Treatment Of Rice Mill Wastewater By Coagulation

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Abstract— *The treatment of the effluent from rice mill unit is necessary to render the effluent suitable for discharge into inland surface waters. In this present study, work was undertaken to treat the rice mill effluent in Sattur which is located nearby Virudhunagar. The coagulation process was carried out to treat the effluent, here the natural (chitosan) and chemical (alum) coagulants are used in different ratios. The optimum dosage of coagulants like Alum, chitosan, and blended Coagulant Alum and chitosan were found out. Here the optimum coagulant dosage of blended coagulant Alum & chitosan shows better result than optimum dosage of alum and chitosan individually. A conventional jar test apparatus is employed for the tests. Thus the coagulation process removes TSS, COD & Color to the acceptable level which gives a satisfactory result.*

Keywords— ***Effluent; Coagulation; alum; chitosan; blended coagulant.***

I. INTRODUCTION

The rice mill effluents carry high load of suspended and dissolved organic matters causing serious environmental pollution. The process of manufacturing the parboiled variety of rice involves hot water treatment of paddy in a series of cylindrical steel containers followed by steaming. After a baking period of 5-6 hours the waste water is discharged from the containers and is let off in the open in the surrounding areas around the mill. This discharged water which carries a high load of suspended and dissolved organic matter is the prime source of environmental pollution. The discharge of this effluent is about 4000-5000 lit per 100 bags of paddy processed in the plant. The prime environmental hazard of the rice mill effluents is their foul smell which develops in the discharged effluents with the passage of time. The effluents when let off in untreated form are great nuisance in the populated localities.

Waste water coming from rice mill operations contains high concentration of organic and inorganic substances causing significant polluting phenomena. In order to sustain our global water supply, many environmental operation programs have been established to address pollution issues. Numerous environmental directives, regulations and legislation have been issued in order to define quality standards for water. The high chemical oxygen demand, suspended solids, conductivity, salinity, and total dissolved solids still pose an economical problem for the industries since these have been employed as major parameters. Parboiled rice production generally requires huge amount of water for soaking of the paddy. Hence water pollution may arise if not properly treated. Water pollution can cause by high levels of organic material present in waste water. To remove/reduce the concentration of organic or non-organic compound because some of the constituent compound found in industrial waste water is toxic to microorganism, Pre-treatment may be required before the industrial wastewater can be discharged to a municipal collection system.

The use of industrial waste water in agriculture has received considerable attention in recent years. Effluent treatment plant utilizes different technologies and processes for treatment of the waste. They can be streamlined for physio-chemical treatment and biological treatment followed by tertiary treatment but the economy of such treatment requires due attention. Integrated functions with user friendly control makes the operation
much easier.

Our engineers can also custom design effluent treatment plants based on the specific requirements of the clients. Industrial wastewaters from certain industries don't meet the standards for discharge, and certainly not for reuse as process water. First of all, the toxic components have to be removed from the wastewater flow. Physicochemical wastewater treatment is a frequently used technique in the area of wastewater treatment. Physicochemical wastewater treatment techniques are applied for the removal of heavy metals, oils and greases, suspended matter and emulating organic substances, organic and inorganic components, difficult to decompose, non polar organic substances, toxic pollutants or high salt concentrations, phosphorus.

II. PHYSIO-CHEMICAL CHARACTERISTICS OF THE EFFLUENT

The sample collected was characterised initially on parameters such as Chemical Oxygen Demand

(COD), Total suspended Solids (TSS), Total Solids (TS) , Total Dissolved solids (TDS). Table 1 shows the initial characteristics of rice mill effluent.

TABLE 1 INITIAL CHARACTERISTICS

Parameters	*Influent characteristics*
Color	Turbid (yellowish brown)
pH	4.4
COD	520 mg/l
TSS	3775 mg/l
TS	7920 mg/l
TDS	3083 mg/l

III. TREATMENT PROCESS

A. COAGULATION PROCESS:

The coagulation process was done using alum, chitosan and blended alum and chitosan as the coagulant in varying dosages. For Alum dosage are selected 50, 100, 150, 200, and 250 in mg/L, for chitosan dosage are selected 100, 200, 400, 600, and 800 in mg/L and for blended alum and chitosan (1:2 ratio) dosage are selected 100, 200, 300, 400, and 500 in mg/l. Table 2 shows the treated efficiency of optimum dosage of alum, chitosan and blended alum and chitosan.

