



Oxidation and coagulation removal of COD from landfill leachate by Fered–Fenton process

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HIGHLIGHTS

- ▶ Fered–Fenton method was employed to remove COD from landfill leachate.
- ▶ COD removal by oxidation and coagulation was quantitatively determined.
- ▶ The effects of important parameters on COD removal were investigated.
- ▶ Changes in molecular weight cut-offs (MWCOS) during the process was analyzed.
- ▶ The organic components before and after treatment were identified by GC–MS.

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ABSTRACT

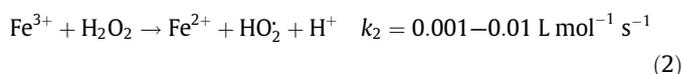
COD removal by oxidation as well as by coagulation during Fered–Fenton treatment of landfill leachate was quantitatively determined in this study. The effects of operating conditions such as H₂O₂ to Fe²⁺ mole ratio, Fenton's reagent dosage, initial pH, current density, inter-electrode gap and hydrogen peroxide feeding mode on COD removal was investigated. The results showed that COD removal by oxidation is dominant due to the high H₂O₂/Fe²⁺ mole ratio employed and the overall COD removal showed the same behavior as oxidation removal. The coagulation removal of COD increased with initial pH and ferrous iron dosage, but it was independent of current density and the inter-electrode gap at a fixed initial pH value and ferrous iron dose. Increasing Fenton's reagent dosage or decreasing the initial pH is likely to promote COD removal by oxidation. There existed an optimal H₂O₂/Fe²⁺ mole ratio, current density or inter-electrode gap to reach the highest COD removal efficiency by oxidation. The stepwise or continuous addition of hydrogen peroxide was more effective to oxidize organics than a single dose of hydrogen peroxide. Nearly all the organic compounds (>4 kDa) were degraded into smaller ones after Fered–Fenton treatment. GC–MS analysis was used to determine the organic compounds before and after the treatment.

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1. Introduction

Sanitary landfilling is the most common disposal alternative to eliminate municipal solid wastes (MSWs) in most countries [1–4]. In China, more than 80% of urban wastes are disposed of at landfill sites. Nevertheless, the leachate generated from landfills contains a variety of contaminants including dissolved organic matter, inorganic compounds, heavy metals and xenobiotic organic substances [1,2], which must be appropriately treated before being discharged into the environment. Although biological process is the most economical way for the treatment of young leachate (<1–2 years old) which contains a high fraction of small molecular biodegradable

organics, it becomes inefficient with the increasing age of the landfill, when the fraction of large molecular refractory organics increases [5–8]. This gives rise to the necessity of developing the efficient method to treat stabilized leachate (>10 years old). As an advanced oxidation process (AOP), Fenton reagent (H₂O₂/Fe²⁺) has been used for pre-treatment, post-treatment or full treatment of such leachate in the past decades due to its simplicity and inexpensive cost [7,9]. In the conventional Fenton process, ferrous ion is very slow to be regenerated after conversion to ferric ion [10–14],



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