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REMOVAL OF COD AND BOD FROM SOAP MANUFACTURING WASTEWATER BY US/Fe/H_2O_2 TREATMENT

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Abstract: *The effluent from the soap manufacturing industry containing high amount of COD and BOD content. This effluent treated with the new emerging advanced oxidation process like Ultrasound with fenton and hydrogen peroxide. At laboratory scale ultrasound treatment examined at varying pH (2, 2.5 and 3) with varying COD to H_2O_2 ratio (8, 6 and 4) and H_2O_2 to Fe ratio (10, 8 and 6). In ultrasound treatment in combination with Fe and H_2O_2, the maximum 91.12% of COD removal achieved at pH: 3, H_2O_2 to Fe ratio 6 and COD to H_2O_2 ratio 6 and maximum 93.77% of BOD removal achieved at pH 3, H_2O_2 to Fe ratio 10 and COD to H_2O_2 ratio 8 with 120 minutes of reactions. Ultrasound with Fe and H_2O_2 treatment gives the better COD and BOD removal efficiency. So this treatment proved to be more effective for degradation of soap manufacturing industry wastewater.*

Keywords- *Advanced Oxidation Processes, Ultrasound with Fe and H2O2, Soap manufacturing effluent, COD removal, BOD removal.*

I. INTRODUCTION

Now a day's number of industries establishing day by day so the wastewater originating from that industries also increases. Around 13.5k million liters per day (MLD) of industrial effluent is originating from the industries in the city areas. The treatment capacity is only 8k MLD.

The wastewater originating from the industries also called an effluent containing organic and inorganic matters also acids, bases, toxic matters, BOD, COD, suspended solids, oil and grease, color etc. For discharging the wastewater to a public sewer or a surface water it is required to treat that industrial effluent. There is a various wastewater treatment processes like conventional treatment processes like bar screens, grit channels, primary sedimentation tanks or clarifiers etc., natural biological treatment systems like attached growth process, suspended growth process, disinfection by ozonation, chlorination etc., advanced oxidation processes like hydrogen peroxide, ozone, fenton, ultrasound, ultraviolet, photolysis, photocatalysis etc.

During a last few years there are a number of newly emerging technologies practicing for the treatment of the wastewater known as advanced oxidation processes. Advanced oxidation processes (AOPs) are the processes which uses a hydroxyl radicals in adequate quantity to treat the industrial wastewater. The number of advanced oxidation processes are carrying out now a days. Number of the advanced wastewater treatment processes uses a combination of strong oxidants (for examples O_3 AND H_2O_2), catalysts (for examples photocatalyst, transition metals) and irradiations (for examples ultraviolet, ultrasound and electron beam).

This study shows the removal or reduction of the COD, BOD and Color which are presents in the industrial wastewater by using ultrasound process with the combination of Fenton and hydrogen peroxide technic.

II. MATERIALS

a. **Wastewater from Soap Manufacturing Industry:** Raw effluent was collected from a soap manufacturing industry located at north region of the state Gujarat. Sample was collected from the equalization tank of the industry. Examining vessel was cleaned and flushed precisely with refined water and afterward washed with sample during collection. At that point effluent was put away in icy store at 4 ºC within 2 hours of collection of the sample.
b. **Reagents:** The $FeSO_4 \cdot 7H_2O$ and hydrogen peroxide solution (30% w/w) in stable form were all analytical grade which were used for study. All reagents utilized were not subjected to any further treatment. The refined water utilized all through the experiments.

