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Effect of Pollutants on Aquatic Plants

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Abstract

Many heavy metal ions have direct influence on various physiological and biochemical processes in plants. Metal ions and their complex exhibit a wide range of the toxicity to the organism i.e. sub lethal to lethal, depending upon the time of exposure and the prevailing conditions in the ambient water. Some metal such as Cu, Zn and Fe are essential for biological system while Pb, Cd, Cr, Ni, As & Hg are highly toxic even in low concentration. As the growth reflects the metabolism of the cell, it has been used as a key indicator of the toxicity of heavy metal ions in microorganisms and it depends on the proper functioning of various metabolic processes, such as photosynthesis, respiration and nutrient uptake, etc. Like all living organisms, plants are often sensitive both to the deficiency and to the excess availability of some heavy metal ions as essential micronutrient, while the same at higher concentrations and even more ions such as Cd, Hg, As are strongly poisonous to the metabolic activities. Researches have been conducted throughout the world to determine the effects of toxic heavy metals on plants. Much work has been carried out in India regarding the occurrence of heavy metals in lentic water bodies causing a sharp increase in pollution. Aquatic plants provide a valuable alternative source for metal remediation. Many scientists have studied accumulation of heavy metal in aquatic plants. High levels of heavy metals such as Al, Fe, Si, Mn were found in *Vallisneria spiralis*, *Hydrilla verticillata* and *Azolla pinnata*, *Riccia fluitans*. Wetland plants possess higher capacities in accumulating trace elements like Cu, Ni, Zn, Pb etc. *Lemna minor*, *Eichhornia crassipes* were found as good accumulators of Cd, Si and Cu. Heavy metal ions can cause plasma membrane depolarization and acidification of the cytoplasm. Excess concentration of Cu causes plant growth retardation and leaf chlorosis. Oxidative stress causes disturbance of metabolic pathways and damage to macromolecules. Nevertheless, copper (Cu) is known to reduce photosynthesis rates and respiration of aquatic moss, *Fontinalis antipyretica*. Accumulation of excessive manganese (Mn) in leaves causes a reduction of photosynthetic rate. Necrotic brown spotting on leaves, petioles and stems is a common symptom of Mn toxicity. Lead is an extremely toxic heavy metal that disturbs various plant physiological processes. A plant with high lead concentration fastens the production of reactive oxygen species (ROS), causing lipid membrane damage that ultimately leads to damage of chlorophyll and photosynthetic processes and suppresses the overall growth of the plant. High levels of Zn in soil inhibit many plant metabolic functions, result in retarded growth and cause senescence. Zinc toxicity in plants limited the growth of both root and shoot. Zinc toxicity also causes chlorosis in the younger leaves, which can extend to older leaves after prolonged exposure to high soil Zn levels. Another typical effect of Zn toxicity is the appearance of a purplish-red color in leaves.

Key words: Toxicity, Chlorosis, Senescence, Heavy metal, Depolarization