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Accumulation of heavy metals in crop plants through irrigation of contaminated ground water in Panipat region.

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Abstract

In the modern industrialization period, most of water resources had affected enormously by seepage, leaching and intermixing of industrial effluents. The textile effluents had consisting high concentrations of trace heavy metals and through its accumulations in different trophic levels of ecosystem ultimately cause the health hazards among livestock and human beings. The different crop plant samples collected from agriculture fields adjoining of textile industrial effluent flowing channels contained in situ these heavy metals e.g. Lead (pb), Copper (Cu), Manganese (Mn), Nickel (Ni), Iron (Fe), Cadmium (Cd) and Zinc (Zn). The bioremediation processes are urgently required to combat ground water pollution.

Key words-: Heavy metals, Textile effluents, Bio-accumulation, Industrial pollution, Crop plants.

Introduction

In India, the industrial effluents have contributed as major source of pollution. Different industries of the country contribute about 16% of the total waste water generated. The treatment facilities have been installed in less than one third of the polluting industries (Gopal, 1994). Most of effluent treatment plants (ETP) have not performed physical and chemical treatment processes satisfactory due to economic reason on commercial scales.

Textile industrial effluents have accounted to about 15-20% of total waste water in the country. The textile effluents containing different colours, inorganic and organic chemicals and heavy metals are highly polluted in nature and vary in its composition. The practice of disposing textile wastewater without any treatment affects the aquatic and soil system. In the adjoining agricultural area of textile industries sector, there is immense potential of ground water being contaminated from effluents.

The present study reveals the accumulation of different heavy metals in crop plants and exhibits the cycles of transfer of heavy metals from industrial effluent to consumer levels and lastly affected the health of livestock and human being.

Materials and Methods

Panipat is situated on the national highway of Delhi-Chandigarh in Haryana, which is well known for textile and dye industries. The effluent samples were collected from the outlet of dyeing units and analyzed the physico-chemical parameters (APHA, 1995). Shoot and root samples of different crop plants grow in agriculture fields were also collected for analysis. These samples were washed with tap water, dilute hydrochloric acid, and distilled water and then dried in oven at 67^0C and grind in a stainless steel grinder to pass through 16-mesh sieve. Plant samples were digested in HNO_{3-} $HClO_4$ diacid mixture and analyzed by atomic absorption spectrophotometer AAS-4129.

Results and discussion

The textile effluent had alkaline pH varied 7.3-8.25. Dissolved oxygen of the dye house waste water was higher in comparison to the sewage water. The impact of dissolved oxygen was also quite obvious on BOD (Biochemical oxygen demand). The COD (Chemical oxygen demand) of the dye waste water was very high being (137 - 734 mg/I). Senthinathan and Azeez (1999) and Groff (1993) reported that textile waste waters may cause problem used as untreated effluent consists higher phosphorous, COD, pH, temperature and absorbable organic halogen. Since NaCI is mostly used for fixing dyes the contents of both CI and Na increased with electrical conductivity.

Concentration of heavy metals in textile effluents as Zn, Ni, Mn and Cd were observed quite low while the Fe, Cu and Pb were analyzed to be slightly higher (table-1). Rahman (1996), Usha (1989) and Khan *et al.* (1995) also found Pb and Cd in excessive amount than those of the permissible limits.

The chemical analysis of the crop plants from the adjoining agricultural fields, which are mostly irrigated by ground water through bore tube well in Panipat region were found to accumulate the heavy metals like Pb, Cd, Fe, Mn, Ni, and Cu contents were with in the prescribed limits excepts lead (Pb). The concentration of Pb in Barseem and Cauliflower shoots was recorded 18 ppm and 24 ppm respectiviely. Moreover Pb contents in roots of crop plants were still higher varied as 16 - 28 ppm(Table-2). It has been earlier reported, by Khan *et al.* (1997) and Navarro (1993) that use of textile industrial wastewater in irrigation, increased heavy metals contents in the crop plants.

The contents of lead are beyond safe limits and hence its sources need to identified and remediated otherwise it would create health hazards. The effluents also cause various health problems such as skin allergies, lung infection, carcino-mutagenic disorders among the human being through contaminated ground water supply by municipal tube well water scheme (Kumar 1998 and Sharma *et al.* 1999).

Reference

APHA, 1995 Standard methods for examination of water and waste water. American *Public Health Association*, 19th edition. Inc, New York. pp.- 1970.

