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ISSN: 1948-5948
Journal of
Microbial &
Biochemical Technology

Commentary

Commentary on Comparative Study of Chromium Phytoremediation by Two Aquatic Macrophytes

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DESCRIPTION

It is imperative to note that hexavalent Chromium (Cr) is an extremely toxic human carcinogen that is 100 times more dangerous than trivalent Cr. This is primarily due to its higher oxidation state and solubility. Once the concentration of hexavalent Cr surpasses a certain threshold, it can have devastating impacts on both animals and plants alike. For plants, hexavalent Cr leads to ultra-structural changes, biochemical modifications, reduced seed germination, inhibited enzymatic activities, nutrient uptake, and metabolic regulation. When plants absorb hexavalent Cr, it is converted into trivalent Cr, which generates Reactive Oxygen Species (ROS) as intermediate products. The catastrophic effects of ROS produce a range of non-enzymatic and enzymatic detoxification systems in plants. Activated antioxidant enzymes can detoxify the harmful effects of hexavalent Cr, neutralize the production of ROS, and safeguard plant cell organelles from Cr-induced oxidative stress. Moreover, the presence of hexavalent Cr in soil and water systems poses a significant risk to ecosystems and human health. Comprehensive measures and regulatory efforts are necessary to mitigate the impact of hexavalent chromium and protect the environment.

CONCLUSION

In aquatic environments, macrophytes play a vital role in maintaining and purifying the surroundings by absorbing metals from the environment. Among the various types of macrophytes, *Pistia stratiotes* and *Marsilea minuta* are known for their exceptional ability to accumulate metals. To compare their Cr accumulation abilities, sets of uniformly sized and weighted plants (2.5-3.5 grams) were exposed to different concentrations of Cr (0.5, 1.0, 1.5, 2.0 mili molar). The results showed that *P. stratiotes* was more efficient than *M. minuta* in Cr accumulation at various concentrations. Although both plants experienced curling and blackening at the edges of their leaves, root browning, and growth decline due to the toxicity of the chromium. Both plants responded to the toxicity in a concentration-dependent manner, resulting in a 30% reduction in biomass at the highest concentration (2.0 mili molar). The chlorophyll content of *P. stratiotes* and *M. minuta* decreased by approximately 50% and 40%, respectively, due to the adverse impact of elevated Cr accumulation or impairment of chlorophyll biosynthesis enzymes. Carotenoid content increased in response to Cr toxicity in both plants, indicating a defense mechanism against Cr toxicity. Exposure to Cr led to an increase in malonaldehyde (MDA) content in *P. stratiotes* in a concentration-dependent manner, which is an indicator of lipid peroxidation in plants under stress. Elevated concentrations of ROS in plants caused oxidative stress, which activated the antioxidant machinery for their survival. Both plants showed an activated enzymatic antioxidative response, up-regulating SOD and GPX. It has been observed that the existence of metals may have detrimental effects on antioxidant enzymes, potentially limiting their ability to effectively detoxify. Sometimes such effects can lead to a decline in enzymatic activity at the highest metal concentrations. Based on the investigation, *P. stratiotes* appears to be a better phytoremediation and accumulator of Cr than *M. minuta,* providing a sustainable and cost-effective solution for wastewater decontamination.

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Received: 01-Sep-2023, Manuscript No. JMBT-23-22980; **Editor assigned:** 04-Sep-2023, PreQC No. JMBT -23-22980 (PQ); **Reviewed:** 18-Sep-2023, QC No. JMBT-23-22980; **Revised:** 25-Sep-2023, Manuscript No. JMBT-23-22980 (R); **Published:** 02-Oct-2023, DOI: 10.35248/1948-5948.23.15.580

Citation: Sharma K, Kumari A (2023) Commentary on Comparative Study of Chromium Phytoremediation by Two Aquatic Macrophytes. J Microb Biochem Technol.15:580.