

## INTISARI

Sebuah instalasi pengolahan air limbah (IPAL) dibangun untuk mengolah air limbah *greywater* dan *blackwater* dari toilet dan kamar mandi umum *Wisdom Park* UGM yang terletak di Dusun Kuningan, Catur Tunggal, Sleman, Daerah Istimewa Yogyakarta. Unit reaktor proses IPAL tersebut terdiri dari sedimentasi, ekualisasi, aerasi 1, aerasi 2 dan *secondary clarifier* dengan sistem pengolahan berupa aerasi intermitten dan aerasi kontinyu dengan menggunakan *Microbubble Generator* (MBG) dan blower. Saat ini belum pernah dilakukan kajian terkait efektivitas sistem proses biologi pada IPAL dalam menurunkan kandungan organik dan nitrogen air limbah. Suatu sistem aerasi intermitten diaplikasikan dengan tujuan untuk mendegradasi kandungan organik dan nitrogen yang terkandung dalam air limbah, juga dapat meningkatkan dan meratakan suplai oksigen sehingga kemampuan penyerapan oksigen menjadi lebih besar. Evaluasi IPAL dilakukan selama 82 hari pengamatan dengan parameter air limbah yang diujikan terdiri dari COD,  $\text{NH}_3\text{-N}$ ,  $\text{NO}_3\text{-N}$ ,  $\text{NO}_2\text{-N}$ , dan  $\text{PO}_4\text{-P}$  yang nantinya akan dibandingkan dengan PerMenLHK No 68 Tahun 2016 tentang Baku Mutu Air Limbah Domestik.

Pada tangki aerasi 1 rerata *removal* COD sebesar 74,62 (19,38)%, *removal*  $\text{PO}_4\text{-P}$  sebesar 56,88 (10,52)%, *removal* total nitrogen sebesar 62,43 (12,45)%, efisiensi nitrifikasi sebesar 84,41 (12,38)% dan efisiensi denitrifikasi sebesar 72,42 (12,15)%. Sedangkan, total konsumsi energi yang dibutuhkan untuk pengolahan air limbah di IPAL dengan debit rerata 82,06 l/hari sebesar 49,27 kWh/m<sup>3</sup> dan biaya sebesar Rp 71.190,00/m<sup>3</sup>. Dengan konsumsi energi terbesar dihasilkan untuk peyisihan fosfat yaitu 3,42 kWh/g $\text{PO}_4\text{-P}$ , penyisihan total nitrogen sebesar 1,52 kWh/gTN, penyisihan ammonia sebesar 1,01 kWh/g $\text{NH}_3\text{-N}$ , dan penyisihan COD sebesar 0,8 kWh/gCOD.

**Kata Kunci:** aerasi intermitten, *microbubble generator*, nitrifikasi - denitrifikasi, total *removal*, konsumsi energi

## ABSTRACT

A wastewater treatment plant (WWTP) was built to treat greywater and blackwater from the public toilets and bathrooms of Wisdom Park UGM located in Dusun Kuningan, Catur Tunggal, Sleman, Special Region of Yogyakarta. The WWTP process reactor unit consists of sedimentation, equalization, aeration 1, aeration 2 and secondary clarifier with a processing system in the form of intermittent aeration and continuous aeration using a Microbubble Generator (MBG) and a blower. Currently, no study has been conducted regarding the effectiveness of the biological process system in WWTPs in reducing the organic and nitrogen content of wastewater. An intermittent aeration system is applied with the aim of degrading organic and nitrogen content contained in wastewater, as well as increasing and leveling oxygen supply so that oxygen absorption capacity becomes greater. The WWTP evaluation was carried out for 82 days of observation with the tested wastewater parameters consisting of COD,  $\text{NH}_3\text{-N}$ ,  $\text{NO}_3\text{-N}$ ,  $\text{NO}_2\text{-N}$ , and  $\text{PO}_4\text{-P}$  which will later be compared with the Minister of Environment and Forestry's Regulation No. 68, 2016 on Domestic Wastewater Quality Standards.

The results of the contaminant removal performance in aeration tank 1 and aeration tank 2 were not much different, indicating that the treatment in aeration tank 2 was not very effective. In aeration tank 1 the mean COD removal was 74,62 (19,38)%,  $\text{PO}_4\text{-P}$  removal was 56,88 (10,52)%, total nitrogen removal was 62,43 (12,45)%, nitrification efficiency was 84,41 (12,38)%, and denitrification efficiency was 72,42 (12,15)% in aeration tank 1. Meanwhile, the total energy consumption required for wastewater treatment at WWTP with an average discharge 82,06 l/day is 49,27 kWh/m<sup>3</sup> and a cost of Rp. 71.190,00/m<sup>3</sup>. Phosphate removal required the most energy, at 3,42 kWh/g $\text{PO}_4\text{-P}$ , followed by total nitrogen removal at 1,52 kWh/gTN, ammonia removal at 1,01 kWh/g $\text{NH}_3\text{-N}$ , and COD removal at 0,8 kWh/gCOD.

**Keywords:** intermittent aeration, micobubble generator, nitrification – denitrification, removal, energy consumption