Current World Environment Vol. **8**(3), 403-408 (2013)

Efficiency of Chemical Treatments on Reduction of COD and Turbidity of Deinked Pulp Waste Water

SHADEMAN POURMOUSA[1] and SOMAYEH SOLTANI PARAFTABI[2]

[1]Department of Wood and Paper Science and Technology, Faculty of Agriculture and Natural Resources, Karaj Branch, Islamic Azad University. Karaj, Iran.
[2]Department of Environment Science, Science and Reseaech Branch, Islamic Azad University, Sistan and Baluchistan, Zahedan, Iran.

http://dx.doi.org/10.12944/CWE.8.3.09

(Received: August 07, 2013; Accepted: November 05, 2013)

ABSTRACT

The effect of poly aluminum chloride with cationic or anionic polymers in treatment of deinked waste water has been studied. The experiments were carried out in jar tests with poly aluminum chloride dosages range of 5-20 mg/l, cationic or anionic polymers dosages range of 1-3 mg/l, pH range of 7.2-8.2, rapid mixing at 100rpm for 2minute, followed by slow mixing at 40 rpm for 10minute and settling for 20minute. The effectiveness of poly aluminum chloride with cationic or anionic polymers were measured based on reduction of turbidity and chemical oxygen demand. The combination of poly aluminum chloride with cationic or anionic polymers is found to give the increase efficiency of purification in the treatment of the deinked waste waters.it can achieve almost66.82 % of turbidity and 63.04 %ofchemical oxygen demand reduction at an optimum dosage of 15mg/l poly aluminum chloride with 3mg/l cationic polymers andpH of 8.2.Theresult suggests that the waste water purified can be used for internal process applications but for injection it to environments goals can be passed biological treatments.

Key words: Deinked waste water, Chemical treatments,Turbidity, Chemical Oxygen Demand, Efficiency.

INTRODUCTION

The pulp and paper industry is one of the oldest industrial sectors in the world. It is a highly capital, energy and water intensive industry with highly polluting process and requires sustainable investments in pollution control methods and equipment.

In the pulp and paper industry, a huge amount of water flowsthrough different processes. For environmental and economic reasons, the plant recycles the water as much as possible. Before recycling the water is purified to a certain degree. The chemical treatment is one of purification methods.The dosing control of chemicals is very demanding because the quality of water may fluctuate considerably and the effects of chemicals on the purification stage[1].

The pulp and paper waste water contains a large amount of pollutants characterized by Biochemical Oxygen Demand (BOD),Chemical Oxygen Demand (COD), suspended solids (SS), toxicity and colorants which cause bacterial and algal slime growth, thermal impacts, scum formation, color problems and a loss of both biodiversity and aesthetic beauty in the environment[2].

Several researches have been studied on biological, chemical and physicochemical treatment of pulp and paper mills waste water 3, 4.based on Thompson et al, the pulp and paper mills waste water have low BOD/COD ratio usually between0.02-0.07. Morais et al believed that the low ratio of BOD/COD makes the biological treatment methods inappropriate for pulp and paper mills waste water[5].

Waste water treatment of pulp and paper mills consumed the large amount of chemicals using alum, ferric chloride, ferric sulphate and lime through chemical processes6. So it seems that physic- chemical processes should be interesting method for treatment of the pulp and paper mills waste water because of they are economic and based on the coagulation - flocculation process of small particles followed by an adjusted settling time[7].

Deinked pulp waste wateris one of the pulp and paper conventional effluents that have especially distinctions. The recycling rate of waste papers has steadily increased decades as parts of the effort to preserve forest resources and reduce the cost of municipal waste treatment. In this work, the effect of chemicals (poly aluminum chloride with cationic or anionic polymers) investigated on deinked pulp and paper mill waste water in order to reduction of COD and turbidity and the measurement of maximum efficiency purification.

