REMOVAL OF COD FROM TEXTILE MILL WASTEWATER BY ELECTRO-COAGULATION PROCESS USING SS/Al AS COMPOSITE HYDROGEL ELECTRODE

PROJECT REFERENCE NO.: 40S_BE_2289

COLLEGE : SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU
BRANCH : DEPARTMENT OF ENVIRONMENTAL ENGINEERING
GUIDE : DR. M. MAHADEVA SWAMY
STUDENTS : MS. UMMAIMA RIDA
           MS. SUMATHI C.R.
           MR. SAGAR GHATTI
           MR. BHUVAN S. GOWDA

Introduction:
Electrocoagulation process has been one of the most commonly being adopted in treating the industrial wastewaters due to the versatility and environmental compatibility. Electrocoagulation uses a direct current source between two metal electrodes immersed in the wastewaters. The electrical current causes the dissolution of anodes into the wastewater and the metal species is being released into the solution, at an appropriate pH, can form wide ranges of coagulated species and metal hydroxides. Under this condition the process will destabilize and aggregate the suspended particles or precipitate and adsorb dissolved contaminants. Dye-containing effluent can be toxic to the environment since dyes are stable compounds which are not easily biodegradable and they are liable to be carcinogenic. The range of COD values in a typical untreated textile–mill wastewater is 150 - 12,000 mg/L and color (Pt - Co) is 5 -2,500 (Ghaly et al., 2014). Electrocoagulation process has been used successfully to remove phenolic compounds, decolorize reactive dye solutions, clarify suspended clay solution, treat textile mill wastewater as well as to remove heavy metals from wastewaters. Several conventional methods such as; adsorption, biological treatment, oxidation, coagulation, and flocculation have been adopted to remove dye(s) from industrial wastewaters. Although these methods have been widely used, they have some drawbacks during regeneration of adsorbent, addition of chemical coagulants causes increase in COD concentration and generates large amount of chemical sludge. Electrocoagulation process has some advantages when compared to conventional methods such as; simple equipment, easy to operate, less retention time, reduction or absence of adding chemicals and less sludge production. However, these technologies are generally limited by their sacrificial anodes, easy passivation, low degradation efficiency or high costs. In addition, the application of these technologies to treat large volumes of dye bearing wastewaters which is not technically and economically feasible.

Zhang and Ma (2016) have conducted studies on the removal of alizarin red S by Fe/Al composite hydrogel electrode. The experimental results showed the COD removal efficiency of 83.8 % with an initial alizarin red S dye concentration of 300 mg/L. Infact, 99 % of decoloration was observed when the novel electrode system was used. Naje et al. (2015) have carried out studies on the performance of EC process by adopting titanium plates as cathode, which helps in oxidizing the dissolved dye(s) present in the textile mill wastewaters. Combined electrical
connections in the same reactor was adopted and the results of which showed a relatively high COD removal efficiency of 93.5% was noticed with an initial COD concentration of 990 mg/L and 97.5% of color removal was observed. Seema et al. (2016) have investigated the direct and indirect electrochemical oxidation of Malachite Green (MG) dye in acidic and basic medium using RuO$_2$-TiO$_2$ and Pt coated Ti mesh as electrodes. MG dye was completely decolorized and 98% of COD removal was observed with an initial concentration of 150 mg/L. Katal and Pahlavanzadeh (2010) have conducted the effective performance studies of EC technique on the treatment of paper mill wastewaters using different combination of Al and Fe electrodes. The removal efficiency of COD and color was more efficient in Al-Al and Fe-Fe combination, rather than Al-Fe or Fe-Al combinations. Naje and Abbas (2013) have performed the combination of EC-EO processes to treat the textile mill wastewaters and the best results were observed when Al and Ti coated with iridium oxide plates with an alternate electrode pack was used and COD removal efficiency was found to be 90% with an initial COD concentration of 985 mg/L and treated effluent COD concentration is 98.5 mg/L.

Most of the earlier studies focused on the removal of dye(s) using Fe, Al and SS electrodes in the Electrocoagulation - Electro oxidation process. However, not much work has been carried out using composite hydrogel electrode. Hence, in the present study it is proposed to conduct laboratory bench-scale electrocoagulation experiments using the sodium alginate hydrogel, a novel electrode on the removal of acid dye(s) from a textile mill wastewaters.

Objectives:

The main objective of the present study is to evaluate the efficiency of COD removal from textile mill wastewaters using Fe/Al composite hydrogel electrode in Electrocoagulation process. However, the specific objectives are as follows:

1. To characterize the textile mill wastewater for COD, BOD, pH, Conductivity, Chlorides, Turbidity and Color and also to fabricate the Fe/Al sodium alginate hydrogel electrode reactor using perspex glass material.
2. To determine the effect of operating parameters such as; pH, current density, electrolysis time, electrode spacing and initial COD concentration on the removal of COD from textile mill wastewaters.
3. To evaluate the performance of Electrocoagulation-Electro oxidation process on the removal of COD from textile mill wastewaters and to study the economy of the process by considering the electrode consumption and power consumption.