ABSTRACT

TWO-DIMENSIONAL ADVECTION-DIFFUSION PARTICLE DISTRIBUTION MODEL WITH CRANK NICOLSON-ALTERNATING DIRECTION IMPLICIT METHOD IN WASTE STABILIZATION PONDS

By

Rossalina Albasatin

NIM   : 24010122420007

Master of Mathematics, Faculty of Science and Mathematics, Diponegoro University

The phenomenon of particle distribution in waste stabilization ponds can be represented in a two-dimensional partial differential equation. In this study, the distributed particles are represented by Biochemical Oxygen Demand (BOD). The constructed model is a two-dimensional advection-diffusion model that will be solved by the Crank Nicolson-Alternating Direction Implicit (ADI) method. The Crank Nicolson method is used to discretize the time and the ADI method is used to discretize the space of differential equations. The model modification obtained will be tested for stability with the Von Neumann method and simulation with Matlab and python software. Particle distribution in the pond shows an advection process that dominates in the area around the inlet and edge of the pond. The diffusion process is seen when the particle distribution reaches the center of the pool. The analysis test results show that the advection-diffusion model is consistent with the second-order differential equation. The CN-ADI method applied to the 2D advection-diffusion model shows unconditional stability. Based on the analysis conducted, it is known that the advection-diffusion mechanism using the CN-ADI method in this study is consistent, stable, and convergent.

Keywords: partial differential equation, Crank Nicolson method, alternating direction implicit method, BOD, advection-diffusion model