III. EXPERIMENT

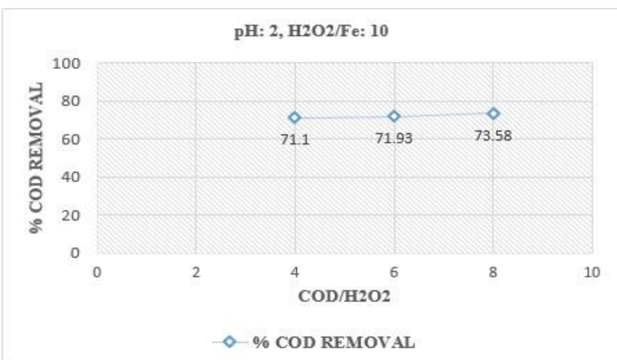
3.1 US/Fe/H_2O_2 Experiment: The ultrasound treatment of wastewater was performed by an ultrasonic stirrer with a frequency of 20 kHz equipped with a probe. The diameter of the tip of probe is nearly 1.5 cm and total length of probe is nearly 6.5 cm which was submersed in the wastewater sample. The ultrasonic stirrer in charge of direct sonication treatment, which won't bring about energy loss in light of the fact that the reaction matrix is in direct contact with the mechanical vibration. Ultrasound/Fe/H_2O_2 experiments were conducted for a 500 mL sample placed in a glass beaker. The pH was adjusted to a using a solution of acid. The sample was set in a measuring glass and illuminated with ultrasonic radiation and fitting measures of Fe and H_2O_2 were included. At desired time intervals, a 5 mL sample was expelled from the container and promptly sifted utilizing a 0.45 ml fiber glass channel to gather the supernatant, which was then analyzed to determine the residual concentration.

IV. Results and Discussion

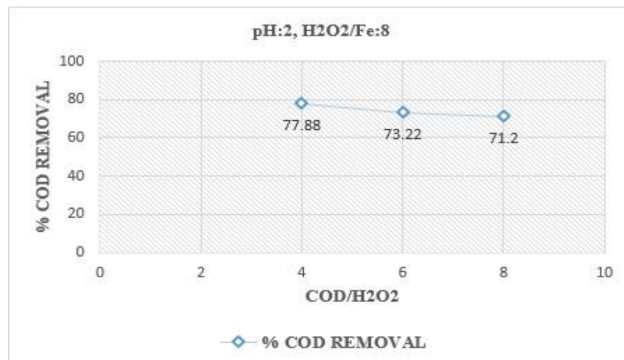
The tests were conducted at different pH (2, 2.5 and 3) with the different H_2O_2: Fe ratio (10, 8 and 6) and COD: H_2O_2 (8, 6 and 4). The removal efficiency of COD and BOD were determined from the tests conducted:

4.1 COD removal efficiency

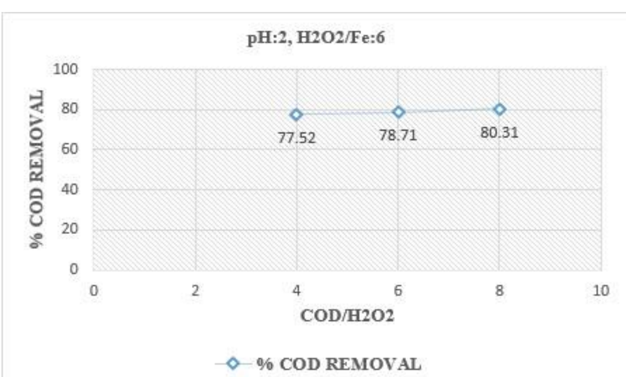
The initial concentration of COD in effluent is 2184 mg/L after removal of oil and grease from the effluent. The maximum COD removal efficiency is 91.12 % achieved with pH: 3, H_2O_2: Fe ratio 6 and COD: H_2O_2 ratio 6 as shown in figure A-9. The dose of H_2O_2 is 1.82 ml per liter and Fe is 2.23 grams per liter for maximum removal efficiency.
The following graphs shows the % COD removal with different combination of pH, H_2O_2: Fe ratio and COD: H_2O_2 ratio:



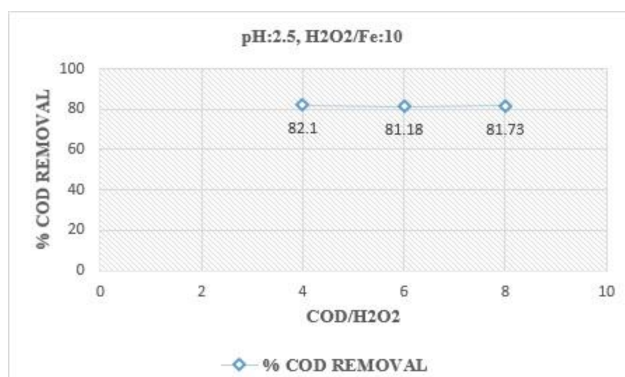
A-1: % COD removal for constant values of pH: 2 and H_2O_2/Fe: 10 while vary COD to H_2O_2 ratio to 8, 6 and 4



