BIOREMEDIASI LOGAM KROMIUM MENGGUNAKAN KOMBINASI FORMULA DARI KONSORSIUM BAKTERI *Brevibacillus borstelensis*, *Bacillus licheniformis*, DAN *Bacillus* sp.

SKRIPSI

Diajukan untuk memenuhi sebagian syarat memperoleh gelar Sarjana Sains
Program Studi Biologi

Oleh:
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PROGRAM STUDI BIOLOGI
FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS PENDIDIKAN INDONESIA

BANDUNG
2025

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BIOREMEDIASI LOGAM KROMIUM MENGGUNAKAN KOMBINASI FORMULA DARI KONSORSIUM BAKTERI *Brevibacillus borstelensis*, *Bacillus licheniformis*, DAN *Bacillus* sp.

Oleh
Salma Setia Nurhaliza

Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Program Studi Biologi, Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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BIOREMEDIASI LOGAM KROMIUM MENGGUNAKAN KOMBINASI FORMULA DARI KONSORSIUM BAKTERI *Brevibacillus borstelensis*, *Bacillus licheniformis*, DAN *Bacillus* sp.

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LEMBAR PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi dengan judul "Bioremediasi Logam Kromium Menggunakan Kombinasi Formula dari Konsorsium Bakteri *Brevibacillus borstelensis*, *Bacillus licheniformis,* dan *Bacillus* sp." ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya bersedia menanggung risiko/sanksi apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

Bandung, Juli 2025
Yang membuat pernyataan,

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KATA PENGANTAR

Penulis senantiasa mengucapkan rasa syukur ke hadirat Allah Subhanahu Wa Ta'ala atas limpahan rahmat dan karunia-Nya yang telah memungkinkan penulis untuk menyelesaikan skripsi dengan judul "Bioremediasi Logam Kromium Menggunakan Kombinasi Formula dari Konsorsium Bakteri *Brevibacillus borstelensis*, *Bacillus licheniformis*, dan *Bacillus* sp.". Penulisan skripsi ini bertujuan untuk memenuhi salah satu persyaratan akademik untuk memperoleh gelar Sarjana Sains di Program Studi Biologi Universitas Pendidikan Indonesia.

Dalam proses penulisan skripsi ini, penulis menyadari bahwa masih terdapat ruang untuk perbaikan. Oleh karena itu, saran dan kritik yang membangun sangat diharapkan agar skripsi ini dapat menjadi referensi yang lebih baik di masa mendatang. Semoga hasil dari skripsi ini dapat memberikan kontribusi positif dalam pengembangan ilmu pengetahuan bagi penulis dan pembaca yang berkepentingan.

Bandung, Juli 2025

Penulis

UCAPAN TERIMA KASIH

Penulis menyadari bahwa skripsi ini tidak akan terselesasikan dengan baik tanpa dukungan dari berbagai pihak yang berarti bagi penulis. Penulis ingin menyampaikan terima kasih kepada seluruh pihak yang turut membantu dalam penyelesaian skripsi ini. Penulis mengucapkan terima kasih dengan segala hormat kepada:

1. Bapak Dr. Wahyu Surakusumah, M.T., selaku dosen pembimbing I sekaligus ketua program studi Biologi FPMIPA UPI yang selama ini telah meluangkan waktu untuk membimbing, memberikan arahan, masukan dan saran, serta motivasi kepada penulis selama proses perkuliahan, penelitian, hingga penyusunan skripsi ini selesai dilakukan.
2. Ibu Dr. Any Aryani, M.Si., selaku dosen pembimbing II yang selama ini telah meluangkan waktu, tenaga, dan pikiran untuk membimbing, memberikan arahan, masukan dan saran, serta motivasi kepada penulis selama proses penelitian hingga penyusunan skripsi ini selesai dilakukan.
3. Alm. Prof. Yayan Sanjaya, M.Si., Ph.D., selaku dosen pembimbing akademik yang telah memberikan ilmu, bimbingan, dan motivasi kepada penulis selama kegiatan perkuliahan dan penyusunan skripsi hingga akhir hayatnya.
4. Ibu Dr. R. Kusdianti, M.Si., selaku koordinator Dewan Bimbingan Skripsi (DBS) yang selalu memberikan motivasi, informasi, dan bimbingannya mengenai skripsi.
5. Seluruh dosen, staff akademik, dan tenaga kependidikan Prodi Biologi FPMIPA UPI atas segala dukungan, ilmu, bimbingan, nasihat, dan juga pengalaman serta fasilitas yang telah diberikan selama kegiatan perkuliahan.
6. Bapak Setiawan, Ibu Susi Susilawati, dan seluruh anggota keluarga yang selalu memberikan dukungan moral dan materil kepada penulis serta pengingat untuk bertanggungjawab atas setiap keputusan yang diambil. Terima kasih telah memberikan ruang kebebasan untuk menentukan arah

hidup tanpa memadamkan dukungan dan doa yang selalu menjadi cahaya di setiap langkah penulis.

