

Wastewater treatment process of organic impurities by Fenton reaction

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The method is for the oxidative degradation of organic contaminants of natural, recycled and waste water. As oxidative degradation of the catalyst, compounds of iron, generated directly in the purification process, wherein the oxidation of the organic impurities by molecular oxygen, activated by a pair $\text{H}_2\text{O}_2/\text{Fe}^{2+}$, and hydrogen peroxide taken in an amount of 30 - 40% of that stoichiometrically required. The proposed method has the following advantages: improved performance and efficiency of the water treatment while reducing the cost of its holding.

Keywords: Oxidation, wastewater, oiled water, Fenton's reagent, ions of variable valence

Introduction

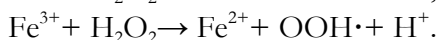
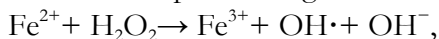
The purpose of experiment carried out was a reduction of duration, decrease in specific oxidant consumption and simplifying the process while maintaining a high degree of purification of water from organic compounds by catalytic decomposition in the presence of hydrogen peroxide.

The possibility of using the Fenton reaction enhances increasing the degree of biodegradation of petroleum products.

Possibility of pre-oxidation-resistant petroleum hydrocarbons was investigated in the Fenton reaction (Fenton, 1894).

Fenton's reaction, the reaction of hydrogen peroxide (H_2O_2) with iron ions (Fe^{2+}), was used to destroy many organic substances (Soloviev, 2009; Ban Fuchen and Wu Huan Zhou, 2005).

Iron ions (II) with hydrogen peroxide to oxidize the iron ions (III), and then under the action of peroxide again transformed into iron (II):



Formed in this oxygen radicals are extremely reactionary and can completely oxidize organic light that is widely used in waste water treatment (US Peroxide, 2009; Bishop et al., 1968; Pontes, Moraes, Machulek, and Pinto, 2010).

The experiments were carried out on the basis of laboratory Tongji University, Institute of the Environmental Science.

For the experiment, we used the following amounts of reagents.

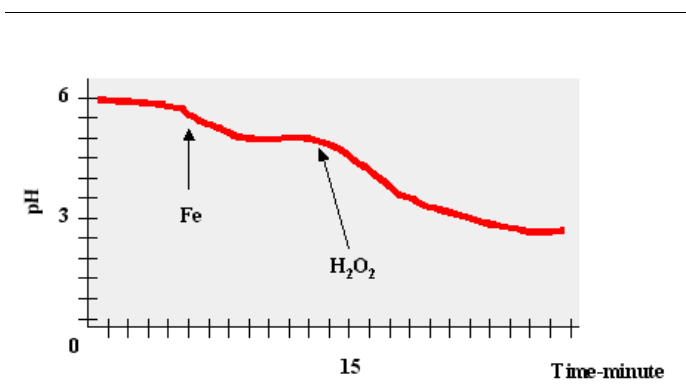
Clay (Jiao Zuo, Local Chinese products) - 100-200 ppm, $\text{FeSO}_4/\text{H}_2\text{O}$ - 4 mmol / l, H_2O_2 - 40mmol / l. Acidic environment pH = 3.

The sequence of the experiment is as follows:

1. The oil content in water in a ratio of 120 mg / l (Stirring 5 hours).
2. After stirring we received the contaminated water in oil. For a more detailed and convenient analysis, we divided the 1 liter of this water into 4 parts.
3. In the first part, the clay was added in an amount of 0.01 grams, stir in a shaker at room temperature.
4. In the condition of the acidic environment of the problem must be pH = 3. In the early water containing oil and clay was pH = 7.8, after we brought it to a desired temperature, by adding there H_2SO_4 (5%).

pH adjustment to 3-5 : if the pH is too high, the iron precipitate in $\text{Fe}(\text{OH})_3$, and will decompose the H_2O_2 to oxygen. Basically, the optimal pH occurs between 3 and 6. It's really important to pay attention to the double pH drop due to the addition of iron and H_2O_2 , as you can see in the following Figure 1. Indeed, FeSO_4 catalyst which contains residual H_2SO_4 and the H_2O_2 addition is responsible for the fragmentation of organic material into organic acids (Kallel, Belaid, Boussahel, Ksibi et al., 2009; Kavitha and Palanivelu, 2004; Coelho, Castro, Dezotti, and Sant'Anna, 2006).