MATERIALS AND METHODS

The waste water was collected from the waste water treatment plant of tissue producing mill of white mixed waste papersat Iran. The samples were taken at overflow of physical treatment stage of plant facility. Waste water samples were characterized and the analyses in Table 1. The parameters were measured based on Standard Methods for the Examination of water and waste water (APHA 1998)[8].

All chemicals used analytically pure chemicals is commercial grade products. Anionic flocculants provided with the commercial cod of GFLOC A190 from Aquatech Company. Cationic flocculants obtained with the commercial cod of NUFLOC F10 from GIG Company. Poly aluminum chloride(PAC) provided from Iranian chemistry Company. Deion water was used to make all solutions.The chemicals were diluted to a concentration of 0.1 Percentages. Then the diluted solution was added to waste water samples.Table 2 shows the important properties of the chemicals that used in research.

Coagulation and flocculation tests were conducted using a conventional jar test apparatus. In each run, one liter samples were poured into six jars. Different dosages of chemicals(at first polyaluminum chloride and then cationic or anionic polymers) were then added and the coagulation began with rapid mixing of 100 RPM for 2 min, followed by slow stirring of 40 RPM for 10 min. the flocks formed were then allowed to settlefor 20 min. The end of sedimentation was set at a time when no appreciable flock settlement was observed. Finally, supernatant was withdrawn with a plastic syringe from near 2 cm below the liquid- air interface for chemical analysis. All the experiments were

Table1: Waste water samples were characterized and the analysed

Distinction	pH	COD	Turbidity	TSS	TDS	Conductivity
Unit		mg/l	FTU	mg/l	mg/l	ms/cm
Equalization tank	7.02	>5000	>1000	4500	4100	3.40
Overflow of physical Treatment	7.07	3562.33	117.23	1546	2670	3.07

Table 2: The important properties of the chemicals used in research

Chemicals	Commercial name	Company	pH 1mgr/l	Cond µs/cm	TDS mg/l	Abbreviation at research
Poly aluminum chloride	PAC	Iranian chemistry.CO	4	75.5	3710	Pac
Cationic polymer	NUFLOC F10	GIG	5.7	121.5	60.8	cat
Anionic polymer	GFLOC A190	Aquatech	8	222	153.4	ani