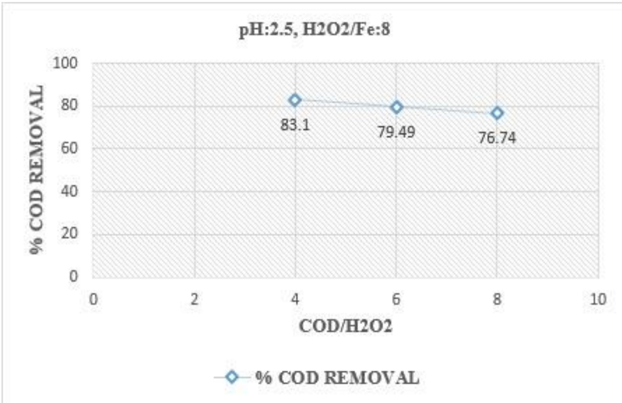
A-2: % COD removal for constant values of pH: 2 and H_2O_2/Fe: 8 while vary COD to H_2O_2 ratio to 8, 6 and 4



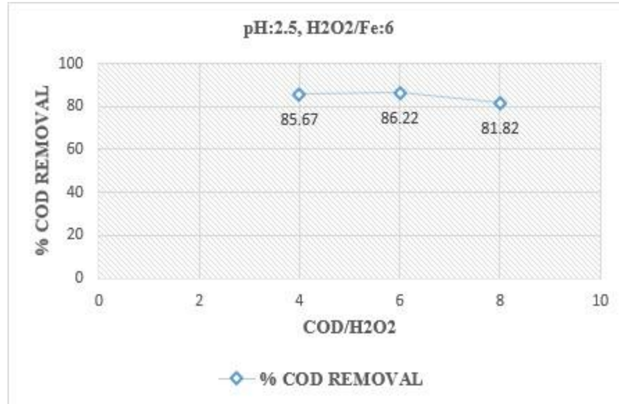
A-3: % COD removal for constant values of pH: 2 and H_2O_2/Fe: 6 while vary COD to H_2O_2 ratio to 8, 6 and 4



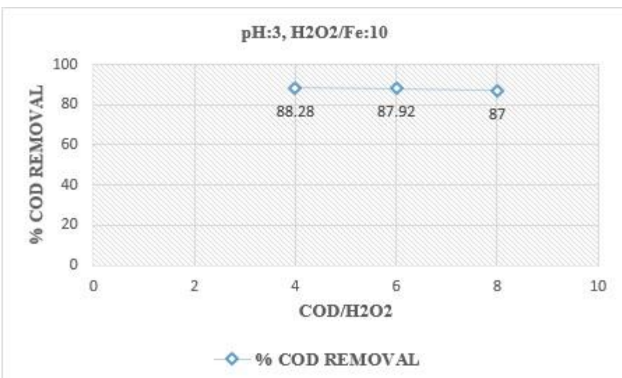
A-4: % COD removal for constant values of pH: 2.5 and H_2O_2/Fe: 10 while vary COD to H_2O_2 ratio to 8, 6 and 4



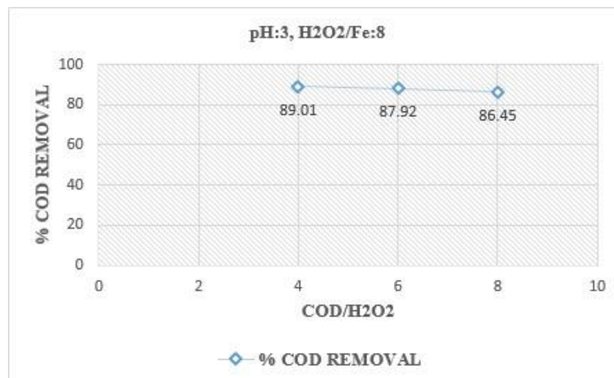
A-5: % COD removal for constant values of pH: 2.5 and H_2O_2/Fe: 8 while vary COD to H_2O_2 ratio to 8, 6 and 4



