NATURE AND EXTENT OF HEAVY METAL POLLUTION FROM INDUSTRIAL UNITS

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Received: July 21, 2018 Accepted: Nov 15, 2018

ABSTRACT *In the last few decades of the 20th century, environmental pollution emerged as a major concern for the survival and welfare of mankind throughout the world. In fact most of the developed countries have already realized the fact that the very existence of life on earth may be endangered, if suitable steps are not taken for the control and abatement of environmental pollution. This is why the industrialized and developed nations have already been spending vast amount of money to control the environmental pollution and the developing countries are beginning to follow their action within the constraints imposed by the limited financial resources, infrastructural facilities and the scarcity of trained man power.*

Keywords: *Environmental pollution.*

INTRODUCTION

Rapid industrialization has resulted in the generation of liquid, solid and gaseous wastes in such a huge quantity that a serious threat is likely to be posed to the quality of water in the years to come. The crux of the present day environmental problem concerning the water is further accentuated due to everyday pouring in of the filth from the communities, untreated wastes from industries and even increasing run-off excess and unutilized fertilizers and pesticides from agricultural fields, orchards and forests. This problem is getting from bad to worse with advancement of technology pertaining to meet the increasing demands of swarming human population. Industrialization is the mainstay of modern society for economic prosperity of our nation. When in 1947, the country threw off the yoke of foreign domination and emerged as a sovereign independent nation. The national Government realized that industrialization was necessary to stabilize the economy of democratic India. Although, rapid industrialization is the utmost need of developing country like India, there should be awareness about the way in which factory effluents should be discharged without much damage to the flora and fauna.

Pollution of the biosphere by heavy metals due to industrial, agricultural and domestic activities has created a serious problem for the safe and rational utilization of soils and water (Igwe *et al.,* 2005; Srivastava *et al.,* 2005). Heavy metal pollution is a serious threat to the environment due to the fact that they cannot be degraded, rather they persist and are accumulated, hence pose severe affects on all life forms. They can cause adverse toxic effects on the plants growing in the affected area leading to a decrease in agricultural productivity. Other side of picture is that due to high cost and scarcity of chemical fertilizers, the land disposal of agricultural, municipal and industrial waste is widely practiced as a major and economic source of nutrients and organic matter for growing cereal crops by poor farmers in Pakistan (Younas & Shahzad, 1998; Jamal *et al.,* 2002). The use of such waste water in irrigation system definitely provide some nutrients to enhance the fertility of soil but also deposit toxicants that change soil properties in the long run. This necessitates a detailed scientific study before any specific waste can be used for irrigation for a particular crop and environmental conditions. Environmental pollution has become a serious problem, at present. Emitted effluents and solid wastes from various industries have increased the amount of contaminants in air, water and soil to hazardous level in many areas. Moreover, indiscriminate use of insecticides, herbicides, pesticides and some other chemicals used for plant protection and allied purposes have also led to their accumulation to damaging concentration in the organisms of the higher trophic level. In the local area, effluents of certain industries are being discharged into city sewage drain. This water is being used for irrigation purposes of crops in several adjoining farms. It was therefore, of interest to see, whether and to what extent such irrigation with polluted water could harm the plants. The heavy metals in the distillery effluent show biomagnifications through food chains and their concentration becomes toxic in edible parts of crop plants.

EFFECT OF HEAVY METAL UPTAKE ON PLANTS

William and David (1973) studied the accumulation of Cd residue from phosphate fertilizers and their effects on plants. At least 80% of Cd impurities in phosphate fertilizers, applied during normal cropping practices, could be accounted for in the cultivated layers of soil examined. Cadmium along with Fe, Cu, Al, Co and Mo usually accumulates more in the roots than in the shoots. However, often moderate and sometimes large conc. of these elements can be found in the shoots (Wallace and Romney 1977). Coughtry and Martin (1978) studied Cd uptake and distribution between roots and shoots of a tolerant and non-tolerant population of *Holcus lonatus* with reference to both concentration and total contents. They observed that the uptake of Cd into the roots of both normal and tolerant plants from nutrient solutions containing 1.00 ppm Cd in extensive and in normal plants as much as 90% of the whole plant Cd remains in the root but translocation allows shoot concentrations to reach 145 ppm. In tolerant plants translocation of Cd to shoots is further reduced with a concomitant increase in waste of Cd concentration in roots.

Davis et al. (1978) summarized the critical level of copper in certain crop plants like wheat, barley, lettuce and rye grass. Bass (1975) extracted fertilizers and animal feed from molasses fermentation residues for their utilization in the crops. Khera and Singh (1975) studied the fertilizers aeration interaction in maize under temporary flooding condition. Williams (1975) described the use of sewage sludge on agricultural land and the effects of various metals on the growing crops. Jung et al. (1979) conducted one and two years pot trials with oat, maize, mustard and sunflower to investigate how phosphatic fertilizers with varying Cd concentration affect the Cd enrichment of the plants (in each case only the shoots were analysed for Cd). Cadmium in plant materials as well as in soil fertilizers were determined by flameless atomic absorption spectroscopy using a graphite vessel. They found that the soil content of water soluble Cd and not the total Cd content of the soil is the decisive factor for the Cd enrichment of plants. The Cd content of the plant material is very strongly influenced by soil pH. Cd uptake increases as the soil pH decreases. Even slight changes in the pH value resulting from any kind of fertilizer application can lead to considerable changes in the Cd content of the plants.

