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Research Article

Textile Industry Wastewater Treatment Using DAP, Urea, and Polymer AQUATREAT @AR 06

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Abstract

Textile Industry is one of the most important and largest industrial sectors in Pakistan. It has a high importance in terms of its environment impact, since it consumes large quantity of textile industrial processed water and produces highly polluted discharge water. The textile industry uses high volume of water throughout its operation, from the washing of fibers to bleaching, mercerizing, dyeing, printing and washing of finished products. A process data collection was performed and integrated with a characterization of the process effluents in terms of treatability and reusability. In this research we use 98% Concentrated Sulfuric Acid for the Neutralization i.e. to maintain pH, Di Ammonium Phosphate (DAP) and Urea for the bacterial growth i.e. to decrease Biological Oxygen Demand (BOD), and we use AQUATREAT @AR 06 for as an efficient coagulation and flocculation agent. The water treated and purified by using this method can be used for the agricultural purposes or can be drain to sewer without any hesitation.

Keywords: Textile Industry; Wastewater; Coagulation and Flocculation; Neutralization; Agitation; Aeration

Introduction

The world's water consumption rate is doubling every 20 years, outpacing by two times the rate of population growth. The availability of good quality water is on the decline and water demand is on the rise. Worldwide availability of fresh water for industrial needs and human consumption is limited. Various industrial and developmental activities in recent times have resulted in increasing the pollution level and deteriorating the water quality. Water shortages and unreliable water quality are considered major obstacles to achieve sustainable development and improvement in the quality of life. The water demand in the country is increasing fast due to progressive increase in the demand of water for irrigation, rapid industrialization, and population growth and improving life standards. The existing water resources are diminishing (i) due to unequal distribution of rain water and occasional drought, (ii) excessive exploitation of ground water sources and its insufficient recharge, (iii) deterioration of water quality due to the discharge of domestic and industrial effluents without adequate treatment. This is resulting into water stress/ scarcity. Country is currently passing through social and economic transition. The proportion of the population which is urban has doubled over the last thirty years (and is now about 30%), agriculture now accounts for about 25% of GDP and the economy has been growing at around 7-9% a year. Country has a highly seasonal pattern of rainfall, with 50% of precipitation falling in just 15 days and over 90% of river flows in just four months [1-3].

Textile Industry is one of the most important and largest industrial sectors in Pakistan. It has a high importance in terms of its environment impact, since it consumes large quantity of textile industrial processed water and produces highly polluted discharge water. The textile industry uses high volume of water throughout its operation, from the washing of fibers to bleaching, mercerizing, dyeing, printing and washing of finished products [4].

Textile industry causes considerable higher impacts to water pollution by discharging their effluents into various receiving bodies includes ponds, rivers and other public sewer. Major pollutants load from the textile industries are from the several of their wet -processing operations like scouring, bleaching, mercerizing and dyeing [5]. Among these various processes, dyeing process normally uses large amount of water for dyeing, fixing and washing processes [6]. Thus, textile wastewater possess a high COD concentration, large amount of suspended solids, broadly fluctuating pH, strong color, high temperature and low biodegradability caused by varying contaminates within water environment [7].

The textile industry is one of the most polluting industries in term of discharge volume and effluent composition. The dye effluent is characterized by strong color, high Chemical Oxygen Demand (COD) with pH varying from 2 to 12. The removals of color and COD reduction pose greatest problems in textile industry [8,9]. Conventionally effluents containing organics are treated with adsorption, biological oxidation, coagulation, etc. Thought the conventional methods have individual advantages, they are lacking in effectiveness, if applied individually. For example, biological

Table 1: Pollutants from Textile Wet Processing.

Process	Various Physico Chemicals
Desizing	Enzymes, Starch, Waxes, CMC
Bleaching	H_2O_2, Sodium Silicate, Organic Stabilizer, Surfactant
Mercerizing	NaOH, Cotton Wax
Dyeing	Dyes, Salts, Surfactants, Urea, Soda Ash
Printing	Urea, Dyes, Pigments, Binder, Soda Ash, Thickener
Finishing	Resins, Formaldehyde, PVA, Waxes, Hydrocarbon

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Table 2: Treatment Methods of Textile Wastewater.

Processes	Advantages	Disadvantages
Biodegradation [19-20]	Rates of Elimination by Oxidizable Substances about 90%	Low Biodegradability of Dyes
Coagulation-Flocculation [21]	Elimination of Insoluble Dyes	Production of Sludge, Blocking Filter
Adsorption on Activated Carbon [22]	Suspended Solids and Organic Substances well Reduced	Cost of Activated Carbon
Ozone Treatment [23-24]	Good Decolorization	No Reduction of the COD
Electrochemical Processes [25-26]	Capacity of Adaption to Different Volumes of Pollution Loads	Iron Hydroxide Sludge
Reverse Osmosis [27]	Removal of all Mineral Salts, Hydrolyzes Reactive Dyes and Chemical Auxiliaries	High Pressure
Nanofiltration [28-31]	Separation of Organic Compounds of Low Molecular Weight and Divalent Ions from Monovalent Salts, Treatment of High Concentrations	--------------------
Ultrafiltration-Microfiltration [32-34]	Low Pressure	Insufficient Quality of the Treated Water

Table 3: Analysis of Effluent Samples.