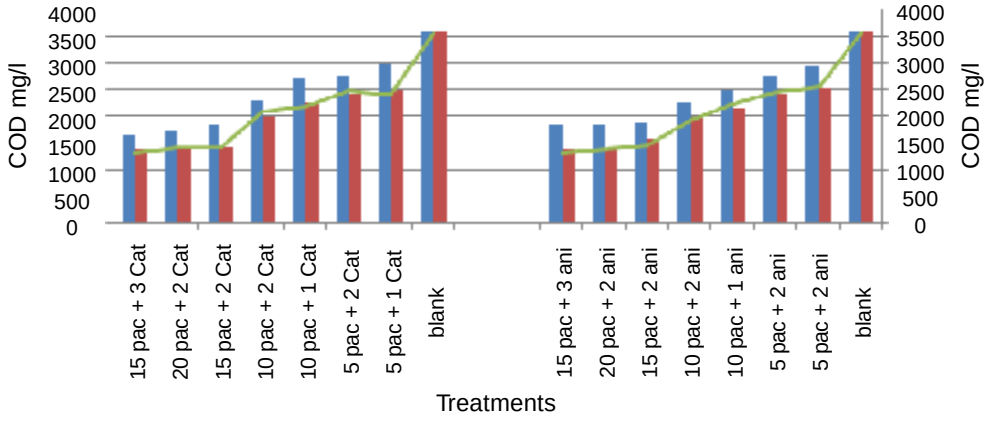

Fig. 1: Effect of chemical treatment on COD reduction at different pH

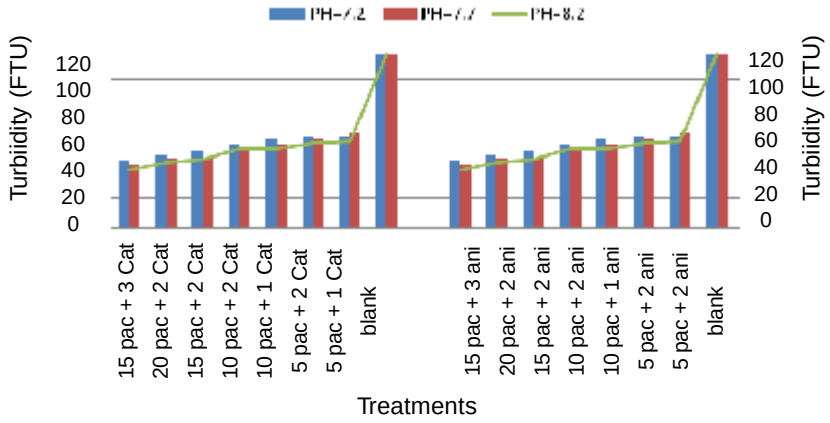

Fig. 2: Effect of chemical treatment on Turbidity improvement at different pH

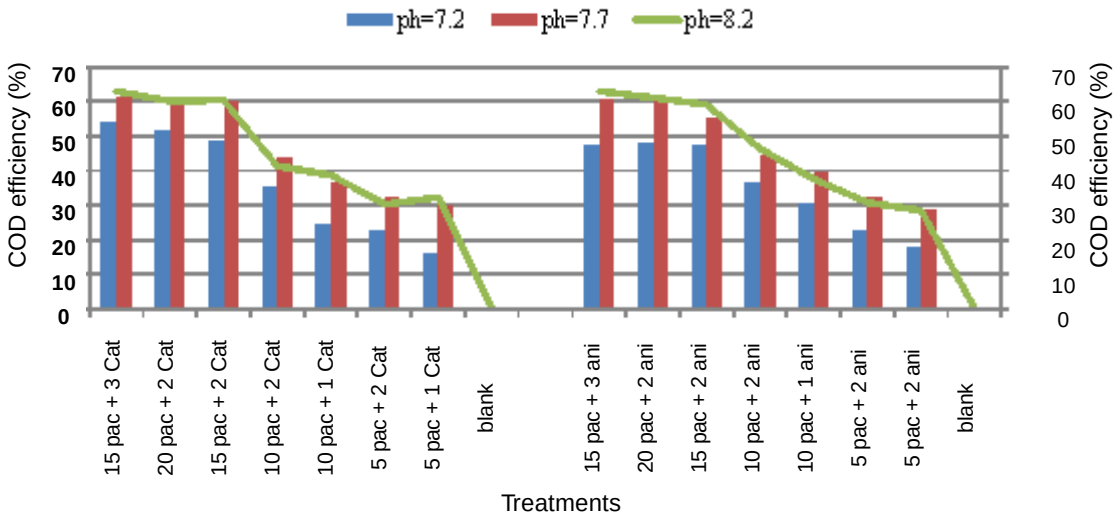

Fig. 3: Comparison of COD Efficiency at the different pH

carried out at ambient temperature of 23 -25 0c.Decrease or increase of pH from control position to designed plan by adding of H_2SO_4 and NaOH was done.

Turbidity was measured by a turbid meter manufactured by Eutech (Model 2100A). Turbidity was measured by putting 10 mL of sample into turbidity cell and places it in turbidity meter to measure turbidity.Chemical Oxygen Demand was determined by the potassium dichromate method.

Waste water samples were treated by different dosages of poly Aluminum Chloride and Cationic or Anionic polymers at three replications. The average ofdataobtained with SPSS software [16].efficency of each treatment calculated via differences of inlet and outlet to inlet of each treatment.

