

Evaluasi Pendekatan Skema Pemodelan Pencemar Nitrogen di Danau Mahoni, Universitas Indonesia = Evaluation of Nitrogen Pollution Modeling Scheme Approach in Mahoni Lake, Universitas Indonesia

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Abstrak

Pencemaran nitrogen anorganik seperti amonia, nitrit, dan nitrat di Danau Mahoni, Universitas Indonesia, menjadi perhatian utama akibat aktivitas domestik dan lingkungan sekitarnya. Penelitian ini bertujuan mengevaluasi efektivitas tiga pendekatan pemodelan: Metode Beda Hingga (Finite Difference Method/FDM), Complete-Mix Flow Reactor (CMFR), dan Plug Flow Reactor (PFR), dalam memodelkan distribusi spasial-temporal pencemar nitrogen. Danau dibagi ke dalam beberapa segmen berdasarkan distribusi sumber pencemar dan arah aliran dominan. Data yang digunakan berupa data sekunder hasil pengukuran konsentrasi parameter kualitas air selama tiga hari berturut-turut pada enam titik, dengan dua kali pengamatan harian (pagi dan siang). Ketiga pendekatan dijalankan dengan masukan dan kondisi batas yang sama, dan dilakukan evaluasi terhadap kinerja pemodelan. Namun, validasi model terhadap data observasi menggunakan nilai Mean Absolute Percentage Error (MAPE) hanya dilakukan untuk pendekatan FDM dan CMFR. Hasil menunjukkan bahwa FDM memberikan akurasi lebih baik untuk parameter amonia (MAPE: 10,72%) dan nitrit (34,00%), sementara CMFR lebih unggul dalam pemodelan nitrat (MAPE: 9,27%). Meskipun belum mempertimbangkan difusi lateral dan sedimentasi, pendekatan FDM dinilai paling mampu menangkap dinamika spasial pencemar nitrogen di danau tertutup.

.....Inorganic nitrogen pollution, such as ammonia, nitrite, and nitrate, in Mahoni Lake at Universitas Indonesia has become a major concern due to domestic and surrounding environmental activities. This study aims to evaluate the effectiveness of three modeling approaches: the Finite Difference Method (FDM), the Complete Mix Flow Reactor (CMFR), and the Plug Flow Reactor (PFR), in simulating the spatial and temporal distribution of nitrogen pollutants. The lake was divided into several segments based on the distribution of pollutant sources and dominant flow directions. The data used were secondary data obtained from water quality measurements conducted over three consecutive days at six sampling points, with two observations taken daily (morning and afternoon). All three approaches were executed using the same input and boundary conditions, and their modeling performance was comparatively evaluated. However, model validation against observational data using the Mean Absolute Percentage Error (MAPE) was only applied to the FDM and CMFR approaches. The results showed that FDM provided better accuracy for ammonia (MAPE: 10.72%) and nitrite (34.00%), while CMFR was superior in modeling nitrate (MAPE: 9.27%). Although lateral diffusion and sedimentation processes were not yet considered, the FDM approach was found to be the most capable of capturing the spatial dynamics of nitrogen pollutants in a closed lake system.