# Evaluasi Pendekatan Skema Pemodelan Parameter BOD, COD, dan DO di Danau Mahoni, Universitas Indonesia = Evaluation of Modeling Scheme Approaches for BOD, COD, and DO Parameters in Mahoni Lake, Universitas Indonesia

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Abstrak

Danau Mahoni Universitas Indonesia merupakan danau terbesar dari enam sistem danau di lingkungan Kampus UI Depok. Berdasarkan Rencana Induk Sistem Penyediaan Air Minum (RISPAM), danau ini direncanakan sebagai sumber air baku bagi Instalasi Pengolahan Air (IPA) karena dinilai memiliki kualitas, kuantitas, dan aksesibilitas yang memadai. Selain itu, Danau Mahoni juga berperan penting dalam sistem drainase kampus serta sebagai kawasan konservasi air. Namun, beban pencemar organik dari permukiman dan aktivitas kampus berpotensi menurunkan kualitas air dan menghambat fungsi danau secara optimal. Penelitian ini bertujuan untuk memodelkan distribusi spasial dan temporal parameter Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), dan Dissolved Oxygen (DO), serta mengevaluasi fungsi danau sebagai badan air penerima limbah berdasarkan simulasi selama 48 jam. Pemodelan dilakukan menggunakan tiga pendekatan, yaitu Completely Mixed Flow Reactor (CMFR), Plug Flow Reactor (PFR), dan Finite Difference Method (FDM), dengan mempertimbangkan reaksi deoksigenasi dan reaerasi. Hasil simulasi menunjukkan bahwa ketiga pendekatan mengidentifikasi konsentrasi tertinggi BOD (>10 mg/L) dan COD (>40 mg/L) di segmen hulu, yang menurun secara bertahap ke arah hilir hingga mendekati 5 mg/L (BOD) dan 16 mg/L (COD), dengan DO meningkat dari 5 mg/L menjadi 8 mg/L. Model FDM memberikan resolusi spasial tertinggi dan tingkat akurasi terbaik, yang memberikan nilai dan pola konsentrasi paling mendekati kondisi aktual dengan nilai MAPE 7,51% untuk COD, dan 24,62% untuk BOD, dan 58,17% untuk DO. Secara keseluruhan, Danau Mahoni menunjukkan kapasitas pemulihan yang cukup baik terhadap pencemar organik, dengan FDM direkomendasikan untuk analisis spasial mendetail.

.....Mahoni Lake, located within the Universitas Indonesia Depok Campus, is the largest among the six interconnected lake systems in the area. According to the Master Plan for Drinking Water Supply System (RISPAM), the lake is designated as a raw water source for the Water Treatment Plant (WTP) due to its favorable quality, quantity, and accessibility. In addition, Mahoni Lake serves a critical role in the campus drainage system and functions as a water conservation area. However, organic pollutant loads originating from surrounding residential areas and campus activities pose a potential threat to water quality and may impair the lake's optimal functions. This study aims to model the spatial and temporal distribution of Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Dissolved Oxygen (DO), as well as evaluate the lake’s role as a receiving water body through a 48-hour simulation. Modeling was conducted using three approaches: Completely Mixed Flow Reactor (CMFR), Plug Flow Reactor (PFR), and the Finite Difference Method (FDM), taking into account deoxygenation and reaeration processes. Simulation results indicate that all three approaches consistently identified the highest concentrations of BOD (above 10 mg/L) and COD (above 40 mg/L) in the upstream segment, gradually decreasing downstream to approximately 5 mg/L for BOD and 16 mg/L for COD, accompanied by a DO increase from 5 mg/L to 8 mg/L. The FDM model yielded the highest spatial resolution and accuracy, producing

concentration values closest to actual conditions, with MAPE values of 7.51% for COD, 24.62% for BOD, and 58.17% for DO. Overall, Mahoni Lake demonstrates a considerable self-purification capacity for organic pollutants, with the FDM approach recommended for detailed spatial analysis.