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Highlights

- Overview of research conducted surrounding the electrochemical regeneration of GAC
- Discusses the regenerative mechanism and theory behind electrochemical regeneration
- Varying reactor configuration and operating conditions affect regeneration outcomes
- Specifies industrial applications for which this technology may be used

Abstract

The electrochemical treatment of exhausted granular activated carbon (GAC) has been identified as an effective alternative to traditional adsorbent regeneration methods (e.g. thermal, chemical, and microbial). However, despite its proven potential and initial investigation over two decades ago, the development of this technology has been progressing slowly, hindering its deployment in industrial applications. Thus, a review has been conducted that aims to present the fundamentals of GAC electrochemical regenerative methods, what research has been conducted to develop the technology to the present day, and lastly, identify limitations and future prospects associated with electrochemical methods. The regenerative mechanism is firstly discussed, followed by a presentation of the varying reactor configurations and operating parameters utilized during the electrochemical treatment of GAC materials exhausted with a broad range of wastewater contaminants. Finally, emerging electrochemical technologies used for the commercial treatment of exhausted adsorbent materials and contaminated soils are discussed.

Keywords: Electrochemical, Granular Activated Carbon, Regeneration, Three-dimensional electrode

1 Introduction

The large surface area, microporous structure, and increased surface reactivity associated with granular activated carbon (GAC) [1,2] makes it one of the most powerful adsorbent materials used in purification processes. In the present day, industries such as oil and gas, pharmaceutical, and waste