

RINGKASAN

Air limbah merupakan salah satu produk sisa yang dihasilkan dari kegiatan industri yang harus dikelola dengan baik. Bioremediasi merupakan salah satu metode pengelolaan air limbah menggunakan bantuan organisme. Penggunaan mikroba hidup dalam proses bioremediasi air limbah memiliki kekurangan, yaitu ketergantungan terhadap kondisi lingkungannya. Metabolit sekunder merupakan yang dihasilkan organisme dan tidak berperan langsung dalam pertumbuhan yang memiliki potensi untuk mendegradasi polutan dalam air limbah industri. Bio P60 merupakan biopestisida yang mengandung metabolit sekunder *Pseudomonas fluorescens* P60. Bio P60 belum pernah diaplikasikan untuk meremediasi air limbah industri sehingga perlu adanya pengkajian mengenai hal tersebut. Penelitian ini bertujuan untuk mengetahui pengaruh 1) konsentrasi Bio P60 dalam meremediasi air limbah industri Jababeka, 2) lama waktu inkubasi dalam meremediasi air limbah industri Jababeka, dan 3) hasil remediasi air limbah industri Jababeka terhadap pertumbuhan tanaman jagung.

Penelitian ini dilaksanakan di *Greenhouse* dan Laboratorium Perlindungan Tanaman, Fakultas Pertanian, Universitas Jenderal Soedirman, Purwokerto pada Desember 2024 - April 2025. Pengambilan sampel air limbah dilakukan di *Wastewater Treatment Plant* (WWTP) 2 Kawasan Industri Jababeka, Cikarang pada tanggal 14 Agustus 2024. Penelitian ini disusun menggunakan Rancangan Acak Kelompok (RAK) non-faktorial secara *in-planta*. Sebelum uji *in-planta*, dilakukan uji pendahuluan remediasi limbah industri dengan Bio-P60 secara *in-vitro*. Uji pendahuluan terdiri atas 7 kombinasi variasi konsentrasi Bio-P60 dan lama waktu inkubasi. Konsentrasi Bio-P60 yang digunakan yaitu 5 mL/L dan 10 mL/L dengan lama waktu inkubasi 2, 4, dan 6 minggu, serta kontrol tanpa inkubasi dan tanpa pemberian Bio-P60. Uji *in-planta* terdiri atas 7 perlakuan, 4 kali ulangan, dan 3 tanaman setiap ulangan sehingga diperoleh 84 unit percobaan. Variabel yang diamati, yaitu COD, BOD, kadmium (Cd), pH, tinggi tanaman, jumlah daun, luas daun, warna daun, panjang akar, bobot tanaman segar, bobot tanaman kering, dan serapan Cd pada daun.

Berdasarkan hasil penelitian diketahui bahwa konsentrasi Bio P60 5 mL/L dan inkubasi 2 minggu mampu menurunkan polutan BOD, COD, dan logam Cd dengan masing-masing penurunan sebesar 93,22 %, 67,24 %, dan 53,92 %. Perlakuan Bio P60 juga mampu menaikkan nilai pH sebesar 48,8%. Namun, nilai BOD dan COD masih berada di atas baku mutu yang telah ditetapkan. Hasil pengamatan evaluasi hasil remediasi menggunakan jagung manis sebagai tanaman indikator menunjukkan bahwa perlakuan Bio P60 memberikan pengaruh yang berbeda nyata terhadap pertumbuhan tanaman jagung, kecuali pada warna daun dan kadar Cd pada daun yang tidak terdeteksi. Hasil remediasi menggunakan Bio P60 mampu meningkatkan tinggi tanaman sebesar 25,65 %, jumlah daun sebesar 14,86 %, luas daun sebesar 34,07 %, panjang akar sebesar 17,15 %, bobot segar tanaman sebesar 17,5 %, bobot kering tanaman sebesar 22 % dibandingkan dengan kontrol.

SUMMARY

Wastewater is one of the residual products generated from industrial activities that must be treated properly. Bioremediation is a method for managing wastewater using organisms. The use of living microbes in the bioremediation process has drawbacks, such as dependence on environmental conditions. Secondary metabolites are compounds produced by organisms that are not directly involved in growth and have the potential to degrade pollutants in industrial wastewater. Bio P60 is a biopesticide containing secondary metabolites from *Pseudomonas fluorescens* P60. Bio P60 has never been applied to remediate industrial wastewater thus, its potential for wastewater remediation merits further research. This research aimed to determine the effect of 1) Bio P60 concentration in remediating Jababeka industrial wastewater, 2) incubation period in remediating the wastewater, and 3) remediated wastewater on the growth of maize.

This research was conducted in the greenhouse, Plant Protection Laboratory, Faculty of Agriculture, Jenderal Soedirman University, Purwokerto, from December 2024 to April 2025. Wastewater samples were collected at the Wastewater Treatment Plant (WWTP) 2 of the Jababeka Industrial Area, Cikarang, on August 14, 2024. This study was designed using a Non-Factorial Randomized Block Design (RBD) for the in-planta test. Prior to the in-planta test, a preliminary test on the remediation of industrial wastewater using Bio-P60 was conducted in-vitro. The preliminary test consisted of 7 combinations of Bio-P60 concentration and incubation period. The Bio-P60 concentrations used were 5 mL/L and 10 mL/L with incubation periods of 2, 4, and 6 weeks, along with a control without incubation and without Bio-P60 application. The in-planta test consisted of 7 treatments, 4 replications, and 3 plants per replication, resulting in 84 experimental units. The observed variables included COD, BOD, cadmium (Cd) heavy metal, pH, plant height, number of leaves, leaf area, leaf color, root length, fresh plant weight, dry plant weight, and Cd uptake in the leaves.

Based on the research results, it was found that the Bio P60 concentration of 5 mL/L and incubation period of 2 weeks was able to reduce BOD, COD, and Cd pollutants by 93.22%, 67.24%, and 53.92%. Application of Bio P60 was also able to increase pH by 48,8%. However, the values of the BOD and COD variables were still above the established quality standards. The evaluation results of the remediation using sweet corn as an indicator plant showed that Bio P60 treatment had a significant effect on maize plant growth, except for leaf color and undetected Cd levels in the leaves. The remediation results using Bio P60 were able to increase plant height by 25,65%, number of leaves by 14,86%, leaf area by 34,07%, root length by 17,15%, fresh plant weight by 17,5%, and dry plant weight by 22% compared to the control.