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BB P13. Influence of sulphate and phosphate ions on Cr(VI) removal by Streptomyces sp. MC1

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Chromium (Cr) is a natural element which is found in rocks, soil, plants, animals, volcanic dust and gases. It can exist in several oxidation states, but the most stable and common forms in the environment are trivalent [Cr(III)] and hexavalent [Cr(VI)] chromium. Cr(III) is an essential micronutrient required for the growth of many organisms but toxic at high concentrations. However Cr(VI) is toxic, mutagenic, carcinogenic, teratogenic at all concentrations and it is the most frequently used in industrial processes like leather tanning.

While, Cr(VI) is highly soluble in water, mobile and biologically available in the ecosystems, Cr(III) shows poor solubility and is easily adsorbed on mineral surfaces. Due to the problems that high Cr(VI) concentrations produce in the environment, the treatment strategy could include the reduction of Cr(VI) to Cr(III).

Reduction ability has been found in a large range of eukaryotic and prokaryotic microorganisms. Streptomyces sp. MC1, isolated from sugar cane, was selected because it showed significant growth and capacity to remove Cr(VI) in liquid minimal medium, abilities that might be useful for bioremediation.

It is believed that Cr(VI) uses sulfate and phosphate transport routes to penetrate the cellular membrane due to its structural similarity to these anions.

The aim of this work was to study the influence of sulfate and phosphate ions on the resistance and Cr(VI) removal. Cells of Streptomyces sp. MC1 were grown in liquid minimal medium supplemented with glucose and with or without 20 mg/L of $K_2Cr_2O_7$ as Cr(VI) source and 5mM of Na_2SO_4 or K_2HPO_4 for 120 h at 30 °C in an orbital shaker (170 rpm). Biomass was determined by dry weight, Cr(VI) concentration in the medium by the colorimetric method of 1,5-diphenylcarbazide, total chromium by flame atomic absorption spectroscopy and residual glucose by the method of dinitrosalicylic.

The presence of sulfate or phosphate ions induced the growth of Streptomyces sp. MC1. However, only sulfate ion enhanced the Cr(VI) removal significantly. On the other hand, total chromium concentration in the supernatant was constant in all assayed conditions. It is known that Cr(III) is a stable and soluble component formed by Cr(VI) reduction. Therefore, it could be inferred that chromium remaining in the supernatant will be as Cr(III). This finding may indicate that the Cr(VI) removal by Streptomyces sp. MC1 was due to reduction to trivalent form but not to chromium bioaccumulation under these conditions.

Cr(VI) reduction to Cr(III) by microorganisms is an interesting strategy of bioremediation. These results may have significant implications in the biological treatment of Cr(VI) in environmental polluted. Further more studies are required for future applications in bioremediations processes.

BB P14. Lindane removal by Streptomyces sp. strains immobilized in agar and PVA-alginate

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γ-Hexachlorocyclohexane (γ-HCH) or lindane is a chlorinated pesticide, which initially played important roles in the control of pests and disease vectors. Nowadays it is well established that it is a toxic, carcinogenic and persistent compound which not only accumulates in animals and plants tissues, but also persist in the environment for long periods. There has been much work on γ-HCH biodegradation. Bacteria and consortia of bacteria capable of degrading lindane under aerobic and anaerobic conditions have been described. Immobilization techniques are gaining importance in bioremediation because of their advantages such as protection of the cells against the pesticide toxicity, reuse of the cells and the facility to recover them from the system. The aim of this work was to evaluate the ability of streptomycetes strains immobilized in agar cubes and polyvinyl alcohol-alginate beads to remove lindane in a liquid system. For this purpose, four streptomycetes strains (Streptomyces sp. A2, A5, A11 and M7) previously selected because of their ability to degrade γ-HCH in pure and mixed cultures, were pre-cultivated in TSB medium for 72 h. Biomass pellets were individually entrapped using: a) 3% agar cubes and b) PVA-alginate beads. 5 g of cubes or beads were put into an Erlenmeyer containing 100 mL liquid minimal medium (MM) supplemented with lindane (1.66 mg L^{-1}) as carbon source. After 96 h of incubation, the cells were collected to determine microbial growth by estimating the colony forming units (CFU mL^{-1}) and supernatant samples were taken to determine residual lindane concentration by gas chromatography. The four studied strains were able to grow in MM supplemented with lindane as sole carbon source. All of them showed lower growth values when they were immobilized in PVA-alginate beads than in agar cubes. Maximal growth (1.35 x 10^8 CFU mL^{-1}) was obtained by Streptomyces sp. A11 immobilized in agar cubes. However γ-HCH removal was more efficient when actinobacteria were immobilized in PVA-alginate beads, showing Streptomyces sp. M7 the greatest lindane removal ability, while no lindane removal was observed with the agar-entrapped bacterial strain, Steptomyces sp. A11. The results showed that PVA-alginate can be used as potential actinobacteria immobilization matrix for lindane bioremediation.