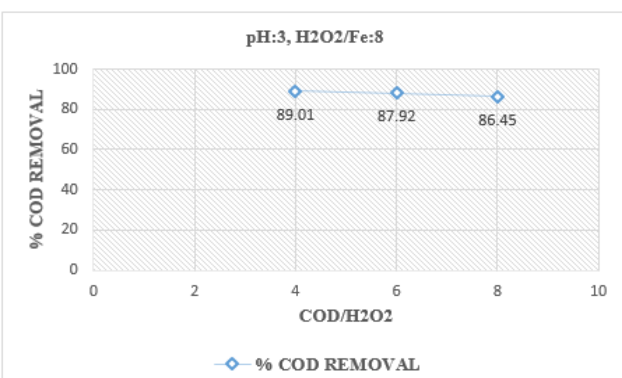
A-6: % COD removal for constant values of pH: 2.5 and H_2O_2/Fe: 6 while vary COD to H_2O_2 ratio to 8, 6 and 4



A-7: % COD removal for constant values of pH: 3 and H_2O_2/Fe: 10 while vary COD to H_2O_2 ratio to 8, 6 and 4



A-8: % COD removal for constant values of pH: 3 and H_2O_2/Fe: 8 while vary COD to H_2O_2 ratio to 8, 6 and 4

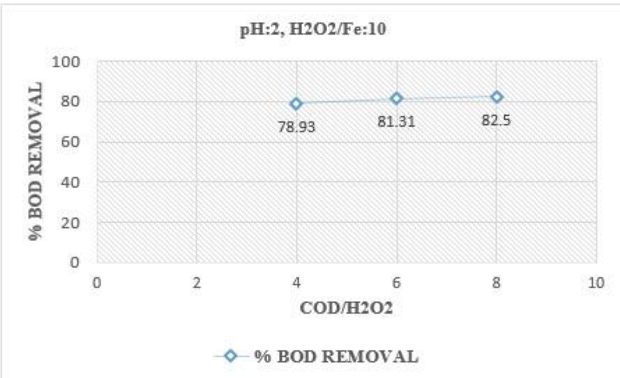


A-9: % COD removal for constant values of pH: 3 and H_2O_2/Fe: 6 while vary COD to H_2O_2 ratio to 8, 6 and 4

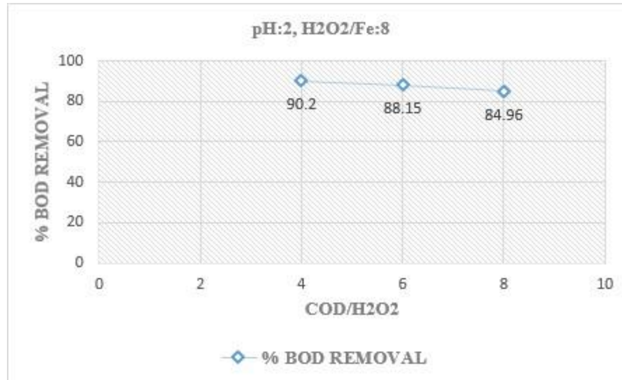
4.2 BOD removal efficiency

The initial concentration of BOD in effluent is 337 mg/L after removal of oil and grease from the effluent. The maximum BOD removal efficiency is 93.77 % achieved with pH: 3, H_2O_2: Fe ratio 10 and COD: H_2O_2 ratio 8 as shown in figure B-7. The dose of H_2O_2 is 0.91 ml per liter and Fe is 1.11 grams per liter for maximum removal efficiency.

