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The impact of industrial effluent on Growth of *Cicer arietinum*

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Abstract

The present paper deals with the study of Physico-chemical characteristics of a industrial effluents and effluent treated soil.The physico-chemical characteristics suggested that effluent was under the permissible limit as per ISI- guidelines. Therefore, there is no harm to use this water for irrigation purpose. The pot experiments reflected that there was increase in total biomass and chlorophyll content in effluent irrigation plants. The most encouraging results were observed in 60% of effluent than 40% and 100 % . The higher concentration of effluent restricts growth of plants like *Cicer arietinum*.

Key Words : *Cicer arietinum, Metalaid, Industrial effluent, Physico-chemical*

Introduction

Metal toxicity has become a problem in marginal cropland because of the increased metal solubility from acid rain. Industrial activities generate large quantities of water containing chemicals , trace elements , effluent containing alkaline, acid calcium carbonate, sodium , potassium , nitrate , almunium are discharged. For these elements known to be essential in animal human and in plant nutrition. " Micronutrients are more useful and explicit term". The micronutrients important for plant growth, are Cu, Zn, Fe, Mn, Mo, Co, Na, B and U possibly.

Various types of chemicals are used for forming the product in metal aid industry. The main chemicals which are used as a raw materials are aluminium ash, aluminium powder, sodium, Silicofloride, nitrate, pf reagent, wooden dust, fly ash, Saw-dust and ash. The treatment used for industrial wastes are almost the same as that of sewage. All types of treatment such as preliminary treatment, primary treatment , secondary treatment , tertiary treatment are also necessary in case of industrial waste treatment. In industrial waste treatment it is impossible to select a well suited treatment for a particular effluent (organic, inorganic and chemical effluent) because of the fact that the quality of wastewater is uniform as well as predictable and the pollutant present is known.

In the present investigation an attempt has been made to analyse the physico-chemical aspect of metal-aid industrial effluent and their effect on the growth parameter of *Cicer arietinum*.

Material and Methods

The material and methods include the following aspects.

* Location of site
* Sampling
* Water analysis
* Soil analysis
* Plant growth

Sample of water for various examination were collected from metal aid industry located in Hardwar District, Soil sample was collected from agriculture land.

Water samples were collected in plastic cans for analysis of physico-chemical characteristics of various parameters i.e pH, electrical conductivity , total dissolved solid, total hardness, dissolved oxygen, alkalinity , sodium, potassium and were estimated as per methods of APHA (1998) and Trivedy and Goel (1986).

Soil samples were collected from the agricultural field and were analysed for various parameters i.e pH, electrical conductivity, alkalinity, organic matter, carbon present, sodium, potassium and bicarbonate. The soil sample were air dried crusted and passed through 2μm sieve and stored in polythene bags for analysis.

Results and Discussion

The results of the above study is shown in table 1-6. The quality and composition of effluents depends upon the type of industry. According to Bhatnagar (1993) colour of water is usually estimated by visual method. Colour of metallic industrial effluent depends upon the metal used.

Temperature is basically an important factor for its effects on chemical and biological reaction in water . The mean value of temperature recorded was 27 ^{0}C ± 0.82 ^{0}C .Electrical conductivity is an indication of dissolve solid and suspended solids. The mean values of electrical conductivity was 0.255 μ mhos/cm ± 0.008 μ mhos/cm. The ability to transmit an electrical current depends on the concentration of charged ionic species in the water Trivedy and Goel (1986). The mean value of pH of effluent collected from metal aid industry recorded was 8.69 ± 0.660 and this is with in acceptable range for industrial effluent (ISI). Alkalinity of water is its capacity to neutralize a strong acid and is characterised by the presence of hydroxyl (OH^+) ions capable for combining with hydrogen (H^+) ions (Saxena, 1994). The mean value of alkalinity was 126.8 mg/l ± 3.02 mg/l.

In the present study , mean value of total hardness has no known adverse effect. Total hardness of water is the sum of alkaline earth metals cations present in it. Hardness is mainly due to presence of carbonate, bicarbonate, sulphate chloride etc. (Trivedy and Goel, 1986).Mean value of dissolved oxygen in the sample observed was 4.738 mg/l ± 0.607mg/l and biochemical oxygen demand (BOD) was 1.538 mg/l ± 0.1321 mg/l. BOD can be defined as the rate of removal of oxygen by microorganisms in aerobic degradation of the dissolved or even the particulate organic matter in water and it is used as an index of organic pollution in water (Saxena, 1994).

In the present study , the mean value of sodium was 3.85 mg/l ± 0.512 mg/l , potassium is also a naturally occuring element in the present study the mean value of potassium was 20.00 mg/l ± 0.895 mg/l.

Soil pH strongly influence plant nutrient availability and soil productivity. From the evidence available , neither a high pH above 8.4 nor a low pH below 5 is favourable for maximum field of crop (Puruthi, 1970). The mean value of pH was found 7.56 ±0.521. According to Verma (1994) the favourable pH for growth of plants is 7.8. The mean value of electrical conductivity of soil was found to be 0.24 μ mhos/cm ± 0.004 μ mhos/cm.

During present study , the mean value of alkalinity was 50.00mg/l ± 0.982 mg/l. In the present study mean value of carbon present is 0.825 %± 0.013 % and the mean value of organic matter was 1.42 % ± 0.019 %.

