TEXTILE WASTEWATER TREATMENT

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ABSTRACT

A treatability study of textile wastewater using coagulation by adding polyelectrolytes ((1-2 ppm) at pH (6.7-7.5) and primary sedimentation followed by aeration and final settling gave a good results. COD decreased from 1835 to 120 ppm, SS decreased from 960 to 120 ppm and sulphate from 1350 to 125 ppm. In the full-scale treatment plant filtration is used to improved results by decreasing COD, from 263 to 55 and SS from 295 to 10 and Sulphate from 158 to 100 ppm respectively.

Keywords: Textile Industrial wastewater, (TIWW) Chemical precipitation, Coagulation, Chemical oxidation, Activated Carbon

INTRODUCTION

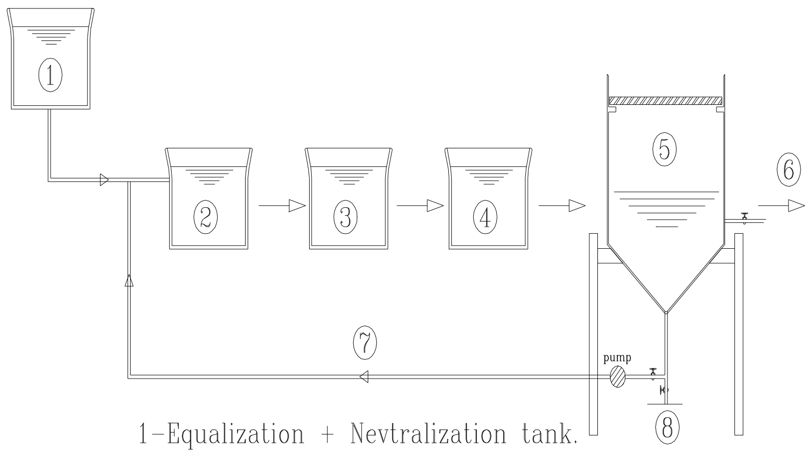
In the textile industries there is growing interest for the process water. Since the purified wastewater in the textile industry is required to satisfy strict quality standards before reuse becomes possible, advanced purification techniques must be available which are efficient and reliable. Wastewater treatment for recycling means an additional cost in manufacturing as product. It can become economically feasible if it brings about reduced water intake costs and reduced discharge fees.

In 1982 the government of Egypt evaluated the law 48 which has set guidelines for wastewater disposal (domestic or industrial) to limit water bodies pollution in the Country. Many of private industrial plants have been trying to do good adaptation to avoid legislation problems. On the other side some companies which uses large quantities of water such as textile industries have been looking after reducing the water bill, through reusing treated effluent wastewater. Groves et al. (1979) used effluents from a treatment pilot plant which were still appreciably palliated and nevertheless found quite acceptable results in dyeing tests for wool, polyster and viscose. Rozzi et al (1995) have found that it is possible to reach the desired water quality if both granular activated carbon and filtration are used after a suitable pretreatment (such as coagulation flocculation and settling). Color removal of textile wastewater was the objective of several researcher Mehrota et al (1995) applied coagulation to remove color from textile dyeing effluents such as Mg CO3 and Fe SO4. Ganjidost et al (1995) used various minerals for the adsorption of color from two textile dyes and found high removal rates at pH below 5. Practical Egyptian solution must be found for the new or already existed textile industrial plants as a large sector of the industrial factories.

The main objective of this research is to observe and evaluated the treatability of textile wastewater to satisfy law 48 in 1982 and to reuse it.

EXPERIMENTAL WORK

An experiments with textile industrial wastewater (TIWW) were made in four tanks reactor, volume of each is 20 litters, Figure(1). The first tank was operated as a coagulator, second was operated as a settler (primary), the third as an aerated tank and fourth as a final settler. Recycling arrangement was taken in consideration. Samples were collected regularly with each cycle of hydraulic retention times. Remaining of (TIWW) was kept at 4°C to be used in following days until collecting new sample from the industrial plant which located at tenth of Ramadan city.



1-Equalization + Nevtralization tank.
2-coagulation tank.
3-Primary sedimentation tank.
4-Aeration tank.
5-Final settler.
6-Effluent to be reused after filteration or to be disposed.
7-Recycling of sludge.
8-Sludge Disposal.

Figure(1): Schematic Diagram of Bench Scale Reactors.

Table (1). Determination of actual dozing of polymer through removal efficiency of suspended solids

Dozing of Polyelectrolyte Polymer (mg/L)	Suspended Solids Removal %
0.50	45 %
1.0	63 %
1.50	71 %
2.00	76 %
2.50	76.6 %
3.00	76.8 %

- The most effective and economic doze is 2.00 mg/l.

