

ELECTRO FENTON PROCESS: MODERN METHOD OF WASTEWATER TREATMENT

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Abstract: The non-biodegradable pollutants in waste water cannot be reduced by biological treatment. The amount of non-biodegradable pollutants is directly proportional to the chemical oxygen demand (COD) of water. To remove these pollutants tertiary treatment is adopted. From the long list of available processes, the advanced oxidation process is one of the best tertiary treatment method. The advanced oxidation process, though effective is not a green process.

A electro-Fenton (E-Fenton) process is develop, in which the desired pH for an effective E-Fenton reaction and for a neutral treated media could be obtained by utilizing the reaction released H^+ and OH^- instead of chemical addition. In the electro-Fenton process, chemical oxidation was the principal mechanism and contributed 75% of the total removal of COD. The pH adjustment not only allowed the E-Fenton reaction to occur in its favourable pH range, but also benefited any potential subsequent biological treatment process or a final discharge.

Keywords: Electro Fenton, Wastewater treatment, Degradation, Organic pollutant

INTRODUCTION

Advanced Oxidation processes are used to oxidize complex organic constituents found in wastewater that are difficult to degrade biologically into simpler end products. There are various processes used in AOP like ozonisation, oxidation with per magnet etc.

Fenton and Electro Fenton both processes are classified under advanced oxidation process (AOP). AOP is wastewater treatment technique in which highly oxidation agents used to oxidise the pollutants in wastewater.

Fenton reaction is commonly used method in waste water treatment. The classical Fenton reagent, consisting of the reactions between homogeneous Fe^{+2} catalysts and hydrogen peroxide (H_2O_2), is highly efficient for the reduction of COD due to the hydroxyl radicals generated by the Fenton reactions.

However, the classic Fenton processes require a strong acid condition ($pH < 3$) to avoid the hydrolysis of ferrous and ferric ions, and to achieve optimal removal rate of

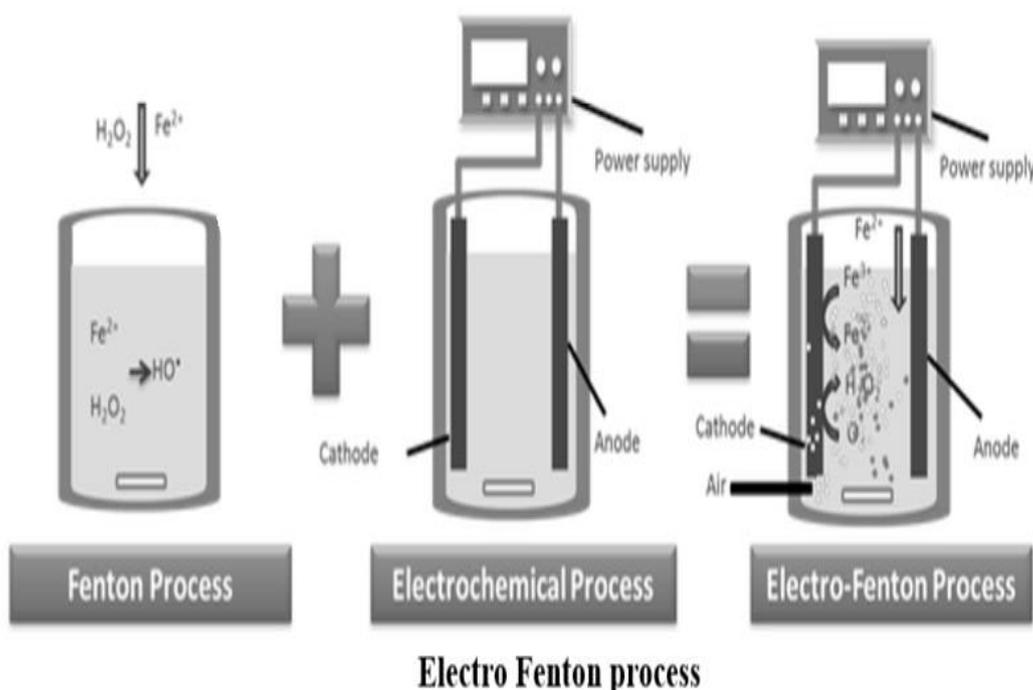
pollutants. Additionally, non-recyclable soluble iron salts yield large amount of iron oxide sludge, which needs further separation from the treated water.

Fenton process has high sludge generation and less efficient process for high COD reduction. To overcome this problem Electro Fenton is advancement in Fenton process.

Electro Fenton process consist of an electrolytic cell who regenerates the Fenton reagent (H_2O_2 and Fe^{+2}) in given reactor who continues the Fenton's reagents effect in system. It regenerates ferrous ion from ferric ion at anode and H_2O_2 at cathode by oxygen and hydroxyl ion.

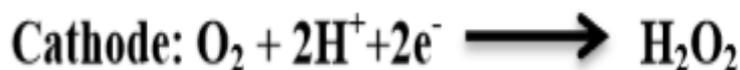
2. ELECTRO-FENTON PROCESS

Electro Fenton is one of the advanced oxidation process used in wastewater treatment technology. It is modified process of conventional Fenton process. It consists of electrolysis cell that regenerates Fenton reagent by electrochemical reaction between anode and cathode. Electro Fenton is basically electrochemical reaction which is combination of two reaction Fenton reaction and electrochemical oxidation (EO). This both reaction works in single reaction chamber. Fenton is a chemical reaction where EO is electrochemical reaction who oxidise the pollutant by electrochemical process.



3.MECHANISM OF PROCESS

The process starts with Fenton process in which Fenton reagent is dosing in reactor then current supply starts by any electric source. First conventional Fenton take place as per reaction number 1 & 2. Then electrochemical reaction starts at cathode and anode as per given reaction.



At anode ferric ion converts into ferrous ion by reduction and hydrogen peroxide is regenerated at cathode by electrochemical oxidation of oxygen gas. This way Fenton reagent regenerates in reactor.

As per researches Electro Fenton is dependent on the type of electrode. The electrode of process may sacrifice (active) like mild steel, iron or aluminium or neutral like platinum, stainless steel, titanium oxide. For commercial process titanium and stainless steel is economically suitable for plant and pilot scale projects.

INSTRUMENTS FOR ELECTRO-FENTON

1. Stainless steel 316 (SS-316) plate electrodes
2. DC power supplier (30V, 5A) variable power system
3. Magnetic stirrer
4. Glass Conical Flask 250ml
5. COD digester
6. Glassware

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