

# Effect of Heavy Metals on the Biological Activity of Certain Soil and Groundwater Microorganisms

F.N. Barakah, E.M. Ramadan and A.M. Heggo

Department of Soil Science, College of Agriculture,  
King Saud University, P.O. Box 2460, Riyadh 11451, Saudi Arabia

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**Abstract.** *Pseudomonas* P<sub>13</sub>, *Bacillus* B<sub>35</sub>, *Streptomyces* S<sub>2</sub> and *Mucor* F<sub>3</sub> (isolated from calcareous soil and groundwater) were grown at different levels of heavy metals (Fe, Mn, Zn, and Cu) in a batch culture. Growth kinetics and biological activity of these organisms were studied. The results obtained revealed that all tested levels of heavy metals (5 - 30 mg l<sup>-1</sup>) supported growth of *Pseudomonas* P<sub>13</sub> and *Bacillus* B<sub>35</sub> on the 1<sup>st</sup> day of incubation, thereafter the growth rate decreased gradually to less than the control. Low levels of heavy metals (5 and 10 mg l<sup>-1</sup>) enhanced *Streptomyces* S<sub>2</sub> and *Mucor* F<sub>3</sub> growth. Consumed carbon and carbon utilization efficiency were higher in the control than treatment. Tested organisms also showed higher amount of growth per unit of consumed carbon, nitrogen and phosphorus in heavy metals-free medium than treated one. *Mucor* F<sub>3</sub> was the most resistant microorganism to high concentrations of heavy metals where the growth was reduced from 26.1% to 35.7% at 20 and 30 mg l<sup>-1</sup> heavy metal, respectively. *Pseudomonas* P<sub>13</sub> and *Streptomyces* S<sub>2</sub> were more sensitive to high levels of heavy metals.

**Keywords:** Microorganisms, soil, ground water, heavy metals toxicity, growth, CNP-consumed

## Introduction

In the last five decades of this century the world had faced a number of formidable environmental problems such as enrichment of soil and water with heavy metals, recalcitrant pesticides, disposal of animal and industrial wastes, acid rain and depletion of the ozone layer, etc. Duxbury and Bicknell [1] and Angle *et al.* [2] reported that industrial activities and disposal of waste products have resulted in the contamination of many terrestrial environments with heavy metals. The extent to which these environments are polluted and whether the metals adversely affect biological systems are difficult to determine. Many heavy metals are essential for microbial growth and metabolism at low concentration, e.g. Cu, Zn, Mn, and Fe, whereas others have no known essential biological function, e.g. Au, Ag, Cd, Pb, Hg and Al [3]. Bacteria