Table II Jar test result

Coagulant	Jar test values					
alum	Dosage (mg/l)	50	100	**150**	200	250
	Turbidity (NTU)	130	123	**112**	138	146
Chitosan	Dosage (mg/l)	100	200	**400**	600	800
	Turbidity (NTU)	146	132	**121**	135	143
Alum + Chitosan	Dosage (mg/l)	100	200	300	**400**	500
	Turbidity (NTU)	110	95	82	**78**	97

From the above table we obtained the optimum value as 150 mg/l, 400mg/l anf 400 mg/l for alum, chitosan and blended alum and chitosan respectively.

The fig.1,2,and 3 shows the optimum value obtained for each coagulant alum, chitosan and blended alum and coagulant respectively.

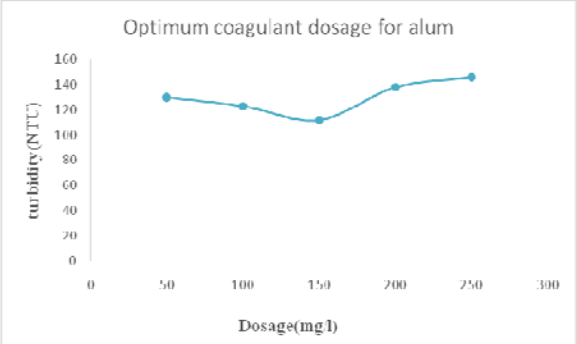

Fig.1 Optimum coagulant dosage for alum

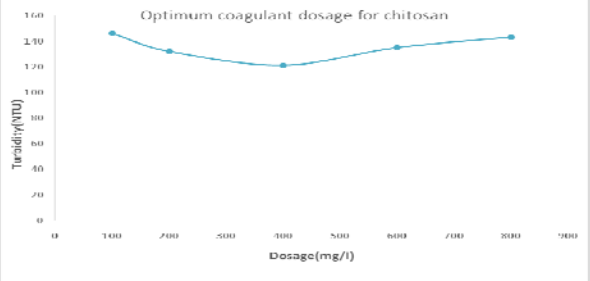

Fig 2.Optimum coagulant dosage for chitosan

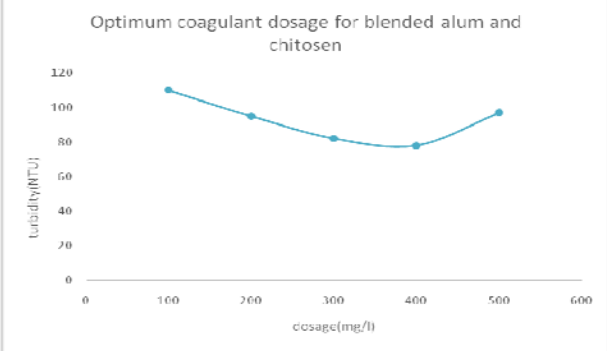

Fig 3 Optimum coagulant dosage for blended alum And Chitosan

IV RESULTS AND DISCUSSION

The characteristics of parameters are observed after the coagulation process for each coagulant.Table 3. shows the results of parameters obtained after coagulation process.

Table 3. Characteristics Of Parameter After Coagulation Process

Parameters	*Effluent characteristics after treatment*		
	Alum	*Chitosan*	*Blended Alum + Chitosan*
pH	6.3	6.2	7.1
COD	196	243	126
TSS	1024	1800	280
TS	2567	3456	2163
TDS	1964	2321	1800

The table 4. Shows the removal efficiency percentage of parameters form the effluent.

Table 4. Removal Efficiency of parameters in the effluent

Parameters	*Removal efficiency of parameters(%)*		
	Alum	*Chitosan*	*Blended Alum + Chitosan*
COD	62.30	53.30	75.8
TSS	72.9	52.3	92.6
TS	67.6	56.4	72.7
TDS	34.8	24.7	41.6

It is observed that the influent of COD is 520 mg/l. After the coagulant process, the concentration is decreased into maximum of 126mg/l . Similarly for other parameters such as TSS, TS & TDS the concentration is considerably decreased and the removal efficiency of COD, TSS, TS &TDS are tabulated above.

IV. Conclusion

Characterization of parameters such as COD, Total suspended solids, Total Dissolved solids and Total solids present in the rice mill effluent exceeded the effluent discharge standards. Hence in this phase, work has been done to remove the Total Suspended solids and COD. For the removal of Total suspended solids we have used Alum, Chitosan and blended alum and Chitossan as coagulant agents. Among all the coagulants used the removal efficiency of COD, TSS, TDS and color was higher for blended Alum and chitosan coagulant as compared to alum and chitosan coagulant. The optimum dosage of 400mg/l of blended alum and chitosan shows the removal efficiency of >75 % for COD and > 90% for TSS respectively. Form this study the blended alum and chitosan coagulant (Natural and Chemical) giver better result.

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