RESULTS AND DISCUSSION

Waste water distinctions at equalization tank and Overflow of physical Treatment summarized in Table 1. Table 2 shows the important properties of the chemicals that used in the research.Comparison of results were made for treatments based on turbidity and chemical oxygen

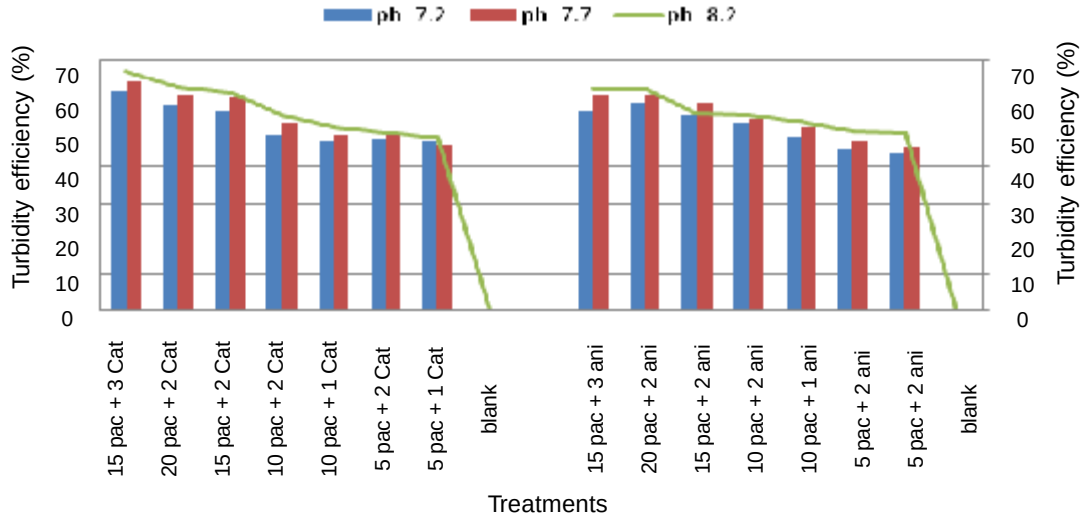

Fig. 4: Comparison of Turbidity Efficiency at the different pH

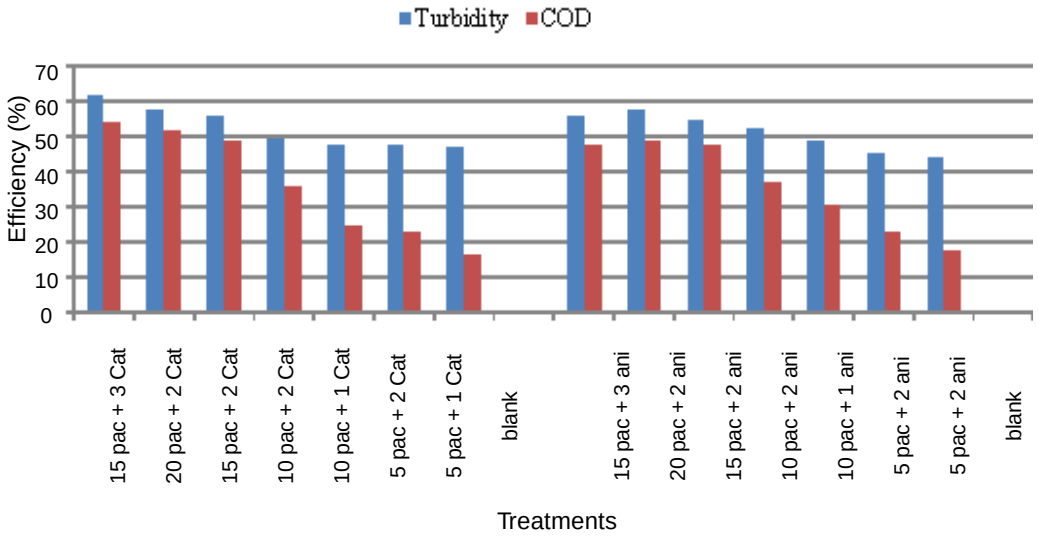

Fig. 5: Comparison of COD and Turbidity Efficiency at the pH=7.2

demand at variation of pH conditions are shown in Fig of 1 to 7.

