

Chapter 12

Ozonation With Catalyst in Landfill Leachate Treatment

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ABSTRACT

Landfill leachate is a hazardous pollutant generated from a landfill site. Discharge of landfill leachate has caused a major contamination to the environment and detrimental to human health. This chapter introduces an alternative method to treat recalcitrant pollutant in leachate by using ozonation with catalyst. The production of hydroxyl radical in ozonation was not enough to oxidize complex molecular structure in the leachate. Theoretically, the addition of catalyst enhances the capacity of radical and accelerates the chemical reaction. The effectiveness of ozonation with Fenton (O_3 /Fenton), hydrogen peroxide (O_3/H_2O_2), and zirconium tetrachloride ($O_3/ZrCl_4$) in removing pollutant such as chemical oxygen demand (COD), color, and improvement of biodegradability by using this process were also discussed in this chapter. Comparison in term of treatment cost and benefits of the application of chemical as catalyst are briefly elaborated at the end of this chapter.

INTRODUCTION

The sanitary landfill has been practice worldwide as municipal solid waste (MSW) disposal. This method has become a favourite in most of the country due to the low cost and easy handled. In Malaysia, there are 296 landfills reported and about 166 are still operating. It was also noted that, out of the 166 operating landfills, only 11 of them are sanitary landfills and capable of preventing the landfill gas and leachate from escaping to the environment (Johari et al., 2014). The general composition of solid waste in landfill are food waste, plastic, paper, wood, textile, glass, rubber and metal as depicted in the Figure 1 (Aziz, 2016).

Variety sources of MSW in the landfill make the wastewater is more complex and difficult to be remediated. The by-product produce from landfill is called as landfill leachate. Meanwhile, the summary of landfill leachate characteristic at Alor Pongsu landfill site, Pulau Burung landfill site and Kulim landfill site, Malaysia is summarizes in the Table 1.

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Figure 1. General solid waste composition in Pulau Burung Landfill Site, Malaysia

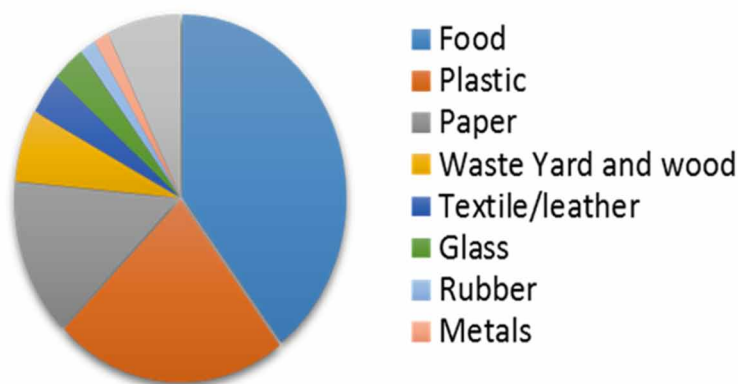


Table 1. Summary of leachate landfill characteristics at nearby landfill site

Parameter	Unit	Value	Location	MEQA*
Temperature	°C	29-33.5	Matang landfill site	40
		30.5-34.7	Pulau Burung landfill site	
pH		8.1-8.5	Pulau Burung landfill site	6.00-9.00
		8.05 - 8.66	Matang landfill site	
		7.59 - 8.25	Kulim landfill site	
Color	PtCo	2933-3615	Pulau Burung landfill site	-
		2220-6398	Matang landfill site	
		279-3029	Kulim landfill site	
COD	mg/L	1123-3180	Pulau Burung landfill site	400
		770 - 1456	Matang landfill site	
		110-1295	Kulim landfill site	
BOD ₅	mg/L	60-243	Pulau Burung landfill site	20
		100 - 257	Matang landfill site	
		29-285	Kulim landfill site	
NH ₃ -N	mg/L	620 - 2050	Pulau Burung landfill site	5
		500 -857	Matang landfill site	
		210 - 720	Kulim landfill site	
BOD ₅ /COD		0.05-0.10	Pulau Burung landfill site	-
		0.14 - 0.39	Matang landfill site	
		0.20-0.24	Kulim landfill site	
DO	mg/L	0.14	Pulau Burung landfill site	-
TDS	mg/L	5306	Pulau Burung landfill site	-

(Pulau Burung, Matang and Kulim landfill site) from 2010 until 2015 (Zin et al., 2012; Aziz and Bashir, 2015; Zakaria et al., 2015; Amr et al., 2013; Othman et al., 2010; Zainol et al., 2012; Zainol et al., 2011; Aziz et al., 2010)

*Environmental Quality (control of pollution from solid waste transfer station and landfill) Regulation 2009 under the Laws of Malaysia Environmental Quality Act (MEQA) 1974 (MDC, 1997).

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