RESEARCH PAPER

Effect of nickel stress on growth and antioxidants in cyanobacterium *Cylindrospermum* sp.

ABHISHEK CHRIS

Department of Botany, Wilson College, MUMBAI (M.S.) INDIA
Email : achris1@rediffmail.com

Paddy field cyanocterium *Cylindrospermum* sp. grown in BG-11 medium containing various concentrations (0, 25, 50, 75 and 100 µM) of Ni, showed a dose dependent decreases in growth (Chlorophyll-a). Nickel treated cells exhibited increased rates of MDA, demonstrating enhanced lipid peroxidation. Antioxidant enzymes such as superoxide dismutase (SOD) and peroxidase (POD) activity increased with the increase in nickel concentrations. Proline contents also proportionately increased with the elevated Ni concentration in cyanobacterium. Study shows that the antioxidant (enzymatic and non enzymatic) activities might play a central role in cellular protection against the Ni induced oxidative stress.

Key words **:** *Cylindrospermum* sp., Ni, MDA, POD, SOD

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INTRODUCTION

Heavy metals can be included in the main category of pollutants. Nickel is a heavy metal used extensively and can contaminate the soil mainly through sewage sludge, industrial compost and atmospheric fallout, especially near processing plants (Poulik, 1997).Nickel is an essential micronutrient for plant growth and it is also a component of enzyme urease which is required for nitrogen metabolism in higher plants (Dixon *et al.,* 2004). However, excess nickel is known to be toxic and many studies have been conducted concerning Ni toxicity in various plant species (Pandolfini *et al.,* 1992; Gajewska and Skodowska, 2008; Ahmad, *et al*., 2009; Khan and Khan, 2010; Gajewska and Skodowska, 2010; Singh and Pandey, 2011). The most common symptoms of nickel toxicity in plants are growth inhibition, photosynthesis, mineral nutrition, sugar transport and water relations (Seregin and Kozhevnikova, 2006).Over production of reactive oxygen species (ROS) is a common response of plants to heavy metal stress especially nickel stress (Blokhina *et al.,* 2003). It is well established that the overproduction of ROS induces oxidative damage to various cellular constituents, such as lipid, proteins and nucleic acids (Shah *et al.,* 2001). One of the most damaging oxidative effects is the peroxidation of membrane lipids, which results in concomitant production of melondialdehyde (MDA) (Hodges *et al.,* 1999). Plants have evolved antioxidative mechanism to detoxify and eliminate these harmful ROS (Chri, *et al*., 2008). The antioxidative defense system includes antioxidant molecules like proline and antioxidant enzymes such as superoxide dismutase (SOD, EC 1.15.1.1) peroxidase (POD, EC 1.11.1.7) as well as catatlase (CAT, EC 1.11.1.6). SOD is the first enzyme in detoxifying process, converts O_2^- to H_2O_2 and POD and CAT catalyse the breakdown of H_2O_2 (Asada, 1992, 1999). Proline also acts as an effective ROS quencher and accumulates heavily in plants under metal stress (Alia and Pardha Saradhi, 1991).

The role of nitrogen fixing cyanobacteria in enhancing soil fertility has been long known and is well documented (De, 1939; Venkataraman, 1981; Sinha and Hader, 1996). Cyanobacteria contributes to overall soil health not only by its ability to perform biological nitrogen fixation but also because of its ability to produce polysaccharides and other bioactive compounds which has a growth stimulating effect on plants, as well as ensuring maintenance of soil quality and preventing erosion (Singh, 1950).

The toxic effect of nickel on cyanobacteria especially on their growth, carbon fixation, nitrogen metabolism (Rai and Raizada, 1985, 1986), phosphorus metabolism (Asthana *et al.*, 1992) and bioremediation (Shukla *et al.,* 2009) are studied earlier

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