Remediation of distillery wastewater using Titanium dioxide nanoparticles

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Abstract - *The spent wash effluent stream from aqueous distilleries is a dark brown, foul-smelling, and highstrength effluent. With extraordinarily high COD and BOD values, it is also one of the most complex and difficult effluents. As a result, distilleries are one of the top 17 polluting businesses. Even after treatment, there is still a large amount of BOD/COD left over. This frequently leads in the dumping of low-quality waste water into the environment. The primary goals of this study are to collect and analyse the features of distillery wastewater, as well as to investigate the Tio_2 Nanoparticles' treatment efficiency. Finally, it was discovered that a dosage of 12g/L of Tio_2 Nanoparticles performs well, with a maximum COD removal efficiency of 79.46 percent at pH 4 and a maximum duration of 75 minutes.*

Key Words*: *Distillery waste water, TiO_2 Nanoparticles, UV irradiation.

1. Introduction

Industrial wastewater generation was limited to modest amounts until the mid-eighteenth century. However, many countries around the world followed suit, bringing with them rapid industrial revolutions in order to supply the demand. the pressures imposed by population increase at an exponential rate As a result, greater numbers are produced. a large amount of wastewater generated by enterprises pollutes the environment While it was being disposed of, material was treated partially or not at all. Currently, there are approximately 17 industries. which have been designated as the most polluting These include caustic soda, cement, distilleries, and others. fertilisers, iron and steel, oil refineries, paper and pulp, and dyes and dye intermediates Pesticides and medicines, sugar, textiles, thermal power plants, tanneries, and other industries are all affected. There are 295 distilleries producing ethanol, with sugar cane molasses accounting for the majority of the alcohol produced. Distillery effluent, the most of which is spent wash, is nearly 15 times the total amount of alcohol produced. If disposed of untreated, roughly 40 billion litres of effluent can put significant stress on waterways, resulting in widespread aquatic life destruction. The technological requirements and costs of putting up a treatment plant for distillery waste water are extremely high. As a result, the focus of this research is on the oxidation treatment of distillery waste water.

2. Sample collection and characterization

The sample was obtained from a distillery in Chengalpet district for this study. The distillery uses cane molasses as its primary raw material and produces ethyl alcohol. The sample was collected using the proper protocols and transferred to the laboratory for further examination. The characterisation was carried by using standard analytical methods.

3. Materials used i)Tio_2 Nanoparticles

Thermal breakdown of a precipitate derived from a precursor solution of titanium isopropoxide (IV) and isopropyl alcohol produced Tio_2 nanoparticles. **ii)UV lamp:**

The removal of organics from distillery wastewater was also linked to decreases in ultraviolet absorbance at 254 nm (UV254), providing a surrogate for assessing organics removal efficacy during UV/Tio_2 treatment.

4. Results and discussion

Table-1 summarises the parameters of the collected distillery waste water. The result demonstrates that the sample has a higher concentration due to the manufacturing process.

Table- 1: Characteristics of raw distillery waste water.

S.No	Parameter	Value
1	pH	4.8
2	Total dissolved solids (TDS; mg/L)	38,000
3	Chemical oxygen demand (COD; mg/L)	76230
4	Chloride (mg/L)	6784
5	Sulphate (mg/L)	2143
6	Total alkalinity (as $CaCO_3$; mg/L)	22,700
7	Biological Oxygen Demand (BOD)	4765 mg/L
8	Total Suspended solids (TSS)	2467 mg/L

Table-2 shows the results of the experiments performed with various Tio_2 Nanoparticle doses. The elimination of organics was a significant emphasis of this study. The chart clearly shows that the dosage of 12g/L Tio_2 Nanoparticles performs well in terms of effective organic elimination.

Figure 1 shows the percentage of COD removed. It is obvious that the dosage of 12g/L resulted in the highest elimination efficiency. The efficacy of COD elimination is 78.5 percent.

Table -2: COD removal efficiency for various TiO_2 Nanoparticles dosages at different durations

Duration (in minutes)	COD in mg/L							
	2	4	6	8	10	12	14	16
15	66223	68334	65456	65776	60775	59435	60872	60799
30	56345	60753	62378	51275	46273	44835	46369	46273
45	54781	52825	54782	47643	42640	32485	42733	42627
60	49754	47821	50178	39743	34739	24845	34834	34748
75	49786	47972	50637	23864	18859	16389	18953	18855
90	48945	47922	47835	23967	18961	16432	19053	18926

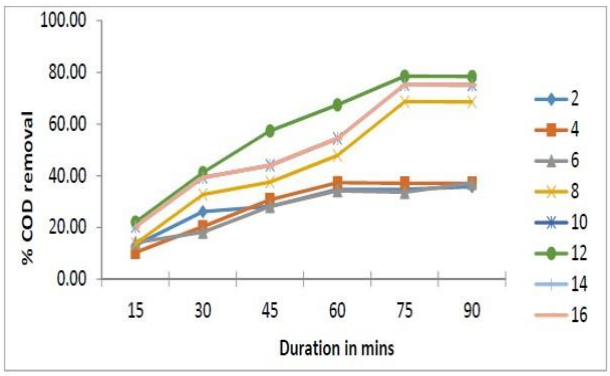

Figure-1: COD removal efficiency for various Tio_2 Nanoparticles dosages at different durations

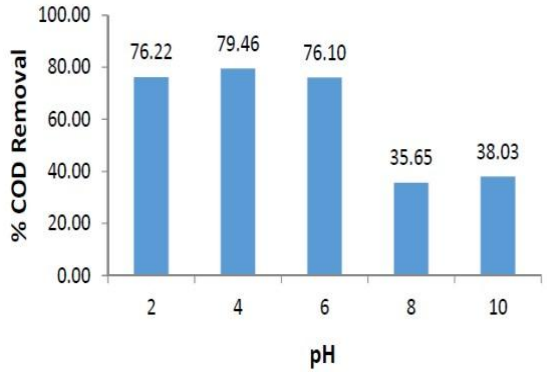

Figure-2: COD removal efficiency for Tio_2 Nanoparticles under varying pH

Further tests were carried out using the optimum dose of 12g/L Tio_2 Nanoparticles at pH values of 2, 4, 6, 8, and 10 using the optimum dosage of 12g/L Tio_2 Nanoparticles. It was only near the sample pH that the maximum COD elimination effectiveness of 79.46 percent was discovered. COD elimination effectiveness is lower in the alkaline pH sample.

5. Conclusion

The Tio_2 Nanoparticles dosage of 12g/L performed well in this trial, with a maximum COD elimination efficiency of 79.46 percent at pH 4 and a maximum duration of 75 minutes. Post or pretreatment procedures can be used to improve the efficiency of the removal process.

6. References

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