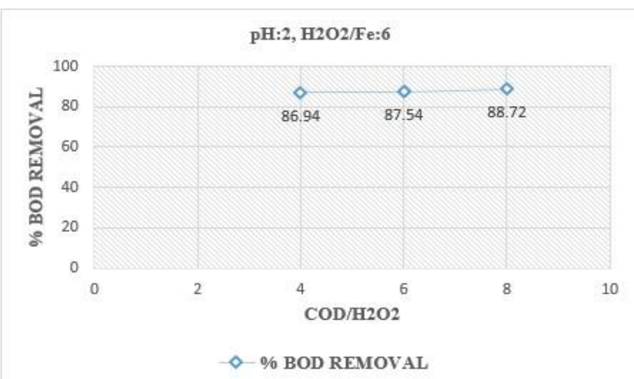
The following graphs shows the % BOD removal with different combination of pH, H_2O_2: Fe ratio and COD: H_2O_2 ratio:



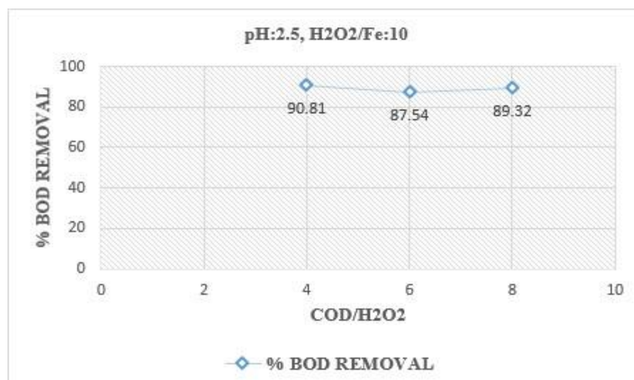
B-1: % BOD removal for constant values of pH: 2 and H_2O_2/Fe: 10 while vary COD to H_2O_2 ratio to 8, 6 and 4



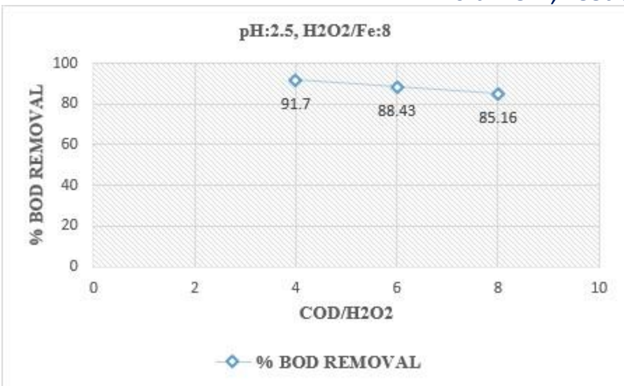
B-2: % BOD removal for constant values of pH: 2 and H_2O_2/Fe: 8 while vary COD to H_2O_2 ratio to 8, 6 and 4



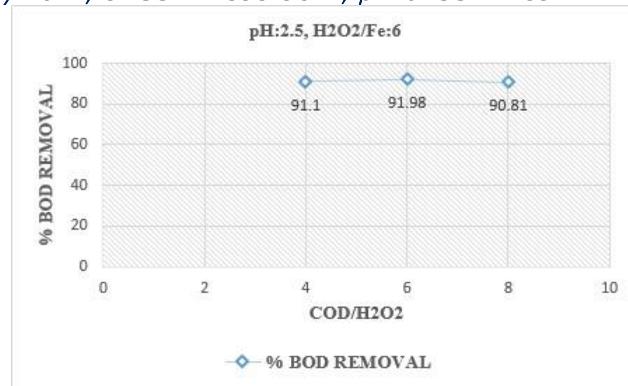
B-3: % BOD removal for constant values of pH: 2 and H_2O_2/Fe: 6 while vary COD to H_2O_2 ratio to 8, 6 and 4