In order to design the best treatment for removal of COD and turbidity improvement, the research continued at three range of pH.The impact of different dosages of poly aluminum chloride with cationic or anionic polymers at three range of waste water pH, on chemical oxygen demand reduction, turbidity improvement and performance efficiency are shown at Fig 1 to 7.

Based on figures, the impact of chemicals was utilized on quality of waste water clarification. the best results for COD reduction, take place at injection of 15 mg/l poly aluminum chloride with 3 mg/l cationic or anionic polymerstowaste water at PH: 8.2.at this position the performance efficiency of each treatment for COD reduction from 3562.33mg/l at blank samplesreached to1316.67-1317.83mg/l where is equal to 63.02-62.01%performance efficiency of COD removal respectively (Fig 1& 3).COD removal at pH: 7.2 take place with low efficiency at treatments. But the performance of COD removal increased at pH: 7.7and 8.2. Atthis range of pH,have not differences significantlyexcept at first treatments.

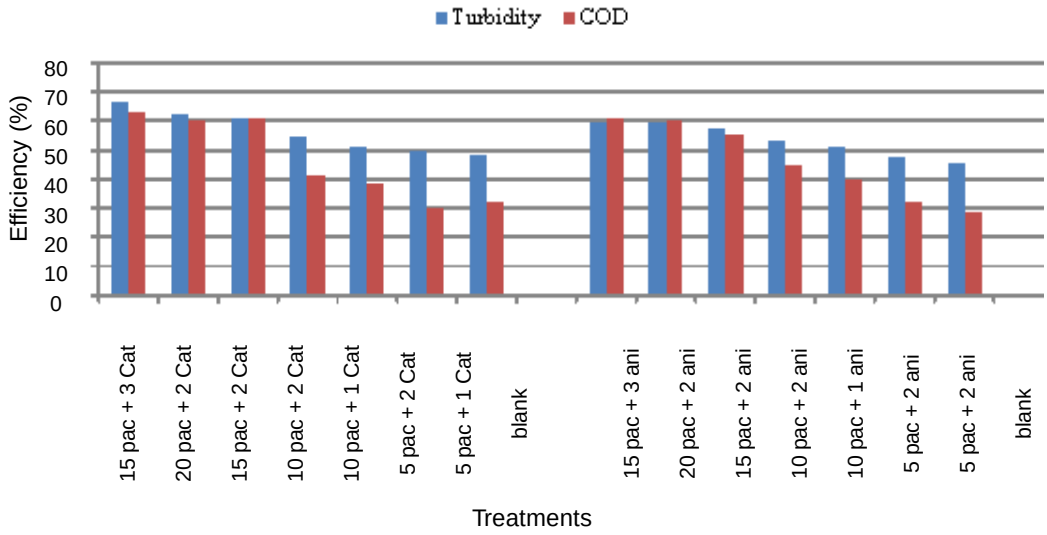

Fig. 6: Comparison of COD and Turbidity Efficiency at the pH=7.7

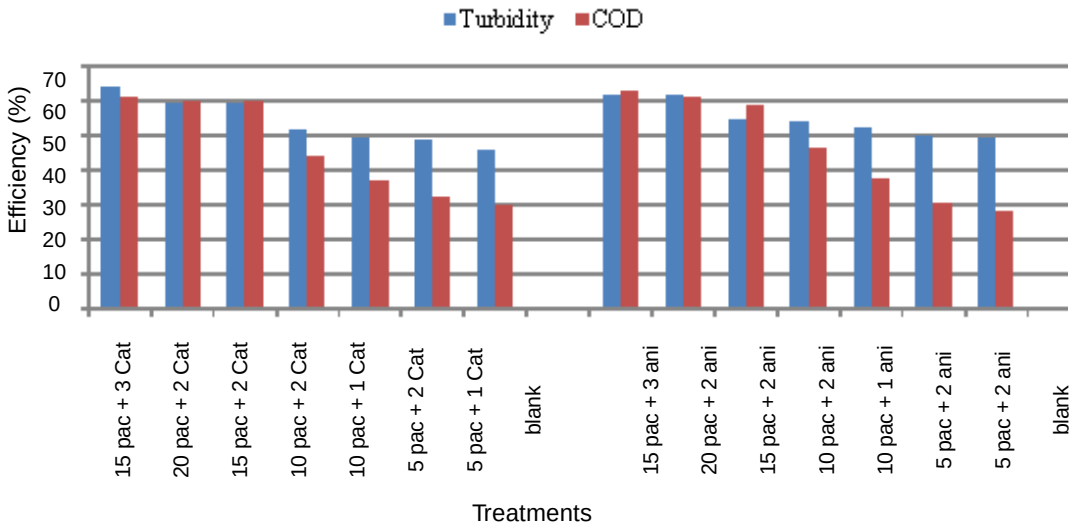

Fig. 7: Comparison of COD and Turbidity Efficiency at the pH=8.2

According to the figures, the best treatments for turbidity improvement take place attreatment of 15 mg/l poly aluminum chloride with 3 mg/l cationic polymers to waste water at pH: 8.2.at this position the performance efficiency of the treatment for turbidity improvement reached from 117.23FTU reached to 38.9 FTU that is equal 66.82%turbidity improvement efficiency (figures 2 & 4).Turbidity improvement at pH: 8.2 take place with high efficiency at treatments compared to other pH.

