Cod Removal from Industrial Waste Water from PALGHAR MIDC Area Using Low-Cost Technique

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Abstract: Rapid urbanization and industrialization increase organic pollutants in river and dam water which ultimately affects on water quality level. This research papers deals with the study of analysis of water parameters like pH, COD, presence of heavy metal and to treat this waste water by using low-cost technique. In this study, water samples from three different industries were analyse and treated by using batch experiment process using Fenton`s reagent followed by charcoal treatment. Effect of pH, dose of Fenton`s reagent and charcoal were examined in order to optimize the COD reduction.

Keywords: Fenton`s reagent, industrial wastewater, chemical oxygen demand

INTRODUCTION

The water effluents from pulp and paper industries are often very complex, and it is almost impossible to characterize all types of constituents. Chemical and mechanical pulping processes will generate different wastewaters because different quantities of water and/or additives are used [1-5]. The wastewater will generally contain carbohydrates (glucose, xylose, galactose, manose, arabinose etc.), extractives (fatty acids, resin acids, triglycerides) and low molecular weight compounds (formic acid, acetic acid, oxalic acid). In textile and paper colouration industries synthetic dyes from residual dye baths are released in to waste streams. It is estimated about 10-15% of dyes goes unused in textile effluents [6-7]. Conventional high-technology wastewater treatment systems are in many situations not a suitable solution in developing countries because it is not sustainable to install wastewater systems which require guaranteed power supply, replaceable spare parts and a skilled labour for operation and maintenance. Improved process engineering, process closures and use of external treatments have in recent years drastically lowered the BOD [8-9]. However, the COD emissions have not decreased to the same extent and must therefore be further reviewed. Chemical precipitation, which can bind large parts of the remaining COD into solid matter, making it possible to be removed from the effluent by various separation technologies, contributes to an efficient COD removal. However, a major drawback with this type of treatment is the generation of large quantities of sludge which is difficult to dewater (consumes a lot of energy) and generates large quantities of waste [10-13]. A cheap and more effectively methods for treating liquid waste before discharging it into any other water systems is required [14-16]. A lot of wastewater technologies are known which include physicochemical treatment processes and biological treatment processes. COD is a parameter that represents the amount of oxygen needed for complete decomposition of organic matter. In terms of pulp and paper production, COD originates from dissolved raw materials, process aids and all substances formed during pulp cooking that are not removed with the black liquor [17-18]. These types of substances are often very persistent and cannot be removed efficiently, causing negative effects on environment. Therefore, industrial effluents containing dyes must be treated before their release into the environment.

Experimental

Collection of wastewater sample

The wastewater sample is collected from different industries from Palghar MIDC area which is a town in Konkan division of Maharashtra state.

Preparation of Fenton solutions

Fenton`s reagents were prepared by dissolving 150 gm of solid Ferrous sulphate and hydrogen peroxide 50% m/w in 500 ml deionized water.

EXPERIMENTAL SETUP AND PROCEDURE

Effect of pH

In order to study at what pH range COD level will decrease it is important to study effect of pH for COD removal. As Fenton's reagent more effectively work in acidic range, first the pH of the solution adjusted between 2 to 5 using 0.1 N H_2SO_4 solution. For the study of effect of pH 200 ml of waste water from each industry were put in three different shaking bottles. After that, the various amounts of hydrogen peroxide solutions and $FeSO_4.7H_2O$ (in a solid state) were added and shaken for 1hr. after that resultant solution were filter off and treated with 0.1 gm of charcoal followed by filtration. The obtained results were depicted in table no.1 and fig no.1. COD was determined in accordance with standard methods [APHA, 1992], while pH was measured using a pH meter.

Effect of Contact time

In order to optime the reaction time for the removal of COD, 200 ml of waste water from each industry were put in three different shaking bottles and shaken for 2 hr by adding adequate amount of Fenton`s reagent followed by charcoal treatment and examine the effect of contact time. Results are depicted in table no.1 and figure no. 2

Effect of Temperature

H_2O_2 decomposes into oxygen and water above the 40ºC temperature. So, in order to estimate the effect of temperature, temperature of the solution was set in between 25 to 35ºC and examine the effect of temperature for the removal of COD and results are depicted in table no.1 and figure no.3.

