

## INTISARI

IPAL komunal Mina Sehat di Desa Minomartani, Kecamatan Ngaglik, Kabupaten Sleman dibangun pada tahun 2012 untuk mengolah air limbah domestik dengan sistem pengolahan menggunakan *Anaerobic Baffled Reactor* (ABR) dan *constructed wetland*. Sejak bulan April 2015 unit *constructed wetland* berhenti beroperasi karena matinya tanaman yang digunakan dan timbul bau yang tidak sedap. Melihat kondisi di atas, maka dilakukan reaktivasi operasional *constructed wetland* untuk kemudian dilakukan evaluasi dan optimalisasi agar hasil kualitas air efluen limbah dari unit ABR IPAL komunal menjadi lebih baik.

Penelitian ini bertujuan untuk mengetahui efektivitas *constructed wetland* dalam menurunkan BOD, COD, amoniak, dan fosfat, mengevaluasi desain, dan meningkatkan kinerja *constructed wetland*. Penelitian dimulai dengan pengambilan data berupa pengukuran debit, pengukuran dimensi eksisting *constructed wetland*, penyiapan media, tanaman, aklimatisasi tanaman, dan operasional *constructed wetland* secara kontinyu. Penelitian dilakukan selama 45 hari dengan pengambilan sampel pada hari ke-0, 7, 14, dan 45. Parameter yang diuji adalah BOD, COD, amoniak, dan fosfat. Analisis data meliputi analisis debit, waktu detensi, *hydraulic loading rate* (HLR), *BOD loading rate*, efisiensi penurunan polutan, laju penurunan polutan, dan kemampuan tiap tanaman dalam menurunkan polutan dalam air limbah.

Hasil penelitian menunjukkan *constructed wetland* skala lapangan mampu menurunkan konsentrasi BOD sebesar 22,4% - 42,7%, COD sebesar 15,2% - 28,6%, amoniak (NH<sub>3</sub>) sebesar 0 - 25%, dan fosfat (PO<sub>4</sub>) sebesar 0 - 42,2%. Dari hasil evaluasi desain *constructed wetland* skala lapangan didapatkan hasil waktu detensi sebesar 2 jam, *loading rate* sebesar 3,68 m<sup>3</sup>/m<sup>2</sup>.hari, *BOD loading rate* = 1183,68 Kg/ha.hari. Dari hasil analisis perhitungan diketahui bahwa desain *constructed wetland* skala lapangan masih belum memenuhi kriteria desain. Berdasarkan hasil perhitungan laju penurunan polutan dan kemampuan tiap tanaman dalam menurunkan polutan dalam air limbah maka untuk meningkatkan kinerja *constructed wetland* dibutuhkan waktu detensi selama 19 jam atau jumlah tanaman kana sebanyak 265 batang. Dengan waktu detensi selama 19 jam maka *constructed wetland* mampu menurunkan BOD menjadi 5 mg/L, COD menjadi 23,44 mg/L, amoniak menjadi 0,01 mg/L, dan fosfat menjadi 0,07 mg/L. Dengan jumlah tanaman kana sebanyak 265 batang maka *constructed wetland* mampu menurunkan BOD menjadi 5 mg/L, COD menjadi 40,93 mg/L, amoniak (NH<sub>3</sub>) menjadi 0,013 mg/L, dan fosfat menjadi -8,86 mg/L.

**Kata kunci :** *Constructed Wetland*, Tanaman Kana, Efisiensi Penurunan, Evaluasi Desain, Kinerja

## ABSTRACT

Mina Sehat Communal Wastewater Treatment Plant (WWTP) in Minomartani, Ngaglik, Sleman, was established in 2012 to treat domestic wastewater by using Anaerobic Baffled Reactor (ABR) and constructed wetland processing systems. Since April 2015, the operation of constructed wetland unit was stopped due to the death of the plant used and smells. Perceiving such condition, operational reactivation of constructed wetland for evaluation and optimization later are performed to make the quality of wastewater effluent water from communal WWTP ABR unit better.

This study aimed at identifying the effectiveness of constructed wetland for BOD, COD, ammonia, and phosphate removal, evaluating design and improving the performance of constructed wetland. This study was begun by collecting data in form of discharge measurement, the measurement of the existing dimension of constructed wetland, the preparation of media, plants, plants acclimatization, and constructed wetland operational continuously. This study was undertaken for 45 days with data collection on 0<sup>th</sup>, 7<sup>th</sup>, 14<sup>th</sup>, and 45<sup>th</sup> days. Parameters tested were BOD, COD, ammonia, and phosphate. Data analysis comprised discharge analysis, detention time, hydraulic loading rate (HLR), BOD loading rate, efficiency of pollutants removal, pollutants removal rate, and the ability of each plant in pollutants removal in wastewater.

The result of the study shows that field scale constructed wetland is able to remove the concentration of BOD of 22,4% - 42,7%, COD of 15,2% - 28,6%, ammonia (NH<sub>3</sub>) of 0 - 25% and phosphate (PO<sub>4</sub>) of 0 - 42,2%. Based on the result of field-scale constructed wetland design evaluation, it is obtained detention time of 2 hours, loading rate of 3,68 m<sup>3</sup>/m<sup>2</sup>.day, BOD loading rate = 1183,68 Kg/ha.day. According to the result of estimation analysis, it is identified that field scale constructed wetland design still has not met the design criteria. In accordance with the estimation result of pollutants removal rate and the ability of each plant in pollutants removal in wastewater, to improve the performance of constructed wetland, it takes detention time for 19 hours or the number of *Canna indica* of 265 bunches. With detention time of 19 hours, constructed wetland is able to remove BOD level to 5 mg/L, COD to 23,44 mg/L, ammonia to 0,01 mg/L, and phosphate to 0,07 mg/L. With the number of *Canna indica* of 265 bunches then constructed wetland is able to remove BOD to 5 mg/L, COD to 40,93 mg/L, ammonia (NH<sub>3</sub>) to 0,013 mg/L, and phosphate to -8,86 mg/L.

**Keywords:** Constructed Wetland, Kana Plant, Efficiency of Removal, Design Evaluation, Performance