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The Evaluation of Chemical Coagulation for Treatment of Kashan Textile Sewage

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Abstract: The purpose of this investigation was to study the effects of chemical coagulation to remove the pollutants from Kashan Textile Sewage (KTS). The Lime, ferricchloride and alum were tested by jar test analysis. The removal of COD and colour is intended as indicators parameter. The results shown that lime with 1500 mg L^{-1} dosage is more efficient for treatment of KTS. Thus, Lime is optimum coagulant for this sewage.

Key words: Textile sewage, chemical coagulation, human health, industrial sewage, removal, jar test, treatment

INTRODUCTION

Kashan has many textile factories that generate a lot of industrial sewage which discharge into environment without any treatment. In several past decades, of this sewage used for irrigation of agricultural corps such as creals, trees and vegetable. It might be said generally that is will contain various Pollutants including synthetic organic chemicals, dyes, suspended solid, detergent and heavy metals such as cadmium, lead, cobalt, crumium and arsenic[1,2]. Application of raw industrial sewage for agriculture irrigation has adverse effects to human health and environment elements such as water, soil and agriculture products[3,4].

There is increasing environmental interest in the presence of synthetic chemicals and heavy metal in industrial sewage. Consequently wastewater treatment plants are regarded as logical points for controlling the transport of pollutants to the environment[5,6]. The objective of sewage treatment include the removal or destruction of pollutants from the waste stream prior to its discharge to environment or reuse for agriculture[7,8].

Kashan Located in the arid area and is facing with a shortage in water availability, thus reuse of treated sewage is a necessary.

Previous studies shows that the Kashan Textile Sewage (KTS) has a BOD to COD ratio less than 0.5 which is due to presence of non-biodegradable organic material. Consequently this sewage is not biologically treatable and for pollutants removal require chemical treatment[1,5]. The objectives of this research were to determine the efficiency of chemical coagulation to remove pollutants in this sewage.

MATERIALS AND METHODS

The study was carried out during the September to November 2003 based on chemical coagulation. Experimental methods consist of jar test analysis by application of lime (CaO), ferric chloride ($FeCl_3$) and alum (Al_2 (SO_4). 18 H_2O) as coagulants materials.

The raw sewage samples were 24 h composite sample that were taken biweekly from waste stream in a channel Known as " black water channel. A total of six sample sets were analyzed for each coagulants. During Jar test experiments, Chemical Oxygen Demand (COD), True colour and pH were tested upon raw sewage and treated effluent (After addition of each coagulants) in accordance with procedure described in the standard methods[9].

The sequence of operations applied to a Jar test is as follow:

- Addition of coagulates to raw sewage and rapid Mixing for 1 min at 90-100 rpm.
- Gentle mixing for 20 to 30 min at 25-30 rpm.
- Floc sedimentation without mixing for 2 to 3 h.
- Sampling from supernatant and analysis for COD, Colour and pH determination.
- Finally, efficiency were calculated by below equation[10]:

$$E\% = \frac{C_o - C_e}{C_o} \times 100$$

Where:
C_o = Concentration of pollutants in raw sewage
C_e = Concentration of pollutants in treated effluent

RESULTS

As shown in Table 1 the mean concentration of COD and color were 823 mg L^{-1} and 115 True Color Unit (TCU), respectively. In addition, values of pH in raw sewage was between 7 to 8 during the study.

Based on Jar test analysis, optimum lime, ferric chloride and alum dosage to effective coagulation was determined to be 1500, 240, 400 mg L^{-1}, respectively (Table 2).

Table 1: Raw sewage characteristics of KTS used to Jar test analysis

No. of sample	Parameter COD (mg L^{-1})	Colour (TCU)	pH
1	976	125	7.4
2	1084	140	8.0
3	996	115	7.8
4	754	110	7.4
5	488	95	7.0
6	640	105	7.9
Mean	823	115	-

Table 2: Results of Jart test analysis for coagulants addition to Kashan Textile Sewage (Optimum dosage of lime=1500 mg L^{-1} Alum=400 mg L^{-1} and ferricchloride = 240 mg L^{-1})

	Coagulants								
	Lime			Ferricchloride			Alum		
No. of sample	COD	Colour	pH	COD	Colour	PH	COD	Colour	pH
1	349	25	12.0	430	40.0	6.4	556	55	6.7
2	453	30	12.4	408	50.0	6.2	531	70	6.4
3	294	20	12.5	216	70.0	6.4	547	60	6.6
4	164	15	12.5	380	60.0	6.4	384	50	6.5
5	124	35	12.0	234	45.0	6.4	224	55	6.6
6	220	15	12.0	256	50.0	6.5	288	65	6.7
Mean	267	23	-	320	52.5	6.7	421	59	-

COD as milligram per liter (mg L^{-1}), Colour as true colour unit (TCU)

Table 3: Efficiency for COD and colour removal from Kashan textile sewage (as percent)

