RESEARCH ARTICLE

Isolation and Identification of Iron, Chromium, and Manganese Tolerant Filamentous Fungi from Mining Soil

Patrícia de A. Nóbrega[1], Beatriz L. Ferreira[1], Lucas S. Sá[1], Francinaldo S. Braga[2], Roberto M. Bezerra[2] and Irlon M. Ferreira[1,*]

[1]*Biocatalysis and Applied Organic Synthesis Laboratory, Federal University of Amapá, Rod. JK, KM 02, 68902-280, Macapá, Amapá, Brazil;* [2]*Laboratory of Bioprospection and Atomic Absorption, Federal University of Amapá, Rod. JK, Macapá, 68903-419Amapá, Brazil*

Abstract: ***Background*:** In this study, filamentous fungi from iron mining soils in the Amazon were isolated and identified as *Talaromyces verruculosus*, *Trichoderma pseudoasperelloides*, *Penicillium rolfsii, Aspergillus cf. pseudoviridinutans*, *Aspergillus niger*, *Purpureocillium lilacinum*, and *Penicillium cf. guaibinense*.

***Objective*:** The objective of this study was to evaluate the isolated strains for radial growth rate (VCR) on solid media and liquid in the presence of metals.

***Methods*:** All these strains showed adaptive behavior in the presence of metals (Fe^{2+}, Mn^{2+}, and Cr^{3+}), but not significantly compared to controls.

***Results*:** The *T. verruculosus* strain was selected to evaluate its growth capacity in solid and liquid media, enriched with 1, 10, and 20 mg/L of iron, chromium, and manganese, respectively.

***Conclusion*:** *T. verruculosus* strain showed tolerance to the concentrations of the metals studied. Therefore, we can suggest that this characteristic of metal tolerance (Fe^{2+}, Mn^{2+}, and Cr^{3+}) exhibited by fungi isolated from Amazonian environments may indicate the potential for bioremediating areas polluted by heavy metals.

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1. INTRODUCTION

Increasing industrialization and population growth around the world (anthropogenic action) have increased human exposure to environmental pollution [1]. Currently, pollution caused by heavy metals is one of the major issues worldwide [2]. Most of the pollution caused by heavy metals is severe, long-term, and non-reversible in nature [3]. The most common heavy metals that act as pollutants include arsenic (As), lead (Pb), mercury (Hg), chromium (Cr), zinc (Zn), cadmium (Cd), copper (Cu), and nickel (Ni) [4]. These have been listed as pollutants of priority concern by the US Environmental Protection Agency (USEPA) [5].

Excessive exposure of the human body to heavy metals is deadly, given that their bioaccumulation in human cells and tissues causes neurological, cardiovascular, hematological, reproductive, and immunological disorders. Other risks promoted by heavy metals include hypertension, skin cancer, and diabetes [6-8].

The methods available for soil and water remediation can be categorized as chemical, physical, or biological. Biological methods can be implemented either in the polluted area or as remediation strategies [9].

Fungi can successfully break down or transform complex toxic contaminants into simpler or less toxic agents. This process can be achieved by using different strategies that fall into two general categories: biosorption, which includes binding metal to the surface, and bioaccumulation, which involves intracellular uptake of metals *via* cellular metabolism [6]. These transformations change the ionic state of metals, which may affect their solubility, mobility, and bioavailability [10].

The fungi commonly reported as capable of undertaking bioremediation of heavy metals include *Rhizopus oryzae*, *Aspergillus* sp. (*versicolor, terreus, niger* and *fumigatus*), *Penicillium chrysogenum*, and *Gloeophyllum sepiarium* [11]. For example, Khan *et al.* (2019) showed *A. fumigatus* and *A. flavus* to achieve high removal efficiencies for Pb of 99.20% and 99.30%, respectively, while 96% and 95.50% of Hg were removed by *A. niger* and *A. terreus*, respectively.

*Address correspondence to this author a the Biocatalysis and Applied Organic Synthesis Laboratory, Federal University of Amapá, Rod. JK, KM 02, 68902-280, Macapá, Amapá, Brazil; E-mail: irlon.ferreira@gmail.com

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