Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 24 (2016) 603 – 610

Procedia Technology

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

Control of Electrocoagulation Batch Reactor for Oil removal from Automobile Garage Wastewater

Harinarayanan Nampoothiri M.G[a], Manilal A.M[b]*, Soloman P.A[c]

[a].M.Tech Scholar, Department of Chemical Engineering, GEC Thrissur,680009, India
[b]Assistant Professor, Department of Chemical Engineering, GEC Thrissur,680009, India,
[c] Professor and Head, Department of Chemical Engineering, GEC Thrissur,680009, India,

Abstract

Wastewater from Automobile garages and workshops is an important contributor to the water pollution. Oil is one of the major content of wastewater from vehicle garages. The work focuses on the design of an electrocoagulation (EC) reactor for the removal of oil content in wastewater from Automobile garages with automation and control for efficient operation. The samples for the study were collected from Kerala State Road Transportation(KSRTC) Thrissur depot. Experimental study has been conducted to investigate the influence of various factors affecting electrooagulation. Major factors selected were current density, time of EC, salt concentration and pH on oil removal. The influence of these factors on percentage oil removal was found to be non-linear. Experiments were designed by Response Surface Method(RSM) and a nonlinear empirical relationship between percentage oil removal and input parameters was obtained. Responses were optimized using MINITAB software and these values were used in the control purpose. Control and automation of electrocoagulation process was developed with reaction time in the batch electrocoagulation reactor as the controlling variable. Power supply to the electrodes was also controlled with a level switch. Both inlet and outlet control were proposed for the efficient run of the batch EC reactor.

Peer-review under responsibility of the organizing committee of ICETEST – 2015

Keywords: Electrocoagulation; Response Surface Method; Control and automation

* Corresponding author. Tel: +919497412445
E-mail address: manilalam@gectcr.ac.in

Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.136

1. Introduction

Environmental pollution is a potential threat to living conditions in the earth. Overpopulation has resulted in the larger utilization of natural resources which paved the way for the increase of pollutions in the environment. Water conservation is one area which requires a significant attention[1].. In day to day life water is polluted in many ways. Industries are one of the major sources of water pollution. [2]. High levels of pollutants are present in industrial wastewater. Along with different metals and nonmetals, oil and grease has contributed largely to the water pollution. [3]. The impact of oil content in water is seen by modern scientists and separation of oil from water hence become highly important. Both the oil and grease are important for many fields like automotive, flour mills and so forth. The automobile service stations use large amount of water for washing and maintenance activities. Thus the mixing of water with oil particles is easily possible in these units. Water discharging from these automobile workshops and garages in large quantities causes water pollution especially in urban arenas[4] Water treatment is unnoticed in most of these vehicle garages and workshop. The task centers on enforcing an effective method for water treatment from automobile garages.

The main objective of the present work is to design a control system for the batch eletrocoagulation system for the oil removal process. Different parameters that influence the oil removal by electrocoagulation were analyzed for developing the control system for the optimal operation of the batch system. Wastewater from Kerala State Road Transport Corporation (KSRTC) Thrissur depot is taken for analysis. KSRTC depot Thrissur uses large quantities of water (10000 liters per day) and large quantity of oil contained wastewater is brought forth. Oil is one of the major content in this kind of wastewater. There are several methods available for oil removal from effluent, such as physical treatment, chemical handling, biological treatment, membrane treatment [3]. Electrocoagulation technique (EC) is one of the modern technologies in wastewater treatment. It is the combination of chemical and physical treatments [5]. It is an electrochemical method which applies the basic precepts of traditional water treatment [6]. In contrast to coagulation method in which particles known as coagulants are added to aggregate the pollutant, EC uses electrodes to release coagulants. Electrocoagulation has been under research for removal of pollutants from wastewater. Electrocoagulation includes the advantages like huge sludge production, process inefficiency, and necessity of further treatment mechanism. Electrocoagulation was successfully conducted for wastewater treatment. [7-13]. Hence the possibility of electrocoagulation treatment for smaller water treatment units like automobile garages is investigated. The viability of control and automation of the Electro coagulation based water treatment is investigated. Experimental design using Response Surface Methodology, a statistical tool, is used to develop combinations of influencing parameters for conducting the batch experiments. RSM can be used for empirical modeling of the system relating input and yield parameters. [14-16] A mathematical relationship between output term and input values with non linear terms can be developed using RSM.

2. Materials And Methods

2.1 Wastewater Characteristics

. The samples were collected from the workshop of the KSRTC Thrissur depot. Around 10000 litres of water per day is used for different purposes in the KSRTC workshop. The samples were analyzed. The COD of the sample1 was 540 mg/L a second sample was 1600 mg/L. Total solids were 220mg/L, Total Dissolved Solids (TDS)was 40mg/L and Total Suspended Solids was 180 mg/L. The pH of the water samples examined and found to be 6.2. All content in the sample was examined by fluorescence spectroscopy. The fluorescence peak is held between 300-340 nm. The excitation wavelength of oil is 337 nm. The density of the feed was 970 g/l