Sustainable Energy Technologies and Assessments 47 (2021) 101353

Contents lists available at ScienceDirect

Sustainable Energy Technologies and Assessments

journal homepage: www.elsevier.com/locate/seta

A systematic diagnosis of state of the art in the use of electrocoagulation as a sustainable technology for pollutant treatment: An updated review

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ARTICLE INFO

Keywords:
Electrocoagulation
Electrocoagulation-flotation
Contaminant removal
Operating conditions
Drinking and waste waters treatment

ABSTRACT

Electrocoagulation (EC) and electrocoagulation-flotation (ECF) are of widespread interest owing to their effectiveness for the simultaneous abatement of a broad range of pollutants in drinking and waste waters, but their capability can vary significantly depending on the operating conditions. The effect of operating conditions on the performance of EC has been the subject of much debate over the last few decades. This review aims to focus on the application of EC/ECF processes for pollutants removal under different operating conditions, emphasizing the principal issues that compose the foundation of EC/ECF. It has been found that the current density (typically 1–20 mA/cm^2), type of electrode (Al or Fe), and electrolysis time are the key process parameters that influence performance. Although some key mechanisms of pollutant abatement in EC/ECF processes have been identified, recent studies have begun to reveal how the underlying removal mechanisms using the EC/ECF processes depend on the nature of pollutant. Key mechanisms of pollutant abatement include charge neutralization, reduction–oxidation, and precipitation/co-precipitation. The development of improved or innovative cell designs, as well as systematic modeling of EC reactors, are needed. Future research focused on hybrid technologies with cost-effective energy supply may lead to innovative treatment options for wastewater treatment.

Introduction

One of the most significant global problems in today's industrialization, particularly in agriculture, is the contamination of water [1,2]. In the last few decades, the supply of fresh water, human development, and environmental protection became threatened by the ever-increasing industrial contamination [3,4]. Intensive research is being done for toxic pollutants mitigation from wastewater. These toxic pollutants include natural and synthetic organic pollutants as well as several heavy metals [5–8]. Hence, water treatment and reclamation are of increasing importance, and significant concern was given to environmental protection and human health issues. This can be achieved by applying efficient and cost-effective green technologies to remove pollutants from drinking and waste waters [9]. A broad range of conventional methods

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https://doi.org/10.1016/j.seta.2021.101353
Received 7 September 2020; Received in revised form 18 May 2021; Accepted 1 June 2021
Available online 17 June 2021