Industrial Waste water (Palghar MIDC)	Fe^{2+} ml	H_2O_2 (ml)	pH	Temp. (ºC)	Time (min)	Initial COD (ppm)	Final COD after charcoal treatment	% Removal
	8	12	3.2	30	60	1825	845	53.70
Pharmaceutical Industry	10	15	3.8	35	60	1762	912	48.25
Dye industry	8	12	3.5	30	60	3254	895	72.49
	10	15	4.0	35	60	3120	1035	66.82
Textile Industry	8	12	3.4	30	60	2024	654	67.68
	10	15	3.8	35	60	2125	623	70.68

RESULTS AND DISCUSSION

In the first part of the investigations, optimization of Fenton's reaction was carried out for the three types of waste water like dyes, textile and pharmaceutical wastewater. Different doses of H_2O_2, as well as concentrations of Fe^{+2} ions and pH were reduced from 8-10 to 3-4 and residences time about 60 min. The wastewater sample is collected from primary tank or collection tank or equalization tank. The optimum COD reduction by this process is in the range of 60% to 85%. The comparison between raw water COD and after Fenton Process can be visualized by the following chart.

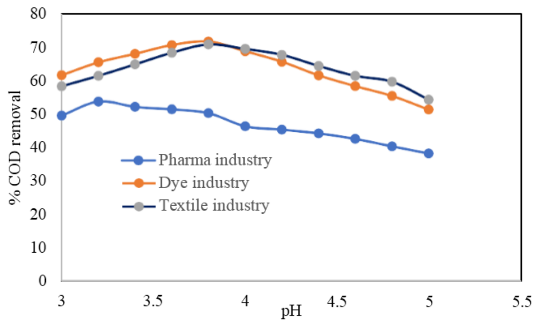

Figure No.1 Effect of pH on COD removal

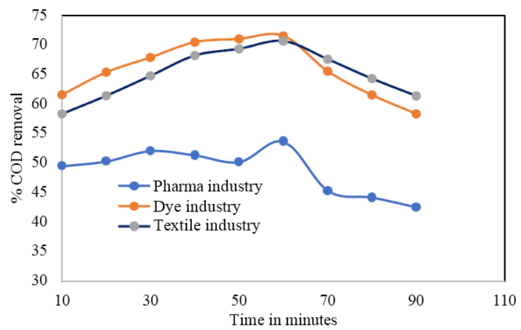

Figure No.2 Effect of contact time on COD removal

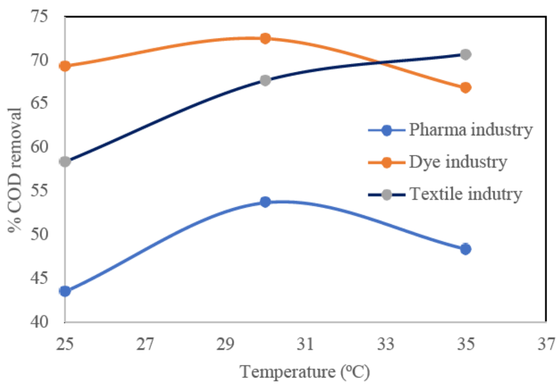

Figure No.3 Effect of temperature on COD removal

CONCLUSION

The study concluded that pH, contact time and temperature have a significant influence on Chemical oxygen demand (COD) removal efficiency by using Fenton's reagent followed by charcoal treatment. This shows that these Fenton's reagent followed by charcoal treatment have enormous potential to degrade the COD from pharmaceutical industry, dye industry and textile industry and resolve the problem of unnecessary high COD present in the effluents of industries. Further pilot scale studies are required with these strains for actual industrial applications, and detailed study is needed to explore the mechanism involved.

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