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Production of organic acids and solubilization of silicate rocks in vitro by filamentous isolated fungi from ferruginous soils of Minas Gerais – Brazil

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The autochthonous community of filamentous fungi in harsh environments, such as near mining areas soils, develops adaptive mechanisms that involve the production of various metabolites of biotechnological interest. The prospecting potential with fungi to add fertilizer value to silicate rocks as an alternative source of nutrients and soil conditioners is relevant to the sustainability of Brazilian agriculture. The aim of this study was to evaluate the production of organic acids as biosolubilization mechanism of silicate rocks in vitro by filamentous isolated fungi of areas impacted by mining and its surroundings. We evaluated nine isolates of fungi belonging to Multifunction Microorganisms Collection of Embrapa Maize and Sorghum (CMMF-EMS) for the production of lactic acid, oxalic, citric and potassium release (K) from two silicate rocks (glauconite and phlogopite) in liquid culture medium. Initially, each isolated in the collection preserved at -86 °C was reactivated and tested for purity in the culture medium potato-dextrose-agar (PDA) for seven days. Then, five discs mycelium of 8 mm diameter of each isolate were inoculated into Erlenmeyer flasks containing 50 ml of liquid culture medium (MISK) supplemented with rock powder as the only source of potassium that were incubated for 14 days stirring 100 rpm, at temperature of 28° C. After this period, the cultures were centrifuged and filtered. An aliquot of the supernatant of each culture was used for quantification of organic acids (citric acid, oxalic and lactic) via HPLC (High Performance Liquid Chromatographic) and potassium concentration by spectrophotometry atomic emission (ICP). The production of organic acids varied depending on the type of rock and fungal isolate. Regardless of the rock, mean values ranged from 13 mg.L-1 to 1.400 mg L-1 for citric acid, 68 mg L-1 t to 329.049 mg.L-1 for lactic acid and 0,54 mg.L-1 to 9,5 mg.L-1 for oxalic acid, and the highest values were observed for isolated CMSV 798, identified as Penicillium sp. There was significant positive correlation between the organic acid production and release of K in the middle with larger coefficient for citric acid. On the other hand, there was a negative correlation among pH, release of K and organic acids, although it was significant only for citric acid. The data suggest that, among the evaluated acids, citric acid has greater relevance as a mechanism involved in the bioavailability of nutrients from silicate rocks. Besides, the variability among the fungi inhabitants of ferruginous environments allow selection of isolates with biotechnological potential of agro-industrial interest.