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Sistem Aerasi dalam Menurunkan Beban Organik pada Air Embung Techno Park
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ABSTRAK

Embung *Techno Park* dibangun sistem *inline* dengan aliran anak sungai Code. Pada awal desain, tujuan embung difungsikan sebagai kolam retensi limpasan air hujan saat musim penghujan, namun demikian saat musim kemarau fungsi embung bertambah sebagai kolam restorasi kualitas air sungai akibat buangan air limbah domestik dari masyarakat di sekitarnya. Tujuan penelitian ini mengkaji sejauh mana kualitas air embung dapat diperbaiki dengan bantuan teknologi aerasi.

Teknologi aerasi menggunakan 1 set *Microbubble Generator* (MBG) dengan 3 *nozzle* dan pompa celup yang terapung pada kedalaman 40 cm di tengah embung. Profil DO diukur pada radius 0,5 m, 2 m, dan 5 m dengan sudut 60^o dari aerator; dan kedalaman 1 m dari dasar embung dalam 3 periode pengukuran. Efisiensi kerja MBG dihitung dari rerata profil DO pengukuran periode 1. DO diurnal diukur akibat supersaturasi pada periode 3. Kondisi supersaturasi kualitas air embung diverifikasi dengan metode status trofik dari pengukuran Fosfat. Selain DO, kinerja aerasi pada embung juga diukur dari parameter COD di *inlet* dan *outlet* embung. Debit anak sungai/aliran drainase ke *inlet* embung diukur pada 3 periode pengukuran kualitas airnya.

Aerator 3 *nozzle* MBG berdaya listrik 100 watt mampu mentransfer O_2 rerata harian = 1,13 kgO_2/hari, efisiensi = 0,95 kgO_2/kWh pada luas permukaan embung 952,35 m^2 dan volume air sebesar 695,97 m^3. Aerasi selama 24 jam pada periode 3 menghasilkan fluktuasi DO diurnal dengan rerata kenaikan DO (k_1) = 0,2575/jam pada siang hari dan pada malam hari penurunan DO (k_2) = 0,2370/jam. Indikasi adanya pemakaian O_2 yang cukup tinggi di malam hari oleh mikroorganisme/tumbuhan berklorofil terverifikasi dengan status trofik perairan yang hipereutrofik. Secara umum, 3 *nozzle* MBG efektif meningkatkan DO rerata pada periode 1 dan 2 berturut-turut adalah 1 mg/l dan 0,78 mg/l dengan standar deviasi masing-masing 0,30 mg/l dan 0,25 mg/l. Rerata COD *removal* pada periode 1 dan 2 berturut-turut adalah 35,11% (COD_{inlet} 13,47 mg/l) dan 35,11% (COD_{inlet} 13,47 mg/l). Pada periode 3 teramati kondisi hipereutrofik dimana terjadi peningkatan DO rerata 2,31 mg/l (standar deviasi 1,56 mg/l), dengan fluktuasi COD_{inlet} rerata 18,79 mg/l (standar deviasi 13,56 mg/l) dan COD_{outlet} rerata 14,38 mg/l (standar deviasi 2,94 mg/l).

Kata kunci: Aerasi, *Microbubble Generator* (MBG), Status trofik, COD *removal*

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ABSTRACT

Techno Park basin was built as an inline system with the small Code tributary. The main purpose of the basin was to function as a retention basin for surface runoff during the rainey season, however, during the dry season the function of the basin increased as to restore water quality due to domestic wastewater discharge from the surrounding community. The purpose of this study was to assess the extent to which water quality of the basin can be improved with the help of aeration technology.

The aeration technology applied was 1 set of Microbubble Generator (MBG) constructed using a submersible pump and installing three horizontal nozzles at a depth of 40 cm from the water surface. DO concentrations profiles were measured the inlet & outlet; at distances of 0.5 m, 2 m and 5 m from the aerator (with a spread angle of 60^o); the depth of 1 m below surface water; and the bottom of the basin. The average of DO concentration profiles in period 1 were to determine MBG efficiency. Diurnal DO was measured due to supersaturation in period 3. During hours of day light the DO increases exponentially and then during the night it decreases exponentially, where k_1 and k_2 are the time constants for this daily raise and fall. The supersaturation verified by the status of trophic water basin from Phosphate measurements. The aeration performance in the basin was also measured from the COD parameters in the inlet and outlet. Discharge measurements were carried out on the tributary/drainage channel going to the inlet basin in 3 periods of water quality measurements.

Aerator 3 nozzle MBG with power of 100 Watt was capable of transferring an average daily oxygen of 1.13 kgO_2/day with an aerator efficiency of 0.95 kgO_2/kWh on the surface area of the basin 952.35 m^2 and a water volume of 695.97 m^3. Indications of the use of O_2 which was quite high at night by microorganisms/chlorophyll plants were verified with water trophic status of hypereutrophic. The 3 MBG nozzles effectivelly increased the average DO in periods 1 and 2 at about 1 mg/l and 0.78 mg/l with standard deviations of 0.30 mg/l and 0.25 mg/l respectively. The mean COD removal in periods 1 and 2 were 35.11% (COD_{inlet} 13.47 mg/l) and 35.11% (COD_{inlet} 13.47 mg/l) respectively. In period 3, hypereutrophic conditions were observed where an average DO increased of 2.31 mg/l (standard deviation of 1.56 mg/l), with average COD_{inlet} fluctuations of 18.79 mg/l (standard deviation of 13.56 mg/l) and average COD_{outlet} of 14.38 mg/l (standard deviation 2.94 mg/l).

Keywords: Aeration, *Microbubble Generator* (MBG), Trophic status, COD removal