FIGURE 1.



5. Added $\text{Fe}^{(+2)}\text{SO}_4$ 0.11 grams. For 1 hour, the mixture was under the influence of shaking.
6. After after time began adding H_2O_2 . In our case it was 5 drops. Color misalignment changed to yellow.

Were taken bottles 1 liter with 120 mg of mineral oil. Hydrogen peroxide and iron sulfate were added to the respective embodiments experience vials sealed with rubber stoppers and placed on a shaker at 25°C for 5 hours. Initial H_2O_2 concentration was 3.4 g / l $\text{FeSO}_4 \times 7\text{H}_2\text{O}$ and -1.12 g / l. Then the clay were added in an amount of 0.01 g per 250 ml of water contaminated with oil. Further work was carried out with shaking at 25°C, 120 rpm / min.

Also conducted two experiments for a more detailed picture: without the adding of clay; and without adding oil and clay (Table 1).

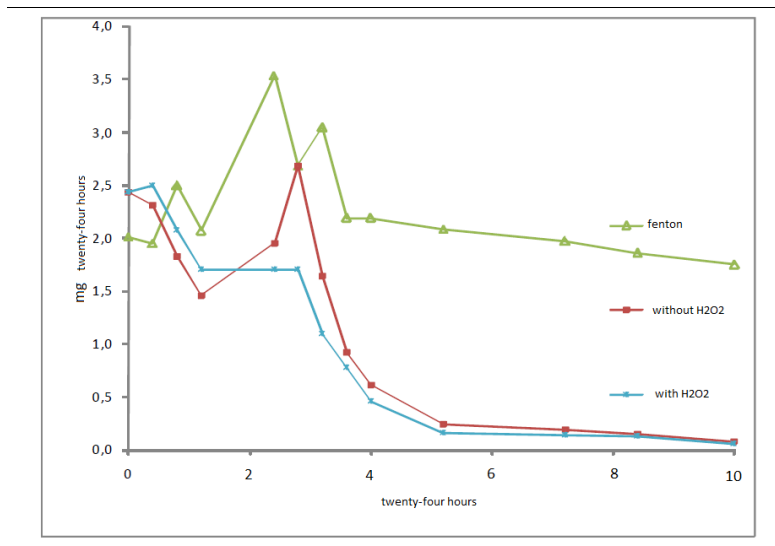
The results are shown in Figure 2.

Pre-treatment of oil by the method of Fenton gives a significant contribution to the activation of the respiratory processes. On day 6 of the experiment, the activity of the Fenton reagent respiration, the respiratory sharp decrease of activity was not observed, which indicated that the deeper degree of oxidation of petroleum hydrocarbons. This is possible only with the involvement of microbiological processes in hydrocarbon oxidation in the course of this reaction.

TABLE 1.

Option of experiment	Samples	Fenton Reagents	Additional components
1	Oil content	+	Clay
2	Oil content	+	Without Clay
3	Lack of oil	+	Without Clay

FIGURE 2. DYNAMIC OF DETERMINATION OF OIL PRODUCTS AFTER PRE-TREATMENT WITH H_2O_2 and Fe^{2+} (BY FENTON), AS WELL AS EMBODIMENTS WITH H_2O_2 PRETREATMENT BUT WITHOUT Fe^{2+} or Fe^{2+} BUT WITHOUT H_2O_2



The results showed that the maximum effect is observed in the oxidation of oil in the embodiment wherein in addition to the Fenton reaction, specialized clay.

In general it can be stated that the pretreatment of oil Fenton's reagent enhances the biodegradation of petroleum products. Given these results, it can be assumed that the Fenton reaction making available microbiological oxidation of about 50% of residual hydrocarbons.

Conclusion

The proposed method has the following advantages: high efficiency of water purification from organic impurities in the mode of oxidative degradation in the presence of hydrogen peroxide, namely improving the performance and effectiveness of the water purification process while reducing the cost of its implementation. The proposed method does not cause secondary pollution, increasing salinity.

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