The trend of variations at the treatments showed, the behavior of polymers is very sophisticated at different levels of poly aluminum chloride injection. So cannot tell which kind of polymers is better than other.it seemed the application of each polymers depended to anionic and cationic traces at deinked pulp waste water effluent. The efficiency of performance at high levels of chemical consumption and upper pH goes better than low levels. The turbidity improvement efficiency was better than COD Reduction performance at all conditions (Fig 5-7).

CONCLUSION

Reduction of COD and turbidity has been studied using different dosages of poly aluminum chloride with cationic or anionic polymers at three range of pH. The results showed that the combination of poly aluminum chloride and polymers is more effective at coagulation and flocculation process.it can achieve 63.04 % of COD and 66.82% of turbidity reduction at the optimum dosages of 15 mg/l of polyaluminum chloride with 3 mg/l cationic polymers. The waste water at this purification quality level can be used for internal process goals but without biological treatments it can't be inject to environment and outdoors applications.

REFERENCES

1. Esko , k.juuso.,Dynamic simulation of water treatment in pulp and paper industry, control engineering laboratory, depts. Of process engineering, 90014, University of Oulu, Finland (2009).
2. Pokhrel ,D. and Viraraghavan.T., *Total Environment*., **333**:37-58 (2004).
3. Rintala, J., Martin,J.L.S., and Lettinga,G.,*Water Sci: Technol.*, **24**:149-160 (1991).
4. Rintala, J., and Puhakka,J.A.P.,A review.*Bioresour.Thechnol*., **47**: 148 (1994).
5. Thompson,G., J.Swain,M.Kay and Forster.C.F., *Bioresour.Technol.*,**77**: 275-286 (2001).
6. Stephenson,R.J., and Duff,S.J.B., *Water Res*. **30**: 781-792 (1996).
7. Kadhum M. shabeeb, Haydar A. Abdulbari, Ali A. Abbas., *Al-Qadisiya J.for Eng. Sci,* **4**, NO:4 (2011).
8. APHA, Standard Methods for the Examination of Water and Waste Water 20 th Edn.,American Public Health Association,Washengton, DC (1998).