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Removal of chemical oxygen demand (COD) and color from dye manufacturing industry by coagulation

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ABSTRACT

The objective of the study was to removal of chemical oxygen demand (COD) and color from dye manufacturing wastewater by coagulation treatment method. Polyaluminium chloride (PACl) and ferric chloride ($FeCl_3$) were used as a coagulants. $FeCl_3$ and PACl used as coagulation in dye manufacturing wastewater treatment not only should be cost effective for coagulating impurities but should not leave toxic or other unconsiderable residues in the water. Jar test was conducted to determine the optimum dosage of coagulant and optimum pH value in dye wastewater for the removal of COD and color. The PACl coagulant dosage between 100ppm to 1000ppm and for $FeCl_3$ coagulant dosage between 1000ppm to 6000ppm has been studied.

Keywords: dye manufacturing industry , coagulation, color removal, wastewater

INTRODUCTION

Textile industry is the major source of wastewater. Wastewater is the major environmental issue of the textile industry. Their disposal is always a matter of great concern since they are considered as a quite dangerous source of environmental pollution. Major pollutants of textile industries wastewater include high suspended solids(SS) , chemical oxygen demand (COD), biological oxygen demand (BOD), heat, color, acidity, and other soluble substances. There are various treatment techniques to remove dye wastewater pollution such as mechanical , chemical , biological methods physicochemical .biological treatment method are generally efficient for biological oxygen demand(BOD) and suspended solid(SS) removal , but not effective for removal of color from dye wastewater because dyes have slow biodegradation rate.

Physicochemical treatment method included coagulation, flocculation, precipitation electro dialysis, floatation, ultra filtration adsorption and others. Coagulation method is mostly applied in textile industries. Coagulation treatment method is effective in removing COD and color.

A dye is used to impart color to materials of which it becomes an integral part. Dye wastewaters can contain toxic organic residues with the major compounds of phenol derivatives, aniline derivatives, organic acid and benzene derivatives. There are numerous types of dyes, which can be classified as acetate rayon dyes, acid dyes, azoic dyes, basic dyes, direct dyes, mordant or chrome dyes, lake or pigment dyes, sulfur or sulfide dyes and vat dyes. Mostly, correlation of chemical structure with color has been accomplished in the synthesis of dye using a chromogen–chromophore with auxochrome. Dyes are complex compounds with a big complicated molecular structure and toxic properties. Thus, it can affect aquatics life, human health and ecological system when dye wastewaters are extremely discharged wastewater into water sources. It eventually makes changes of ecological system and other serious pollution problems.

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The main problem of textile industries wastewater is the color removal which is produce by the dye manufacturing industries. Color removal of textile effluent is essential because of its toxicity and visibility. The color removal varies depending upon the type of dyes wastewater. Coagulants used in this work has been PACl and $FeCl_3$

EXPERIMENTAL PROCEDURE:

A six beaker jar test apparatus was used to determine the optimum dosage of PACl and $FeCl_3$. Also it was used to determine optimum pH value. The coagulant used in this study were Polyaluminium chloride (PACl) and ferric chloride ($FeCl_3$) The procedure for a jar test involve using a 1000ml of each beaker, adding 800ml of wastewater sample to be coagulated to each of the jar test beaker . A coagulant stock solution was prepared using selecting coagulant stand was dosage in each beaker with increasing amount of solution . after dosing of each beaker the sample were stirred for 2 minute . the wastewater with coagulant was left undisturbed for 60 minutes. Allowing the flock formed to settle down .the optimum dosage of coagulant and pH value were determined using this jar test apparatus.

This procedure are performed for several times ,so that thee optimum pH value and Dosage of coagulants can be calculated.

RESULT AND DISCUSSION :

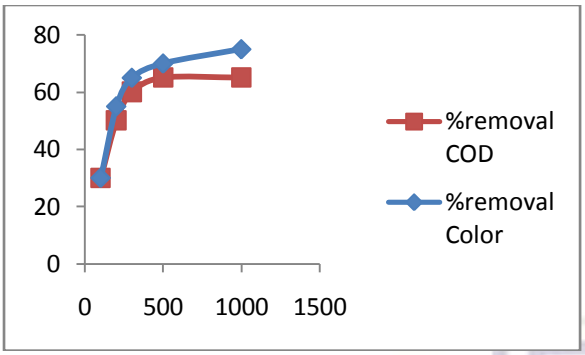

Fig 1- Percent removal of COD and color Vs PAC l Dosage (ppm)

Fig 1 shows that, the percent removal of color , COD for different dosage of PACl as a coagulant.