Parameters	Values		
	Sample 1	Sample 2	Sample 3
pH	11.8	12	10.9
Conductivity (μs/cm)	7.96×10^3	5.24×10^3	5.49×10^3
TDS (mg/L)	3050	3605	3810
TSS (mg/L)	2800	1800	2237
BOD (mg/L)	421.4	312.8	410.2
COD	920	880	840

treatment is the most efficient and economical way of reducing the environmental impact of the industrial effluents containing organic pollutants, but this technique is time consuming and cannot be employed for textile effluent, as textile effluent is recalcitrant to biodegradation. On the other hand, the physical adsorption is expensive for adsorbent regeneration difficult. Furthermore, biological and chemical methods generate considerable quantity of sludge, which itself requires treatment. Due to the large variability of the composition of textile wastewater, most of the traditional methods are becoming inadequate [10-13]. Table 1: given below containing specific pollutants from textile wet processing. Table 2: given below shows the possible treatments of textile wastewater along with their advantages and disadvantages.

Textile dying processes are one of the most environmentally unfriendly industrial processes because they produced colored wastewater that is heavily polluted with dyes, textile axillaries, and chemicals. Colloid particles are removed from the water via coagulation and flocculation process. Effect of coagulant dose, polyelectrolyte dose, pH of the solution, and addition of polyelectrolyte as coagulant aid was investigated and found to be important parameters for the effective treatment of beverages industrial wastewater. Aluminum Sulfate (Alum), Ferrous Sulfate, and Ferric Chloride were commonly used as coagulants. During the high COD removal capacities it has been observed that combined use of Alum and Lime link with Alzheimer's disease [14-34].

Apparently no major studies have been done to clarify the textile waste water by using Urea, DAP, and Polymer AQUATREAT @AR 06. Therefore the aim of this research is to investigate the effect of Urea, DAP, and Polymer AQUATREAT @AR 06 in the treatment of textile wastewater.

Table 4: pH Results of Samples.

	pH of Samples		
	Inlet	Outlet	Percentage Neutralization
Sample 1	11.8	8.3	70.33%
Sample 2	12	7.9	65.83%
Sample 3	10.9	7.4	67.88%

Experimentation

Sampling

The analysis of the wastewater samples of a well-known textile industry in Faisalabad, PAKISTAN has been taken and it is given below in Table 3.

Agitation and aeration

The sample is taken into a beaker and continuously agitated for the purpose of Aeration that is necessary for the bacterial growth in the wastewater.

Neutralization

In this step we add sulfuric acid by dosing. We add sulfuric acid in the ratio of 2.057mL/1L of wastewater. This will reduce the pH of the sample and neutralize the sample. The resulting pH of the samples after the dosing of sulfuric acid is to be found in the range of (7-8.5). The results are tabulated in Table 4: given below as follows.

Bacterial growth

Add fertilizer like Di Ammonium Phosphate (DAP) and Urea in order to increase the bacterial growth i.e. Biological Oxygen Demand (BOD) and maintain to a specific level. This will be beneficial for the next step of treatment that is coagulation and flocculation. Add an equal mixture of Di Ammonium Phosphate (DAP) and Urea that is about 26.78 gram per liter of wastewater. The results are tabulated in Table 5: given below as follows.

Coagulation and flocculation

In this step add some polymers like AQUATREAT @AR 06 this

Table 5: BOD Results of Samples.

	Biological Oxygen Demand (BOD) of Samples		
	Inlet	Outlet	Percentage BOD Change
Sample 1	421.4	526.75	80%
Sample 2	312.8	376.86	83%
Sample 3	410.2	519.24	79%

Table 6: Effluent Parameters Results of Samples.

Parameters	Values		
	Sample 1	Sample 2	Sample 3
pH	8.3	7.9	7.4
Conductivity (µs/cm)	3.24×10^3	3.17×10^3	3.04×10^3
TDS (mg/L)	610	612	925
TSS (mg/L)	504	396	560
BOD (mg/L)	526.75	376.86	519.24
COD	440	390	370

will cause a sudden agglomeration and it will appear on the surface of wastewater. The AQUATREAT @AR 06 is actually a light weight Poly Acrylic Acid used as an anti-scalant agent for wastewater treatment purposes. Add 7.14mg of AQUATREAT @AR 06 in powder form in the beaker and agitate continuously. This will result the formation of coagulation of insoluble dyes, colors, and pigments etc.

Results and Discussions

The results show that the process of neutralization i.e. decreases in pH is about 68% efficient. The results are given below in Table 4.

The result shows that the process of Biological Oxygen Demand (BOD) increase is about 80.66% efficient. The results are given below in Table 5.

After increasing the Biological Oxygen Demand (BOD) for Bacterial Growth the remaining effluent parameters are changed and tabulated in Table 6.

Conclusion

This scientific research shows that the 98% Concentrated Sulfuric Acid efficiently neutralize the sample of textile industry waste water. This research also shows that Di Ammonium Phosphate (DAP) and Urea are found to be effective in order to increase the bacterial growth i.e. Biological Oxygen Demand (BOD) and maintained at a specific level. The AQUATREAT @AR 06 is found to be efficient coagulation and flocculation agent for the removal of insoluble dyes, colors, and pigments etc. the water treated and purified by using this method can be used for the agricultural purposes or can be drain to sewer without any hesitation.

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