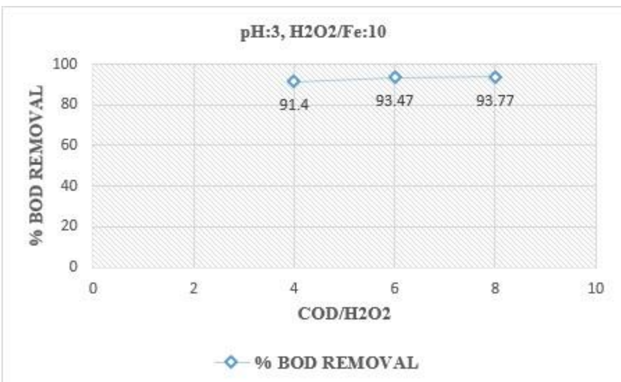
B-4: % BOD removal for constant values of pH: 2.5 and H_2O_2/Fe: 10 while vary COD to H_2O_2 ratio to 8, 6 and 4



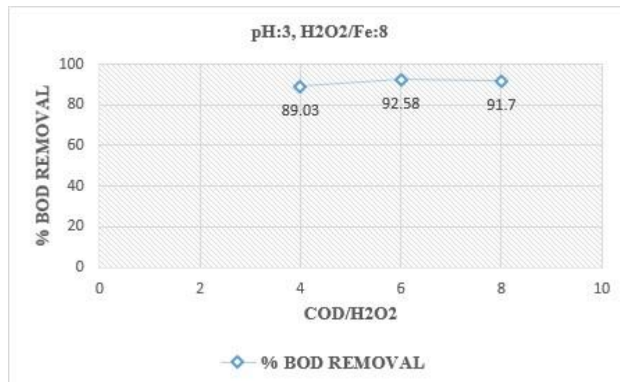
B-5: % BOD removal for constant values of pH: 2.5 and H_2O_2/Fe: 8 while vary COD to H_2O_2 ratio to 8, 6 and 4



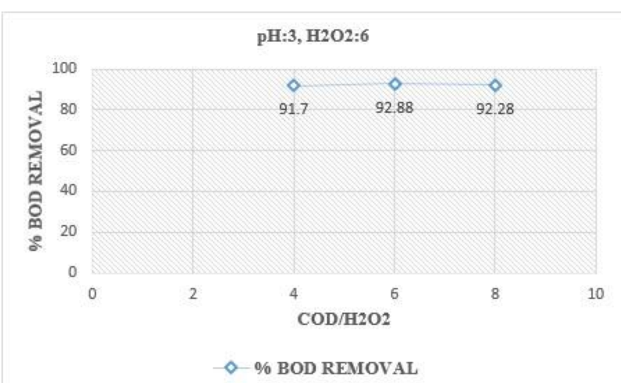
B-6: % BOD removal for constant values of pH: 2.5 and H_2O_2/Fe: 6 while vary COD to H_2O_2 ratio to 8, 6 and 4



B-7: % BOD removal for constant values of pH: 3 and H_2O_2/Fe: 10 while vary COD to H_2O_2 ratio to 8, 6 and 4



B-8: % BOD removal for constant values of pH: 3 and H_2O_2/Fe: 8 while vary COD to H_2O_2 ratio to 8, 6 and 4



B-9: % BOD removal for constant values of pH: 3 and H_2O_2/Fe: 6 while vary COD to H_2O_2 ratio to 8, 6 and 4

IV. CONCLUSION

The removal of organic and inorganic pollution load from wastewater investigated with ultrasound with fenton treatment. The AOPs like ultrasound treatment in combination with fenton treatment proved to be an economical and effective treatment for industrial effluent than conventional treatment. The ultrasound with fenton treatment is one of the exceptionally valuable innovation for the treatment of industrial effluent. Utilizing this treatment, we can reduce the bacterial populace in waste water from soap manufacturing industry. The wastewater was treated at different pH (2, 2.5 and 3) with different H_2O_2/Fe ratio (10, 6 and 8) and COD/ H_2O_2 ratio (8, 6 and 4). The treated effluent was tested for various parameters like COD and BOD. Using the ultrasound treatment with fenton, the maximum COD removal of 91.12 % was achieved with pH: 3, H_2O_2/ Fe: 6 and COD/ H_2O_2: 6 and BOD removal of 93.77 % was achieved with pH: 3, H_2O_2/ Fe: 10 and COD/ H_2O_2: 8. As a result, ultrasound treatment in combination with fenton treatment was found to be more effective treatment for industrial effluent.

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