RINGKASAN

Kontaminasi logam berat kadmium (Cd) pada lahan pertanian meningkat seiring dengan penggunaan pupuk dan pestisida anorganik yang berlebihan dan pesatnya perkembangan industri. Dampak dari hal tersebut menghasilkan pencemar tanah/air yang masuk ke sumber irigasi pertanian dan menyebabkan tanaman budidaya tercemar logam berat. Upaya penanggulangan cemaran logam berat tersebut yaitu penerapan bakteri bioremediasi dan menggunakan bahan organik yang dapat memperbaiki sifat tanah. Penelitian ini bertujuan untuk mengetahui pengaruh aplikasi konsorsium *Bacillus* sp. dan asam humat terhadap penurunan kadar kadmium (Cd) pada tanah dan pertumbuhan tanaman pakcoy.

Penelitian ini dilaksanakan di *screenhouse* Desa Kebanggan pada Agustus – Desember 2023. Penelitian ini menggunakan Rancangan Acak Kelompok (RAK) dengan 2 faktor. Faktor pertama adalah perlakuan konsorsium *Bacillus* sp. yaitu M0 = tanpa bakteri, M1 = konsorsium isolat SJ3 + CR1, M2 = konsorsium isolat BR2 + SJ3 + CR1. Faktor kedua adalah asam humat dengan dosis A1 = 10 kg/ha ≈ 0,0225 g/polibag, A2 = 20 kg/ha ≈ 0,045 g/polibag, dan A3 = 30 kg/ha ≈ 0,0675 g/polibag. Kedua faktor tersebut dikombinasikan menjadi 9 kombinasi perlakuan. Perlakuan diulang 3 kali dengan 3 plot tanaman hingga didapatkan 81 unit percobaan. Variabel yang diamati adalah kandungan Cd akhir tanah, kandungan Cd pada tanaman pakcoy, kadar klorofil total, tinggi tanaman, jumlah daun, luas daun, dan bobot segar. Data kualitatif dianalisis deskriptif dan data kuantitatif dianalisis menggunakan sidik ragam taraf kepercayaan 95%.

Kandungan Cd awal tanah telah dianalisis (sebelum aplikasi) yaitu 0,4814 mg/kg. Berdasarkan hasil penelitian, perlakuan aplikasi konsorsium *Bacillus* sp. (M1 dan M2) dan asam humat dosis 10, 20, 30 kg/ha memberi pengaruh pada penurunan kandungan Cd tanah. Hasil terendah kandungan Cd akhir tanah yaitu 0,2864 ppm pada perlakuan konsorsium *Bacillus* sp. kode SJ3 + CR1 dan asam humat dosis 30 kg/ha (M2A3), dimana kadar Cd akhir tanah tersebut lebih rendah dibandingkan kandungan Cd awal tanah. Perlakuan aplikasi konsorsium *Bacillus* sp. (M1 dan M2) dan asam humat dosis 10, 20, 30 kg/ha memberikan hasil kandungan Cd tanaman lebih rendah dibandingkan perlakuan asam humat dosis 10, 20, 30 kg/ha tanpa aplikasi konsorsium *Bacillus* sp. Hasil terendah kandungan Cd tanaman yaitu 0,0190 ppm pada perlakuan konsorsium *Bacillus* sp. kode SJ3 + CR1 dan asam humat dosis 30 kg/ha (M2A3). Hal ini membuktikan bahwa aplikasi konsorsium *Bacillus* sp. (M1 dan M2) dan asam humat dosis 10, 20, 30 kg/ha lebih efektif dalam menghambat penyerapan Cd pada tanaman dibandingkan aplikasi asam humat dosis 10, 20, 30 kg/ha tanpa perlakuan konsorsium *Bacillus* sp. Hal ini membuktikan bahwa aplikasi konsorsium *Bacillus* sp. dan asam humat dapat menurunkan kandungan Cd pada tanah serta menghambat penyerapan Cd pada tanaman. Namun, aplikasi konsorsium *Bacillus* sp. dan asam humat belum efektif meningkatkan pertumbuhan tanaman pakcoy.

Kata kunci: asam humat, bakteri, logam berat, kadmium, pakcoy

SUMMARY

Cadmium (Cd) heavy metal contamination in agricultural land increases along with the excessive use of inorganic fertilizers and pesticides and the rapid development of industry. The impact of this results in soil/water pollutants entering agricultural irrigation sources and causing cultivated plants to be contaminated with heavy metals. Efforts to overcome heavy metal contamination include the application of bioremediation bacteria and using organic materials that can improve soil properties. This study aims to determine the effect of the application of a consortium of Bacillus sp. and humic acid on reducing cadmium (Cd) levels in the soil and the growth of pak choy plants.

This research was conducted at the Kebanggan Village screenhouse in August - December 2023. This study used a Randomized Block Design with 2 factors. The first factor is the treatment of the Bacillus sp. consortium, namely M0 = without bacteria, M1 = consortium of isolates SJ3 + CR1, M2 = consortium of isolates BR2 + SJ3 + CR1. The second factor is humic acid with doses of A1 = 10 kg/ha ≈ 0.0225 g/polybag, A2 = 20 kg/ha ≈ 0.045 g/polybag, and A3 = 30 kg/ha ≈ 0.0675 g/polybag. The two factors are combined into 9 treatment combinations. The treatment was repeated 3 times with 3 plant plots until 81 experimental units were obtained. The variables observed were the final Cd content of the soil, Cd content in pak choy plants, total chlorophyll content, plant height, number of leaves, leaf area, and fresh weight. Qualitative data were analyzed descriptively and quantitative data were analyzed using a 95% confidence level analysis of variance.

The initial Cd content of the soil has been analyzed (before application) which is 0.4814 mg/kg. Based on the results of the study, the application treatment of the Bacillus sp. consortium (M1 and M2) and humic acid doses of 10, 20, 30 kg/ha have an effect on reducing the Cd content of the soil. The lowest result of the final Cd content of the soil was 0.2864 ppm in the treatment of Bacillus sp. consortium code SJ3 + CR1 and humic acid dose of 30 kg/ha (M2A3), where the final Cd content of the soil was lower than the initial Cd content of the soil. The application treatment of Bacillus sp. consortium (M1 and M2) and humic acid doses of 10, 20, 30 kg/ha gave lower Cd content results in plants compared to the treatment of humic acid doses of 10, 20, 30 kg/ha without the application of the Bacillus sp. consortium. The lowest result of the Cd content of the plant was 0.0190 ppm in the treatment of Bacillus sp. consortium code SJ3 + CR1 and humic acid dose of 30 kg/ha (M2A3). This proves that the application of the Bacillus sp. consortium. (M1 and M2) and humic acid doses of 10, 20, 30 kg/ha are more effective in inhibiting Cd absorption in plants compared to the application of humic acid doses of 10, 20, 30 kg/ha without Bacillus sp. consortium treatment. This proves that the application of Bacillus sp. consortium and humic acid can reduce Cd content in the soil and inhibit Cd absorption in plants. However, the application of Bacillus sp. consortium and humic acid has not been effective in increasing the growth of pak choi plants.

Key words: bacteria, cadmium, heavy metals, humic acid, pak choy