KEMAMPUAN BIOCHAR BAMBU UNTUK MENGADSORPSI INSEKTISIDA BERBAHAN AKTIF DIMETOAT PADA INCEPTISOL

SKRIPSI

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Abstrak

Tanah Inceptisol memiliki kesuburan yang rendah dan kemampuan terbatas dalam menyerap senyawa organik seperti insektisida berbahan aktif dimetoat. Hal ini menyebabkan akumulasi residu pestisida yang dapat mencemari lingkungan dan membahayakan kesehatan manusia. Penelitian ini bertujuan untuk mengevaluasi kemampuan biochar bambu dalam mengadsorpsi dimetoat pada tanah Inceptisol. Biochar dibuat melalui proses pirolisis bambu dan dicampurkan ke dalam Inceptisol sebanyak 2% dari berat tanah (setara 40 ton/ha). Penelitian dilakukan menggunakan metode kesetimbangan batch dengan variasi konsentrasi dimetoat (200, 2.000, dan 20.000 mg/L), lalu dianalisis dengan pendekatan isoterm Langmuir dan Freundlich. Hasil menunjukkan bahwa kombinasi Inceptisol dan biochar bambu mampu meningkatkan pH, kadar C-organik, dan kapasitas tukar kation (KTK) tanah secara signifikan. Adsorpsi dimetoat paling optimal terjadi pada perlakuan Inceptisol + biochar bambu pada konsentrasi 2.000 mg/L, dengan nilai kapasitas adsorpsi (Qe) sebesar 77 mg/g, efisiensi adsorpsi (R) 95,79%, dan koefisien distribusi (Kd) 909,12 L/kg. Model isoterm Langmuir menunjukkan kesesuaian lebih baik dibanding Freundlich. Penelitian ini menyimpulkan bahwa biochar bambu merupakan adsorben potensial dan ramah lingkungan dalam mengendalikan residu insektisida dimetoat di tanah Inceptisol.

Kata kunci: Adsorpsi , Biochar bambu, Dimetoat, Inceptisol, Isoterm Langmuir

CAPACITY OF BAMBOO BIOCHAR FOR ADSORPTION OF DIMETHOATE-BASED INSECTICIDE ON INCEPTISOL

Abstract

Inceptisols exhibit low fertility and limited capacity to adsorb organic compounds such as dimethoate, an active compounds of insectiside. This condition leads to the accumulation of pesticide residues, which may contaminate the environment and pose risks to human health. This study was aimed to evaluate the adsorption capacity of bamboo biochar for dimethoate adsorption in Inceptisols. Bamboo biochar was produced through pyrolysis and applied at 2% of the soil weight (equivalent to 40 tons/ha). The experiment was conducted using a batch equilibrium method with varying dimethoate concentrations (200, 2,000, and 20,000 mg/L), and analyzed using Langmuir and Freundlich isotherm models the parameters analyzed were. The results demonstrated that the combination of Inceptisol and bamboo biochar significantly increased soil pH, organic carbon content, and cation exchange capacity (CEC). The highest adsorption occurred in the Inceptisol + bamboo biochar treated by 2,000 mg/L dimethoate, with an adsorption capacity (Qe) was 77 mg/g, adsorption efficiency (R) was 95.79%, and a distribution coefficient (Kd) was 909.12 L/kg. The Langmuir isotherm model showed a better fit compared to the Freundlich model, confirming that the adsorption process occured as a monolayer on a homogeneous surface. This study concluded that bamboo biochar was a potential and environmentally friendly adsorbent for controlling dimethoate residues in Inceptisols.

Keywords**:** Adsorption, Bamboo biochar, Dimethoate, Inceptisols, Langmuir isotherm