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Hexavalent chromium reduction ability and bioremediation potential of *Aspergillus flavus* CR500 isolated from electroplating wastewater

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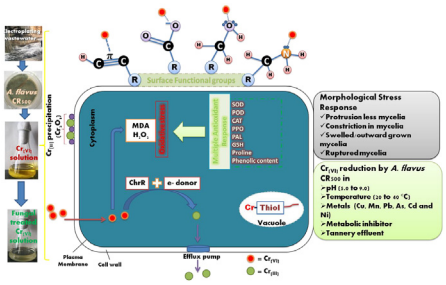
HIGHLIGHTS

- *A. flavus* CR500 show multifarious biochemical and morphological response to deals with $Cr_{[VI]}$ toxicity.
- $Cr_{[VI]}$ induced chromate reductase play a major role in the reduction of $Cr_{[VI]}$ to $Cr_{[III]}$.
- Accumulation, precipitation and adsorption mechanism involve in Cr removal by isolate CR500.
- Isolate CR500 has excellent $Cr_{[VI]}$ bioremediation potential.

GRAPHICAL ABSTRACT



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ABSTRACT

Hexavalent chromium reduction by microbes can mitigate the chromium toxicity to the environment. In the present study $Cr_{[VI]}$ tolerant fungal isolate (CR500) was isolated from electroplating wastewater, was able to tolerate 800 mg/L of $Cr_{[VI}$. Based on the ITS region sequencing, the isolate was identified as *Aspergillus flavus* CR500, showed multifarious biochemical (reactive oxygen species, antioxidants response and non-protein thiol) and morphological (protrusion less, constriction and swelling/outwards growth in mycelia) response under $Cr_{[VI]}$ stress. Batch experiment was conducted at different $Cr_{[VI]}$ concentration (0–200 mg/L) to optimize the $Cr_{[VI]}$ reduction and removal ability of isolate CR500; results showed 89.1% reduction of $Cr_{[VI]}$ to $Cr_{[III]}$ within 24 h and 4.9 ± 0.12 mg of Cr per gram of dried biomass accumulation within 144 h at the concentration of 50 mg/L of $Cr_{[VI]}$. However, a maximum of 79.4% removal of Cr was recorded at 5 mg/L within 144 h. Fourier-transform infrared spectroscopy, energy dispersive x-ray spectroscopy and X-ray diffraction analysis revealed that chromium removal also happened via adsorption/precipitation on the mycelia surface. Fungus treated and without treated 100 mg/L of $Cr_{[VI]}$ solution was subjected to phytotoxicity test using *Vigna radiata* seeds and result revealed that *A. flavus* CR500 successfully detoxified the $Cr_{[VI]}$ via reduction and removal mechanisms. Isolate CR500 also exhibited efficient bioreduction potential at different temperature (20–40 °C), pH (5.0–9.0), heavy metals (As, Cd, Cu, Mn, Ni and Pb), metabolic inhibitors (phenol and EDTA) and in sterilized tannery effluent that make it a potential candidate for $Cr_{[VI]}$ bioremediation.

1. Introduction

Multiple metals are used in electroplating processes in metal plating industries (Arshad et al., 2014; Hackbarth et al., 2016) thus, generated wastewater contain metals such as chromium (Cr),

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