CZU: 504.3.054:582.232.5:546.56

CYANOBACTERIUM *NOSTOC LINCKIA* GROWTH UNDER DIFFERENT CONCENTRATIONS OF COPPER(II) IONS

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Cyanobacteria are ecologically significant prokaryotes that can be found in heavy metals contaminated environments. In these situations, they can act as bioremediators of pollutants, especially heavy metal ions, by sequestering the metal ions on the surface of their cells due to the presence of negatively charged hydroxyl (OH), carboxyl (COOH), carbonyl (C=O), sulfhydryl (SH), and other functional groups that are available to bind with positively charged metal ions. In cyanobacteria, copper plays an essential role as a structural component of plastocyanin, which mediates the electron transport chain, and also an essential cofactor of enzyme superoxide dismutase. However, at higher concentrations (more than 3.0 mg/L), copper is reported to be toxic to microorganisms. Consequently, higher metal contents are transferred to higher trophic levels of the food chain. The permissible limit of Cu^{2+} in water is between 0.05 and 1.5 ppm, and has many health risks associated with the exposure to excess Cu^{2+} in humans. Abnormally high copper levels have been associated with a number of diseases, including neurodegenerative disorders such as Alzheimer's, Parkinson's, and prion diseases.

In this work, the effect of divalent copper ion (Cu^{2+}) exposure was studied on cyanobacterium *Nostoc linckia* growth. A sulfate salt of copper, namely copper(II) sulfate pentahydrate, was used as a source of metallic ions. The copper concentrations chosen for the study were 0.1, 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 10 and 20 mg/L, which were added to the culture in the exponential growth phase of the life cycle. *Nostoc* growth was determined spectrophotometrically at the end of cultivation cycle, which lasted 12 days.

The data showed no significant decrease in the amount of biomass in the case of *Nostoc* growth under the lowest concentrations of copper ions. Hence, in metallic monosystems with 0.1, 0.5 and 1.0 mg/L copper ions, cyanobacterial biomass produced during cultivation cycle was about 1.0 g/L, which means a reduction of up to 15% compared to control. In the case of further metal concentrations such as 1.5, 2.0 and 2.5 mg/L, *Nostoc* growth has sharply decreased up to 32% in comparison with control. Then, the cultivation of cyanobacterial strain under conditions of higher concentrations of copper 5.0, 10.0 and 20.0 mg/L did not have a significant effect on the reduction of biomass production. At the same time, the data were comparable with the cultivation of the culture under conditions of low concentrations of copper ions. Thus, we can see a wave type effect of *Nostoc linckia* growth under various concentrations of metallic copper.

The release of polysaccharides by some cyanobacterial strains has been one of the mechanisms to overcome metal toxicity. The increase in the amount of exopolysaccharides synthesized by nostoc in response to higher concentrations of copper and the protective role of these molecules may explain the wave type effect of *Nostoc linckia* exposure to different concentrations of copper.

Keywords: *Nostoc linckia*, bioremediators, concentrations of copper ions, cultivation cycle, food chain, health risks, heavy metal ions,