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A viable approach for efficient bioremediation of tannery effluent by simultaneous detoxification of hexavalent chromium and pentachlorophenol by an indigenous *Bacillus cereus* strain

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Chromate [Cr(VI), hexavalent chromium] and pentachlorophenol (PCP) as an organic co-pollutant are continuously discharged into the environment beyond the permissible concentration from tanneries and other industries due to inefficient effluent treatment technology. Both pentachlorophenol and Cr(VI) are carcinogens and are highly toxic to all forms of life thus, is a matter of great concern. Bioreduction of Cr(VI) and simultaneous degradation of PCP by indigenous bacteria are the effective and eco-friendly methods to detoxify these pollutants. A bacterial strain identified as *Bacillus cereus* was isolated from tannery effluent for the simultaneous detoxification of both the pollutants from industrial waste. This strain was concomitantly tolerant to maximum of 1500 mg l^{-1} Cr(VI) and 1150 mg l^{-1} PCP concentration and reduced 81% Cr(VI) and degraded 78% PCP simultaneously within 168 h at pH 7.0 and 30°C temperature. The strain exhibited remarkable ability to significantly remediate both the Cr(VI) and PCP simultaneously in the presence of other metals, between 100-140 rpm agitation and over broad pH (6.0-10.0) and temperature (25-40°C) range. A maximum of 90% Cr(VI) reduction and 86% PCP degradation was observed at pH 8.0, 35°C within 168 h of incubation at 120 rpm agitation speed and initial concentration of 1500 mg l-1 Cr(VI) and 1150 mg l^{-1} PCP. This is the first report on 90% Cr(VI) reduction and 86% PCP degradation simultaneously by single indigenous bacteria under variable growth conditions utilizing PCP as a sole carbon source. This was confirmed by stoichiometric release of chloride ion and GC-MS analysis. FTIR spectroscopy characterized the changes in the functional groups of *B. cereus* cell wall surface when grown in presence of Cr(VI) and PCP and SEM-EDS showed the absorption of reduced chromium on bacterial cell surface. Further, the immobilized cells of *B. cereus* were capable to reduce 96% Cr(VI) and degrade 91% PCP at pH 8.0 in 140 h and 160 h, respectively from the tannery effluent in shake flask studies. The results suggest the possible use of this bacterium B. cereus for simultaneous Cr(VI) reduction and PCP degradation from industrial wastewater.

Biography

Tuhina Verma is Assistant Professor in Department of Microbiology of Dr. R. M. L. Avadh University, Faizabad, India. She has completed her PhD from Indian Institute of Toxicological Research (CSIR), Lucknow and short post-doctoral course from MD Anderson Cancer Centre, Houston, Texas. She has published several research papers in journal of International repute. She also undertakes independent research as a Principal Investigator of funded research projects. She is the reviewer of more than five international journals and is the member of Association of Microbiologists of India and Society of Toxicology of India

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