7. Ok Muhammad Abthal Al Wafi dan Vinno Bayu Christofan, selaku rekan satu penelitian yang selalu menemani dan berjuang bersama dari awal penelitian hingga akhir pengerjaan penelitian skripsi.
8. Muhammad Iklil Nurfuad, sebagai seseorang yang menjadi saksi dari hampir seluruh perjalanan kuliah penulis, seseorang yang senantiasa mengingatkan penulis untuk selalu bertumbuh bersama hingga ke depannya.
9. Hana Mumtaz, Siti Sofiah, Yualinda Durotul Marhamah, dan Salma Fitriani sebagai teman dekat penulis selama masa perkuliahan yang menemani, membantu, dan menjadi tempat untuk mencurahkan segala keluh kesah serta kebahagiaan.
10. Aurell Chanaya Putri, Daniswara Aliya Hartono, Gisella Salsabila, Nagisha Lyra Canalya, Saskia Aulia, Siti Aliyah Nur'aini, Vany Mulyati Ornella G., dan Zalfaa Sacita Ulayya, sebagai sahabat penulis yang selalu menemani dan mendukung penulis semenjak duduk di bangku Sekolah Menengah Atas hingga sekarang maupun ke depannya.
11. Teman-teman seperjuangan Laboratorium Riset yang selalu membantu, mendukung, dan memberi semangat selama penelitian di laboratorium.
12. Seluruh teman Biologi C 2021 dan keluarga besar Vishaka Annora yang telah menjadi teman baik penulis selama perkuliahan hingga selesainya masa studi ini.
13. Seluruh pihak yang terlibat dan tidak dapat disebutkan satu persatu atas bantuan dan motivasinya selama penulis menyusun skripsi ini.

ABSTRAK

Bioremediasi Logam Kromium Menggunakan Kombinasi Formula dari Konsorsium Bakteri *Brevibacillus borstelensis*, *Bacillus licheniformis*, dan *Bacillus* sp.

Logam kromium merupakan salah satu polutan prioritas karena menimbulkan berbagai resiko bagi organisme, mikroorganisme, dan lingkungan. Industri kerajinan kulit menjadi salah satu penghasil limbah yang mengandung logam kromium dari limbah penyamakan kulit. Upaya yang dapat dilakukan untuk mengurangi pencemaran logam kromium di lingkungan yaitu dengan metode bioremediasi. Bioremediasi dapat menggunakan mikroorganisme yaitu bakteri, penggunaan konsorsium bakteri dianggap lebih efektif dibandingkan dengan bakteri tunggal. Penelitian ini bertujuan untuk menganalisis kemampuan formula konsorsium bakteri yang berpotensi sebagai agen bioremediasi logam kromium secara *in vitro*. Bakteri diisolasi dari tanah area *rhizosfer* tumbuhan yang berada di sekitar bak penampungan limbah di wilayah Sukaregang, Kabupaten Garut. Bakteri diseleksi dengan memilih bakteri yang memiliki resistensi tertinggi lalu diidentifikasi berdasarkan aktivitas biokimia dan gen 16S rRNA. Kemampuan bioremediasi logam kromium ditunjukkan berdasarkan interaksi antar bakteri dan persentase pengurangan Cr(VI) oleh konsorsium bakteri. Identifikasi bakteri berdasarkan aktivitas biokimia yang dilengkapi dengan analisis gen 16S rRNA menunjukkan ketiga isolat bakteri teridentifikasi sebagai *Brevibacillus borstelensis*, *Bacillus licheniformis*, dan *Bacillus* sp.. Hasil uji interaksi antar bakteri menunjukkan bahwa bakteri penyusun konsorsium saling bersinergi. Seluruh konsorsium bakteri mampu mengurangi Cr(VI) namun memiliki kemampuan yang berbeda. Konsorsium dengan kombinasi tiga bakteri yaitu *Brevibacillus borstelensis*, *Bacillus licheniformis*, dan *Bacillus* sp. memiliki persentase pengurangan Cr(VI) tertinggi yaitu sebesar 39,38%.

Kata Kunci: Bioremediasi, Gen 16S rRNA, Konsorsium, Kromium, Penyamakan Kulit

ABSTRACT

Bioremediation of Chromium Metal Using Formula Combination of Bacterial Consortium Brevibacillus borstelensis, Bacillus licheniformis, and Bacillus **sp.**

Chromium metal is one of the priority pollutants because it poses various risks to organisms, microorganisms, and the environment. The leather craft industry is one of the producers of waste containing chromium metal from tanning waste. Efforts that can be made to reduce chromium metal pollution in the environment are by bioremediation methods. Bioremediation can use microorganisms, namely bacteria, the use of bacterial consortia is considered more effective than single bacteria. This study aims to analyze the ability of bacterial consortium formulas that have the potential as chromium metal bioremediation agents in vitro. Bacteria were isolated from the soil of the rhizosphere area of plants around the waste storage tank in the Sukaregang *area,* Garut *Regency. Bacteria were selected by selecting bacteria that had the highest resistance and then identified based on biochemical activity and the* 16S rRNA *gene. The ability of chromium metal bioremediation was shown based on the interaction between bacteria and the percentage of* Cr(VI) *reduction by the bacterial consortium. Identification of bacteria based on biochemical activity supported by* 16S rRNA *gene analysis showed that the three bacterial isolates were identified as Brevibacillus borstelensis, Bacillus licheniformis, and Bacillus sp.. The results of the interaction test between bacteria showed that the bacteria that make up the consortium synergize with each other. All bacterial consortia are able to reduce Cr(VI) but have different abilities. The consortium with a combination of three bacteria, namely Brevibacillus borstelensis, Bacillus licheniformis, and Bacillus sp. has the highest* Cr(VI) *reduction percentage of* 39.38%.

Keywords*: Bioremediation, 16S rRNA Gene, Consortium, Chromium, Leather Tanning*

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