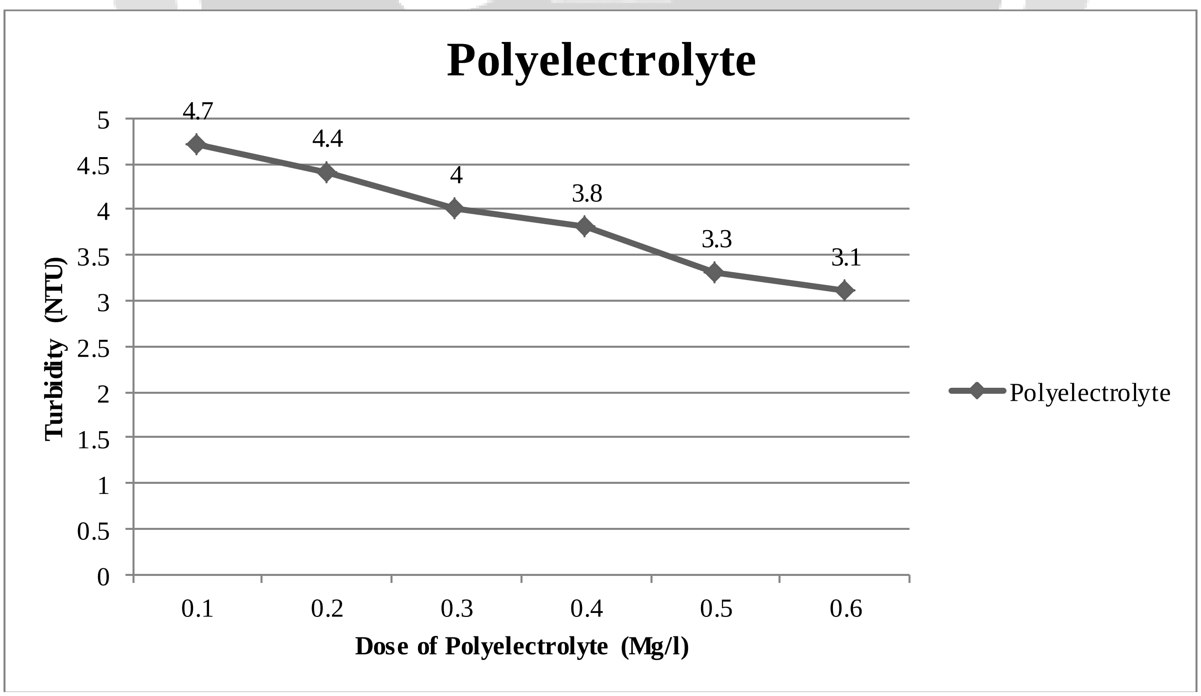

Figure 4: Performance of Polyelectrolyte on removal of turbidity at different dose

Above graph show that Polyelectrolyte dose applies from 0.1 to 0.6Mg/l. While Polyelectrolyte dosing is increase, turbidity is decrease. But efficiency of turbidity removal is 3.1 to 4.7 NTU. We conclude that the optimum dose is 0.1Mg/l.

3.5 Performance of Lime on removal of turbidity at different dose

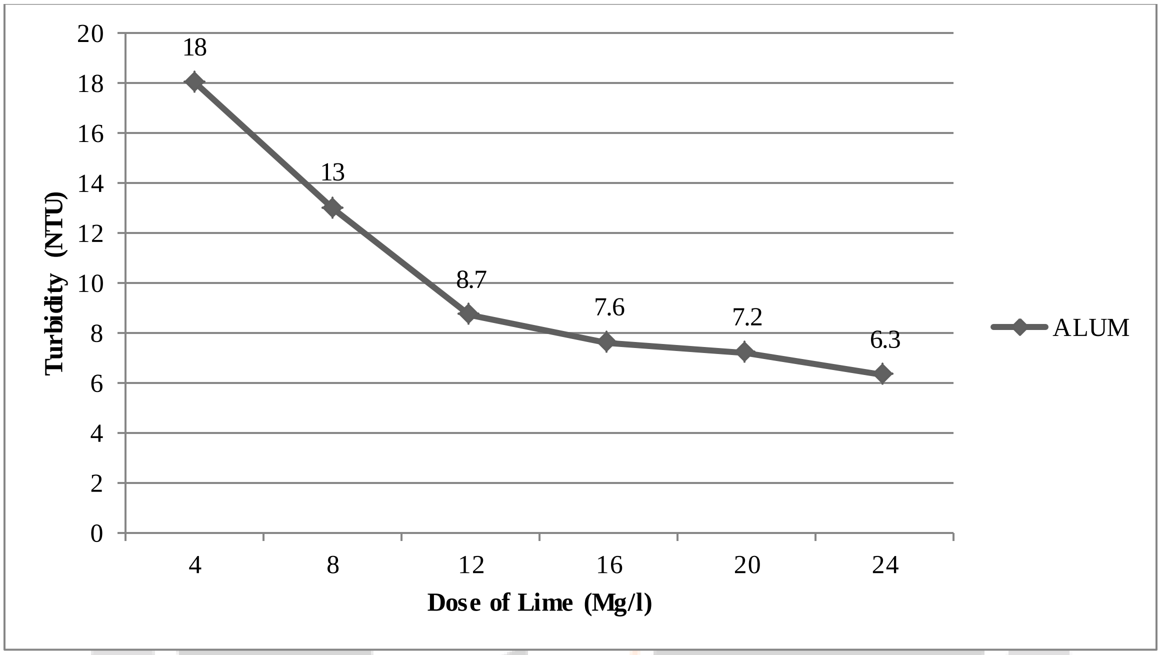

Figure 5: Performance of Lime on removal of turbidity at different dose

Above graph show that lime dose applies from 4 to 24Mg/l. While lime dosing is increase, turbidity is decrease. We conclude that the optimum dose is 12Mg/l. because; we consider optimum dose based on cost of chemicals.

4. CONCLUSIONS

Ceramic tile wastewater contains high volume of suspended matters that resulting from number of materials; clay minerals such as soils, grit, silt, etc. that have an effect on turbidity. Therefore, this study used the turbidity as a standard parameter for jar test experiment. The optimal dosages obtained from this study were applied to the plant for one month resulting in a decrease in chemical usage as well as freshwater requirement due to enhanced water recycling.

This investigation has demonstrated that coagulation with Alum, $Fecl_3$, Polyelectrolyte and Lime is an effective method to clarify ceramic tile wastewater. All the coagulants used were capable to reduce the turbidity from 400NTU to far below the allowable concentration, i.e. < 20NTU. This treatment process results in saving water through reducing water requirement and increasing the recycled water utilization. Coagulation of ceramic tile wastewater may be accomplished with any of the conventional water coagulants including Alum, $Fecl_3$, Polyelectrolyte and Lime.

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