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Investigating the Biosorption Potential of Indigenous Filamentous Fungi from Copperbelt Tailing Dams in Zambia with Copper and Cobalt Tolerance

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Abstract : Filamentous fungi indigenous to heavy metals (HMs) contaminated environments have a considerable biosorption potential yet are currently under-investigated in developing countries. In the work presented herein, the biosorption potential of three indigenous filamentous fungi (Aspergillus transmontanensis, Cladosporium cladosporioides, and Geotrichum candidum) isolated from copper and cobalt mining wasteland sites in Zambia's Copperbelt province was investigated. In Cu and Co tolerance tests, all the fungal isolates were shown to be tolerant, with mycelial growth at HMs concentrations of up to 7000 ppm. However, exposure to high Cu and Co concentrations hindered the growth of the three strains to varying degrees, resulting in reduced mycelial biomass (evidenced by loss of the infrared bands at 887 and 930 cm-1 of the 1,3-glucans backbone) as well as morphological alterations, sporulation, and pigment synthesis. In addition, gas chromatography-mass spectrometry characterization of the fungal biomass extracts allowed to detect changes in the chemical constituents upon exposure to HMs, with profiles poorer in maltol, 1,2-cyclopentadione, and n-hexadecanoic acid, and richer in furaldehydes. Biosorption tests showed that A. transmontanensis and G. candidum showed better performance as bioremediators than C. cladosporioides, with biosorption efficiencies of 1645, 1853 and 1253 ppm at pH 3, respectively, and may deserve further research in field conditions.

Keywords : bioremediation, fungi, biosorption, heavy metal
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