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Performance Evaluation of Algal-Fungal Microbiome in the Treatment of Chromium Contaminated Water Resources at Rania-Khan Chandpur COPR Site, India

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Microbiome-based restoration of contaminated soil-water systems is a relatively new and multi-method approach. Microbiome can be one of the key drivers of such restorations. For this purpose, the screening of microbiomes that have the potential to treat contaminants is of huge interest for the research community. In view of this, the objective of our study was to investigate the capability of the algal and fungal microbiomes to decontaminate chromium (Cr) leachate collected from a chromite ore processing residual (COPR) dump site located at Rania-Khan Chandpur, Kanpur Dehat, which is one of the highly Cr-contaminated sites in India. Two fungal strains-*Aspergillus fumigatus* and *Aspergillus lentulus,* and three algal cultures namely, PA6 (a consortium of *Chlorella* sp., and *Phormidium*), PA9 (a consortium of *Chlorella* sp. and *Dictyospherium*) and Ulothrix (a single strain culture, isolated from the Cr-contaminated soil-water samples from Rania) were used under varying initial Cr concentrations of 1 mg/L to 50 mg/L by diluting leachate from Rania COPR site. In the case of the fungal strains, *A. fumigatus* showed better Cr removal and biomass productivity than *A. lentulus* under varying Cr concentrations. Among the algal cultures, PA6 showed the best Cr uptake potential and biomass productivity in all the Cr concentrations (except 50 mg/L) with as high as 91.2 %, 70.5%, 52.5%, and 44% Cr removal in 1 mg/L, 5 mg/L, 10 mg/L, and in 20 mg/L, respectively. Based on the results, we recommend the application of an algal-fungal combination (consortium) i.e. *A. fumigatus* and PA6 in contaminated areas where the Cr concentration is below 20 mg/L. From the practical point of view, the outcomes of this study would be helpful in designing a demonstrative scale bioremediation system to restore such highly contaminated sites. For industrial scale management, this study can work as a foundation for developing commercial algal-fungal consortia.