	Coagulants					
	Lime		Ferricchloride		Alum	
No. of sample	COD	Colour	COD	Colour	COD	Colour
1	64	80.0	57.0	68.0	43.0	56.0
2	58	78.5	62.3	64.0	51.0	50.0
3	70	82.6	78.3	39.1	45.0	47.8
4	78	86.3	49.6	45.4	490	45.5
5	74	63.1	52.0	52.6	54.0	42.1
6	65	85.1	60.0	52.3	55.0	47.6
Mean	68	79.3	59.8	53.5	49.5	49.7

The mean concentration of COD and colour in treated effluent were 267 mg L^{-1} and 23 TCU for lime addition, 320 mg L^{-1} and 52.5 TCU as well as 421 and 59 TCU for ferricchloride and alum as respectively. In the case of lime the values of pH in treated effluent is very high and were between 12 to 12.5 that is due to alkaline properties of lime (CaO). For the case of ferricchloride and alum pH value is between 6.2 to 6.7 that is slightly less than raw sewage is mainly due to produce of acid after addition of these coagulants. Table 3 evidences that by the lime, average removal of COD and colour is 68 and 79.3% whereas, in the case of other coagulants this efficiency are under 60%.

DISCUSSION

Due to presence of Non-biodegradable chemicals and dyes in KTS COD and colour was selected as important indicator for efficiency determination of chemical coagulation. Previous study shown that in KTS the concentivation of heavy metals is less than Iranian reuse standard for agriculture, thus, removal of heavy metal is not detrimental parameter to determine the efficiency[11].

By comparing the results obtained on the three coagulants using in Jar test, it appears that the quality of the treated effluent is significantly better in the case of lime addition. Based on data presented in Table 2, the average concentration in COD for lime is only slightly more than the 200 mg L^{-1} set by Iranian reuse standard for agriculture. For three coagulants where tested, the average content in colour is clearly below the 75 TCU set by this standard[12].

Since in Kashan areas the treated effluent is the reuse for unrestricted irrigation then it is necessary to reduce COD concentration to less than 200 mg L^{-1} by chemical Oxidation with chlorine after coagulation[5,13]

In the case of lime, pH in treated effluent is more than the 6.5-8.5 set by Iranian reuse standard, while for other coagulants pH was compatible with this standard[12].

We suggest that for reuse the treated effluent and to reduce pH below the threshold of Iranian reuse standard (6-8.5) it is necessary that mixing the effluent with water well or Kashan municipal effluent before the irrigation. Although pH adjustment can be Possible by neutralization with acid but it is very costly and we don't recommended for this situation:

The results for actual COD and colour removal for individual coagulants were shows that the lime is more efficient with respect to other coagulants (Table 3). Thus, lime is the optimum coagulant with 1500 mg L^{-1} dosage. Since lime is cheap and available, therefore, lime treatment would be economically accepted to Kashan textile sewage[1]. In conclusion, chemical coagulation with lime and followed by chemical oxidation with chlorine is recommended for KTS, provided that treated effluent mixed by water well or Kashan municipal effluent before irrigation.

REFERENCES

1. Eckenfelder, J.R., 1989. Industrial Wastewater Pollution Control. 2nd Edn., McGraw-Hill. USA., pp: 145-167.
2. Tchobanoglous, G., 2003. Wastewater Engineering and Reuse. McGraw-Hill, New York, pp: 47-111.
3. Donald, R. and L. Rowe, 1995. Hand Book of Wastewater Reclamation and Reuse. CRC Press, pp: 141-172.
4. Gabriel, B., 1999. Wastewater Microbiology. John Wiley and Sons Publication, USA., pp: 39-65.

5. Patterson, J.W., 1985. Industrial Wastewater Treatment Technology. Butterworth Publishers, USA., pp: 1-9.
6. Japan International Cooperative Agency, 1999. Textbook for the Group Training Course in Sewage Works volume II. Tokyo, Japan, pp: 45-64.
7. US Environmental Protection Agency, 1992. Manual Guidelines for Water Reuse. Washington, DC.
8. Crites, R. and G. Tchobanoglous, 1998. Small and Decentralized Wastewater Management Systems. WCB, McGraw Hill. New York, pp: 22-41.
9. APHA., AWWA, WPCF, 1995. Standard Methods for the Examination of Water and Wastewater. 19th Edn., Washington, DC., USA.
10. Qasim, S.R., 2001. Wastewater Treatment Plant Design. CBS College Publishing, USA., pp: 379-430.
11. Miranzadeh, M.B., 2003. Kashan Textile Sewage Study. Kashan Water and Wastewater Company, Iran.
12. Iranian, E.P.A., 1999. Guidelines for Effluent Ruse. Islamic Republic of Iran.
13. Ronald, A., 1989. Pretreatment of Industrial Wastewater. Water Pollution Control Federation, Alexandria, USA., pp: 72-120.