ACTION OF Fe_2O_3 AND Fe_2ZnO_4 NANOPARTICLES ON STRAINS OF ACTINOBACTERIA AND FILAMENTOUS FUNGI

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Background: Nanoparticles can exert both beneficial and adverse effects on microorganisms, including DNA modification, accelerated aging, and cell death. They may also act as biostimulants, enhancing the biosynthetic properties of microorganisms of industrial, medical, and agricultural importance. Therefore, studying the effects of nanoparticles on the biosynthesis of biologically active substances is both relevant and necessary.
The aim of this study was to evaluate the effects of Fe_2O_3 and Fe_2ZnO_4 nanoparticles on the biosynthesis of biologically active substances in strains of actinobacteria and filamentous fungi.
Materials and methods: The study subjects included two actinobacterial strains (*Streptomyces gougerotii* CNMN-Ac-14 and *Streptomyces fradiae* CNMN-Ac-11) and three filamentous fungi (*Penicillium* sp. 7, *Penicillium* sp. 12, and *Penicillium* sp. 14). The main parameters assessed were anti-inflammatory and antioxidant activities, along with protein content and catalase activity. Fe_2O_3 and Fe_2ZnO_4 nanoparticles, at concentrations of 1, 5, and 10 mg/L, were tested as stimulators of bioactive compound biosynthesis in the studied strains. The following opportunistic microorganisms were used as test strains: *Aspergillus fumigatus, Fusarium solani, Fusarium oxysporum*, and the pathogenic yeast *Candida albicans*.
The results indicate that the addition of Fe_2O_3 and Fe_2ZnO_4 nanoparticles to the nutrient medium during subculturing of actinobacteria and filamentous fungi reduced antifungal and antioxidant activities in all studied strains. In the actinobacterial strains *Streptomyces gougerotii* CNMN-Ac-14 and *Streptomyces fradiae* CNMN-Ac-11, an increase in catalase activity was observed in variants containing Fe_2ZnO_4 nanoparticles at concentrations of 1–5 mg/L. The highest protein content in the *Streptomyces fradiae* CNMN-Ac-11 strain was recorded in the variant treated with 1 mg/L Fe_2O_3 nanoparticles, while in the *Streptomyces gougerotii* CNMN-Ac-14 strain, it was observed in the variant containing 10 mg/L Fe_2ZnO_4 nanoparticles. The fungal strain *Penicillium* sp. 7 showed stimulation of catalase activity compared to the control sample in the variant treated with 10 mg/L Fe_2ZnO_4 nanoparticles. In the *Penicillium* sp. 14 strain, enhanced catalase activity was also observed at 10 mg/L Fe_2ZnO_4 nanoparticles, along with an increase in protein content in variants with 5–10 mg/L Fe_2O_3. Regarding the *Penicillium* sp. 12 strain, the tested nanoparticles exerted a stimulatory effect on protein biosynthesis at 1 mg/L for both Fe_2O_3 and Fe_2ZnO_4.
Conclusions: According to the results of this study, it can be concluded that nanoparticles used in the subculturing of microorganisms (actinobacteria and filamentous fungi) can either stimulate or suppress their biosynthetic processes, depending on the strain, nanoparticle composition, and concentration.
Key words: fungi, actinobacteria, nanoparticles, antifungal activity, catalase.

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