Chapter 7
Concentrated Landfill Leachate Treatment by Electro-Ozonation

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ABSTRACT

Municipal solid waste has continued to be a major problem in many nations of the world. The primary methods of treating landfill leachate include physical-chemical and biological treatment processes. Pressure-driven membrane processes, such as microfiltration, ultrafiltration, nanofiltration, and reverse osmosis (RO), are among the utmost promising and capable ways for treating landfill leachate. The concentrated leachate created from pressure-driven membrane processes typically represents 13%–30% of total incoming landfill leachate. Concentrated leachate is a dark brown solution with high levels of pollutants. Treating concentrated leachate is extremely difficult, and thus, a combined treatment system is suggested. In the present study, concentrated landfill leachate was treated using a combined treatment technique that included electro-ozonation. The removal efficacies of chemical oxygen demand (COD), color, and nickel were monitored at original pH (7.3) as well as current and voltage of 4 A and 9 V, respectively.

DOI: 10.4018/978-1-5225-5766-1.ch007

INTRODUCTION

The rapid growth in volume and forms of solid and hazardous wastes as a result of continuous economic development, industrialization, and urbanization is an increasing problem faced by domestic and local governments in ensuring an efficient and sustainable waste management (Mojiri, 2014). A sanitary landfill is assessed based on environmental risk evaluation; planned size; designed cell advance; extensive site preparation; full leachate management; daily and final cover; full gas management; compaction; fence and gate; maintained record of waste volume, type, and resource; and absence of scavenging and trading. A main component of isolation is the management and treatment of leachates (Liermann, 2009). Sanitary landfills are the prevalent way of solid waste disposal. This method has benefits; however, their main drawback is leachate production that should be managed well.

Leachates are generated when moisture mixes with refuse in a landfill; pollutants are dissolved into the liquid phase, after which they accumulate and then percolate. Leachates vary from one landfill to another in the short- and long-terms periods because of variations in climate, hydrogeology, and waste composition. Improvements in landfill engineering are intended to reduce leachate production and collection, as well as improve treatment prior to discharge (Visvanathan et al., 2000).

The primary methods of landfill leachate treatments include physical–chemical and biological treatment processes. In general, combinations of physical, chemical, and biological techniques are applied because of the difficulty in obtaining satisfactory results by a single method (Aziz, 2011).

Biological treatment methods are including anaerobic and aerobic methods. Some of the most and popular physical/chemical methods are membrane filtration, ozonation, adsorption and electrochemical treatments. Goals of current chapter are (1) trends on electrochemical oxidation methods, ozonation methods and concentrated landfill leachate, and (2) investigate performance the electro-ozone reactor in treating concentrated landfill leachate.

LANDFILL LEACHATE

Moisture penetrates into the wastes in a landfill after a while we will have the landfill leachate. Characteristics of leachates differ from one landfill to another in the short- and long-terms periods due to differences in climate, hydrogeology, and waste composition (Visvanathan et al., 2000).

Landfill leachates are considered as wastewater that has the strongest environmental impact. The most significant feature of leachates is the high concentrations of particular contaminants.

Urban landfill leachates consist of contaminants that can be classified into four main groups as follows: (1) dissolved organic matter; (2) inorganic compounds such as calcium, potassium, sodium, ammonium, calcium, magnesium, sulfates, and chlorides; (3) iron and heavy metals such as nickel, lead, copper, chromium, cadmium, and zinc; and (4) xenobiotic organic materials (Aziz et al., 2011; Tengrui et al., 2007).

Concentrated Landfill Leachate

Concentrated leachate is a dark brown solution with a high chemical oxygen demand (COD) and a low biochemical oxygen demand (BOD) to COD ratio, which make it difficult to biodegrade (Zhang et al., 2013). Thus, a combined system should be used to treat concentrated leachate. Shengli et al. (2011)

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