Gopal, B. 1994 Conservation of Inland water in India: An overview. Verh. Internet.Verein. ***Hydrobiologia***, 384:267.

Groff, K.A. 1993 Textile waste. ***J. Water Environment Research***. 65:421.

Khan, T.I. and Jain, V. 1995 Effects of textile industries waste water on growth and some bio-chemical parameters of *Triticum aestivum* var. Raj 3077. ***J. Environ.Pollu.*** 2(2): 47 - 52

Khan, T. I. Kaur, N. and Agrawal, M.1997 Heavy metal analysis of crop plants from agriculture fields of Sanagar town. ***J. Environ. Pollu***. 4(1): 35-36

Navarro, A. and Font, X. 1993 Discriminating different sources of ground water con tamination caused by industrial waste in the Besos River basin, Barcelona. ***J. Applied Geochemistry APPGEY.*** 8:277.

Rahman, A. 1996 Ground water as a sources of contamination for water supply in rap-idly growing mega cities of Asia: Case of Karachi, Pakistan. In: *proceeding of the 18th biennial conference of the international association of water quality*. 34(7-8): 285.

Senthilnathan, S. and Azeez, P.A. 1999 Influence of dyeing and bleaching industries on ground water of Tripur, Tamilnadu, India. ***Bull. Environ. Contam. Toxicol***. 62: 330-334

Sharma, K.P.; Sharma, K.; Bhardwaj, S.M. and Chaturvedi, R.K. 1999 Environmental impact assessment of textile printing industries in Sanagar, Jaipur: A case study. ***J. Ind. Bot. Soc.*** 78: 71-74

Usha, M. 1989 Impact analysis of industries in Sanagar. P. G. diploma field study report Indira Gandhi Centre for HEEPS, University of Rajasthan, Jaipur. pp-65

Table 1: Physico-chemical parameters and heavy metals of textile effluents.

Parameters	Effluent-I	Effluent-II	Effluent-III	Effluent-IV
EC (ms/m)	5.87	1.50	7.70	4.45
TDS(gm/l)	2.93	7.38	4.09	7.28
pH	7.30	8.00	7.50	8.25
DO (mg/l)	7.70	5.20	1.80	1.30
BOD (mg/l)	31	51	27	51
COD (mg/l)	734	158	137	151
Na (mg/l)	9.90	1.84	3.04	5.27
K (mg/l)	0.36	0.43	0.22	0.53
Ca+Mg (mg/l)	11.20	7.60	5.60	9.00
Cl (mg/l)	2.20	3.20	3.00	6.10
CO_3 (mg/l)	1.20	0.00	0.00	0.00
HCO_3 (mg/l)	11.60	6.50	3.95	4.60
PO_4 (ppm)	4.0	0.0	0.0	1.0
NH_3 - N (ppm)	60.90	2.45	2.15	3.50
NO_3 - N (ppm)	3.50	8.40	8.20	2.45
Mn (ppm)	0.06	0.01	0.16	0.069
Ni (ppm)	0.02	0.00	0.05	0.00
Fe (ppm)	0.30	0.03	0.12	0.12
Cu (ppm)	0.13	0.02	0.10	0.40
Cd (ppm)	0.00	0.01	0.02	0.01
Pb (ppm)	0.23	0.18	0.59	0.33
Zn (ppm)	0.20	0.03	0.03	0.11

Table 2: Heavy metals in crop plants samples.

Crop plants	Pb (µg/g)	Cd (µg/g)	Fe (µg/g)	Zn ((µg/g)	Mn (µg/g)	Ni (µg/g)	Cu (µg/g)
Shoots							
Wheat shoot	10	0.20	144	271	16	15.6	4.0
Barseem shoot	18	0.6	172	264	10	23.2	7.2
Radish shoot	0.0	0.0	126	249	21.4	18.8	0.4
Cauliflower shoot	24	0.0	215	284	23.0	0.0	10.3
Coriender shoot	0.0	0.0	107	266	36.0	15.6	2.8
Roots:							
Barseem root	27	0.0	165	220	57.6	30.2	8.3
Radish root	16	0.0	146	136	42.2	0.0	10.4
Cauliflower root	28	0.0	196	156	45.2	0.0	16.2
Coriender root	22	0.0	179	152	36.2	0.0	6.2
Palak root	21	0.0	172	122	35	0.0	12.0