Experimintal study was conducted to select the actual doze of polymer to be added for sedimentation. Table (1) shows the relation between dozing of polyelectrolyte polymer ranged from 0.5 to 3.0 mg/l and removal efficiency of suspended solids. The reslts show that the most effective and economic doze is 2.00 mg/l of polymer. Thus this doze was sed regularly to improve the plant performance with short hydraulic time.

The determination of Total dissolved solids (TDS), suspended solids (SS), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), sulfate (SO4), phosphate (PO4), residual chlorine and ammonia, were carried out as proposed by the standard methods 1995. All those parameters were measured at the beginning to characterize the wastewater but throughout the research work only the following parameters were measured, temperature, pH, TDS, SS, BOD, COD, Chlorine, SO4 and PO4. The characteristics of influent wastewater is shown in Table (2).

Table (2). Textile wastewater characteristics

Parameter	Values		
	Minimum	Maximum	Average
pH	6	10	8.0
TDS (mg/l)	650	1940	1300
SS (mg/l)	710	960	835
BOD_5 (mg/l)	295	1288	790
COD (mg/l)	475	1835	1300
Sulphate (mg/l)	250	1350	800
Phosphate (mg/l)	30	40	35
Ammonia (mg/l)	Nil	Nil	Nil

*All parameters are in mg/l except pH.

RESULTS AND DISCUSSION

It is quite difficult to define a general quality standard for textile water reuse because of the different requirements of each fiber (silk, cotton, polyster, etc…), of the textile process (e.g., scouring, desizing, dyeing, washing, etc…) and because of the different quality required for the final fabric. The textile wastewater which had been used in this research was collocated to be a representative sample of the total effluent. The primary treated wastewater from the industrial plant is generally discharged into the public sewer where it is mixed with domestic wastewater. Using coagulation and aeration with sedimentation as secondary or biological treatment improved the effluent quality. Textile wastewaters have impurities, dissolved colloidal and suspended form, at first are coagulated and precipitated to produce micro-flocs by simply adjusting pH (6.7-7.5) or by adding inorganic or organic coagulating chemical Low molecular weight non-ionic polyelectrolytes (1-2 ppm) were used to reduce sludge production when the impurities are in the form of micro-flocs and other suspended solids. The bench scale reactor tanks was operated at HRT of 6 hours (as selected from literature review), without filtration. The results of this experiment are shown in Table (3). During this experiment the four tanks were operated as one reactor to determine the general trend of treatment. Tank (1) + tank (2) were operated as preliminary treatment, tank (3) + tank (4) were operated as extended aeration treatment. Results show that the effluent of this reactor satisfies Egyptian Law 48 / 1982 to be discharged into public sewers. But it is not allowed to be discharged into surface potable water or to be reused.

Filtration was used as a tertiary treatment to improve the treated wastewater quality. Sand filter and carbon filter were used to remove fine suspended solids and residual colors. Results of this experiment are shown in Table (4). These results show that using filtration with active carbon improved the effluent treated textile wastewater.

Table (3). Wastewater analysis at influent and effluent of reactor tanks

Parameter	Influent	Effluent	Removal % average
pH	6-10	7.5-8.5	-
TDS	650-1940	820-1980	-
SS	710-960	120-295	76%
BOD_5	295-128	45-215	84%
COD	475-1835	65-263	86%
SO_4	250-1350	11-158	92%
PO_4	30-40	Nil	100%

Table (4). Influent and Effluent Concentration before and after filtration

Paramete	Before	After	Removal	Law
pH	7.5-8.5	7.5-8.5	----	6-9
TDS	820-1980	550-1250	40%	1200
SS	120-295	10-18	98.3%	30
BOD_5	45-215	25-30	91.2%	30
COD	65-263	35-45	95%	40
SO_4	11-158	10-135	92%	400
PO_4	NIL	NIL	100%	1

***(All concentration in mg/l except pH)**

CONCLUSIONS

Textile wastewater treatment study has been successfully operated. The aerobic treatment in combination with the use of filtration resulted in a significant SS, COD and color removal. Research was conducted on the development of applicable method of textile wastewater treatment to satisfy Law 48 on 1984, SS, BOD, COD, SO4 and PO4 removal efficiency were 76%, 84%, 86%, 92% and 100% respectively without filtration. Removal efficiency improved with filtration for SS, BOD, COD and SO4 to be 98.3%, 91.2%, 95% and 92% respectively. Using filtration is essential to get treated textile wastewater satisfies law 48/1982 or to be reused.

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