REVIEW OF LITERATURE

Peralta et al. (2001) investigating the effect of heavy metals on alfa alfa (*Medicago sativa* L.) reported stimulated seed germination, root and shoot elongation at 5 ppm but at higher concentration of 40 ppm there was reduction in the seed germination and root and shoot growth. Nan and Cheng (2001) worked on distribution of heavy metals in spring wheat (*Triticum aestivum* L.) and reported that concentration of Cd and Pb in different parts of plants was very much lower than the concentration applied in the irrigation water. Barman et al. (2001) and Minkina et al. (2001) reported that higher accumulation of heavy metals was found in the plant parts in naturally growing weeds and cultivated crop plants irrigated with treated industrial effluent. Liu et al. (2001) and Koumey et al. (2000) showed the effect of heavy metal accumulation in maize (*Zea mays* L.). They reported that root growth with fresh and dry weight decrease progressively with increasing concentration of Cu^{+2} in solution. Shoot growth with fresh and dry weight decrease progressively when leaves were treated with increasing concentration of Cu^{+2} in solution.

Soil is the most important component of the environment, but it is the most undervalued, misused and abused one of the earth's resources (Gokulakrishnan and Balamurugan, 2010). Soil contamination has become a serious problem in all industrialized areas of the country. Soil is equally regarded as the ultimate sink for the pollutants discharged into the environment (Shokoohi et al., 2009). Most plants and animals depend on soil as a growth substrate for their sustained growth and development. In many instances the sustenance of life in the soil matrix is adversely affected by the presence of deleterious substances or contaminants. The entry of the organic and inorganic form of contaminants results from disposal of industrial effluents (Gowd et al., 2010). The source of the organic and inorganic elements of the soil of contaminated area was mainly from unmindful release of untreated effluent on the ground (Shetty and Rajkumar, 2009). The contamination of soils with heavy metals or micronutrients in phytotoxic concentrations generates adverse effects not only on plants but also poses risks to human health (Murugesan et al., 2008).

EFFECT OF POLLUTION ON ENVIRONMENT

Chatterjee et al. (1976) extracted potash fertilizer from distillery wastes. Irvine and Knights (1976) studied the use of chemicals viz. nitrogen, phosphorus and potassium present in effluents in agricultural fields. Kirkham (1976) estimated trace elements in corn, grown on long term sludge disposal site. Limay (1976) worked out the utilization of industrial wastes in agricultural field. Azad et al. (1984) studied the nature and extent of heavy metal pollution from industries situated in the vicinity of Ludhiana. The effluent samples

from the industrial units were analysed periodically and revealed Zn, Fe and Ni in particular while Pb, Cu, Cd, Ca and Mn in general near by metal industries. They observed that the concentrations of these heavy metals are more in the evening than in the morning hours. The heavy metals in the industrial effluents were found variable depending upon the source and of much higher conc. than the contents observed in soil.

EXPERIMENTAL PLANT

The test plant, *Brassica juncea* L. belongs to the family Brassicaceae and includes about 375 genera and 3200 species (Willis, 1973). Different oil-rich species of Brassicaceae are grown in different parts of the country. *Brassica juncea* is most widely grown in U.P, Punjab, Bihar and Bengal. The characteristic plant of *Brassica* is a tall, annual herb with 120-150cm height, with simple or branched stem, large leaves (the lower being lyrately pinnatipartite), bicarpellary, syncarpous superior ovary bearing large number of ovules on parietal placenta and siliqua with replum. The plant has tap root with secondary roots coming- out as laterals, branched stem, hairy and lyrate leaves. The infloresence is corymbose receme and bears small ebracteate bright yellow flowers. The biological yield as measured in terms of total dry matter of the plant at final harvest is closely related with economic (seed) yield.

The crop is largely grown during the cold season, especially in Doaba districts and usually sown in parallel lines mixed with wheat and barley. The oil yield of the seeds is an important ingredient of Indian cookery and is also used for lighting purpose.

The fruit is a siliqua developed from a bicarpellary, syncarpous and superior orary and is about 3.5cm in length with an extended beak and is divided longitudinally into two halves by the replum, a thin and membranous structure. The two halves are cleaved away from base upwards leaving the replum with the seeds pressed against it.

Conclusion:

The problem of waste disposal in its acute forms in which it exists today began in Nineteenth century with advent of industrial revolution and phenomenal growth of population. The waste disposal problem, however, evokes little interests from the mill owners because of additional costs involved in treatment of waste.

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