The result of Jar test in this experiment are presented in fig 1.The optimum dosage of PACl is found to be 1000ppm.at the optimum dosage , about 65% of COD removal and 75 % of color reduction was achieved.

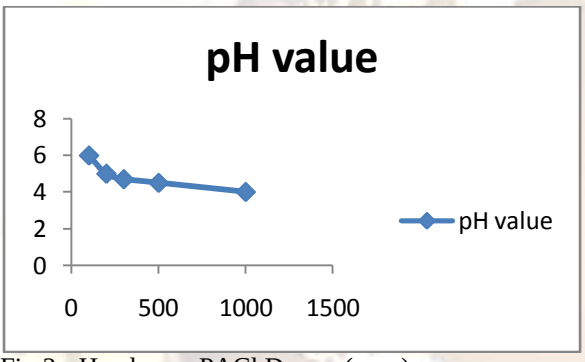

Fig 2-pH value vs PACl Dosage(ppm)

Fig 2 shows that, the pH value for different dosage of PACl as a coagulant.

The result of Jar test in this experiment are presented in fig 2.The optimum dosage of PACl is found to be 1000ppm . Reduction in pH value was observed with increasing dosage of PACl dosage. The pH value was found to be 4.

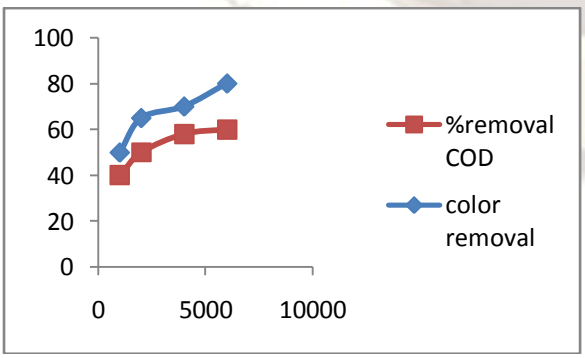

Fig 3-Percent removal vs Dosage of $FeCl_3$ as a coagulant (ppm)

Fig 3 shows that ,the percent removal of color , COD for different dosage of $FeCl_3$ as a coagulant.

The result of Jar test in this experiment are presented in fig 3.The optimum dosage of $FeCl_3$ is found to be 6000ppm.at the optimum dosage , about 58% of COD removal and 80 % of color reduction was achieved.

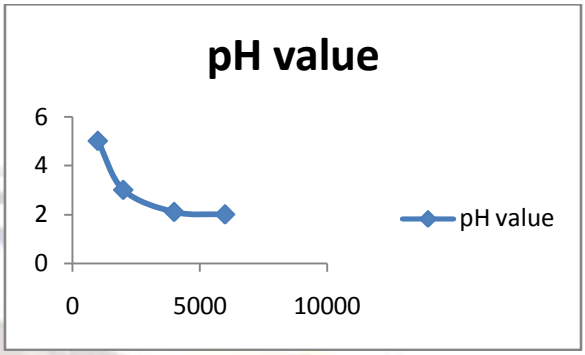

Fig 4 pH value vs Dosage of $FeCl_3$ as a coagulant(ppm)

Fig 2 shows that , the pH value for different dosage of PACl as a coagulant.

The result of Jar test in this experiment are presented in fig 4.The optimum dosage $FeCl_3$ was found to be 6000ppm . Reduction in pH value was observed with increasing dosage of $FeCl_3$. The pH value was found to be 2.

CONCLUSION:

In this study coagulation treatment method used to removal of COD and color removal from dye wastewater. The optimum dosage of coagulant are determine for removal of color and COD. It is also seen that pH is reduce by adding dosage of coagulant in dye wastewater

The percent color removal 75% using PACl of concentration 1000ppm at a pH of 4. $FeCl_3$ of concentration 6000ppm can be achieved up to 80% color removal at a pH of 2.

The percent COD removal 65% using PACl of concentration 1000ppm at a pH of 4. $FeCl_3$ of concentration 6000ppm can be achieved up to 58% COD removal at a pH of 2.

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