

# Municipal Solid Waste Management Using Bioreactor Landfill in the Treatment of Organic Waste from Jatibarang Landfill, Semarang-Indonesia

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**Abstract.** Landfilling is one of the easiest methods to be applied in the management of municipal solid waste (MSW). In its development, bioreactor landfill methods that have various advantages over conventional landfill emerge. This experiment aims to study the use of bioreactor landfills for the management of organic waste in Jatibarang Landfill, Semarang-Indonesia. There are 4 bioreactor landfills operated: 2 anaerobic bioreactors with leachate recirculation and addition of water, and 2 aerobic bioreactors. Different results are shown from these two types of bioreactor, where aerobic bioreactors reach peak temperatures (55°C each) faster even though anaerobic bioreactors reach higher temperatures (60°C and 61°C respectively). Anaerobic bioreactors reach a higher final pH value than aerobes while the accumulation of nitrogen content from an aerobic bioreactor is 2 times higher than anaerobes.

Keywords: **Landfilling; Bioreactor Landfill; Aerob; Anaerob.**

## 1 Introduction

The Jatibarang Landfill, which is the final waste treatment facility in Semarang City, manages 4000 tons waste daily with a composition of 61.95% organic waste from the total municipal solid waste (MSW) produced. The Jatibarang Landfill still uses landfilling method as the waste management system, which still has an impact on the environment that affects water, soil, and air. This method is still often used due to the consideration of its use in managing organic and inorganic waste and low-cost requirements [1], [2]. Without better management, the resulting municipal waste can cause various kinds of environmental problems or become vectors of diseases caused by leachate, landfill gas, and municipal solid waste itself.

Landfill bioreactor appears as one of the appropriate technologies and is widely used to manage waste biologically, especially organic. The biodegradation process that occurs in the bioreactor of landfills can be accelerated by reusing the leachate produced to be recirculated back into the reactor. With this recirculation leachate, the quantity and quality of the leachate produced can be improved and the production of methane gas can be optimized, which can be reused to become alternative renewable energy [3,4,5]. Renewable energy from methane gas can be used to support the daily activities of people living near landfill locations.

There are various parameters taken into account in the biodegradation process that occurs in bioreactor landfills. Water content and pH level play an important role in conditioning the environment to make an ideal

condition for bacterial activity. With leachate recirculation and addition of water and aeration, these ideal conditions can be achieved [6]. These two factors also distinguish bioreactor landfills and conventional landfills [7]. In ideal conditions, the stabilization of solid waste can be reached faster because the development of bacteria rapidly occurs [8]. Faster biodegradation can give an impact on the rise of methane gas generation that can be reused and also reduce landfill usage [5]. According to [9], there are 3 types of bioreactor landfills, namely aerobic, anaerobic, and hybrid. Among them, anaerobic bioreactor is often used because the presence of methane gas generation during the biodegradation process, the second is aerobic bioreactor, able to support the occurrence of faster biodegradation due to the addition of aeration, while the hybrid bioreactor is a method that is still used in small amounts [6], [10].

The aim of this study is to investigate the quality of leachate formed during the decomposition process of leaves and vegetables, which was obtained from Jatibarang landfill, using aerobic and anaerobic landfill bioreactor. Some parameters to be examined are the temperature, pH value, and ammonia (NH<sub>3</sub>). This method is expected to be able to manage the potential of pollution from solid waste and leachate produced in Semarang City to the environment.

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