The value of exchangable Sodium was found 6.35 mg/l ± 0.434 mg/l. Soil temperature also affects the potassium uptake by plants. Reduced temperature shows down plant growth and rate of potassium uptake (Tisdale *et al.* ,1995) . Tisdale *et al.* (1995) reported that when the content of sodium ion increase the potassium ions may become less as sodium ion can partially substitute for potasium. The value of exchangable potassium was 3.04 mg/l ± 0.1289 mg/l in agricultural soil at the time of study. In the present study the mean value of nitrate was 0.0065 % ± 0.02 %.

The results shows that the germination rate in control was high, where as in 40% and 60 % the germination present was slightly less than control and 100 % concentration also exhibit moderate percent for germination of seeds.The shoot length in control was high than in 60% , 40 % and 100% concentration. The 60 % concentration was more suitable for root length of *Cicer arietinum* in comparison to control, 100 % and 40 % effluent.The reduction in root and shoot length in seeds treatment with effluent might be due to the stress caused by high salinity Kumar *et al.* (1993).

The control irrigated plants biomass was found high during the course of study, therefore the plants of control sites were found healthy whereas higher concentration of effluent retards the biomass. Effect of tailing water irrigation on biomass of *Vigna radiata, Tritienum aestivum, Brassica compestris* etc. was studied by Thukral (1986). The study revealed that with the increase of effluent concentration , biomass of different parts of the plant decreased gradually. The 60% content shows the highest amount of chlorophyll than 40%. The control shows relatively less values of chlorophyll content. The least values were observed for 100 % concentration.

References

A.P.H.A. 1998 *In : Standard methods for the examination of water and waste water*, 19 th ed. APHA, Washington ,D.C.

Bhatnagar, M.K. 1993 *In: A study of physico-chemical properties of industrial effluents and city sewage effected of biogas production,* M.Sc. Dissertation ,Department of Chemistry, Gurukul Kangri University , Haridwar.

Kumar, N.V.,Bhagyalakshmi, K.N. and Dhananjaya, M. 1993 Tannery and Chromate industrial effluent and pesticide contamination of reservoir and other water bodies: Physico-chemi cal and ecotoxicological studies . *In: Ecology and pollution of Indian lakes and reser voirs*. Ashish Publishing House New Delhi.

Puruthi, D. 1970 Determination of pH colorimetric method. ***Nature,*** 174 : 1100.

Saxena, M.M 1994 *In: Environmental analysis Water, Soil and Air*, Agro Botanical Publishers, New Delhi.

Tisdale, S.L., Werner. L.N. and John, L.H. 1995 *In : Soil fertility and fertilizer.* Prentice Hall India Pvt. Ltd., New Delhi.

Thukral, A.K. 1986 Effect of tailings water irrigation on the biomass of some crop plants, ***J. Env. Biol.*** 10 (4): 337.

Trivedy, R.K. and Goel, P.K. 1986 Physico- chemical analysis of water *In: Chemical and Biological methods for water pollution studies.* Environmental publication Karad.

Verma, N. 1994 In: Comparitive studies of different sub standard soil with cultivated land in relation to some physico-chemical component, M.Sc. Dissertation of G.K.U Haridwar.

Table 1: Values of Some selected physico-chemical parameters of effluent of metalaid industry (Values are mean ± SE for Eight observation each)

S.No.	Parameters	Mean Values
1.	Color	Grey
2.	Temperature (°C)	27.0 ± 0.82
3.	Conductivity(m mhos)	0.255 ±0.008
4.	pH	8.69 ±0.660
5.	Alkalinity (mg/l)	126.80 3.02
6.	Hardness (mg/l)	144.0 ±0.915
7.	DO	4.738 ±0.607
8.	BOD	1.538 ±0.132
9.	Sodium (mg/l)	3.85 ±0.512
10.	Potassium(mg/l)	20.0 ±0.895

±= Standard Error

Table 2: Values of Some selected physico-chemical parameters of soil in agricultural field. (Values are mean ± SE for Eight observation each)

S. No.	Parameters	Mean Values
1.	pH	7.56± 0.521
2.	Conductivity (mmhos)	0.24± 0.004
3.	Alkalinity (mg/l)	50.00 ± 0.982
4.	Organic matter (%)	1.42 ±0.019
5.	Organic Carbon (%)	0.825 ±0.019
6.	Sodium (mg/l)	6.35 ±0.434
7.	Potassium (mg/l)	3.04 ±0.129
8.	Nitrate (%)	0.0065 ± 0.02

±= Standard Error

Table 3: Values of germination percentage of plant of *Cicer arietinum*

Concentration	Control	40%	60%	100%
Germination%	8.86 ± 2.65	7.86 ±2.23	7.86 ±1.26	6.46 ± 2.04

Table 4: Values of root length and shoot length of plant *Cicer arietinum* (after 20 days of germination)

S.No.	Concentration	Shoot length(cm)	Root length (cm)
1.	Control	20.0±0.041	14.60±0.083
2.	40%	15.97 ± 0.028	11.0 ± 0.062
3.	60%	18.70 ± 0.032	16.50 ±0.070
4.	100%	14.80 ±0.021	13.1 ±0.036

Table 5: Average Biomass (gm/m ^{2})

S. No.	Concentration	Control	40%	60%	100%
1.	Fresh X_1	5874.02	4529.37	4543.52	4465.67
2.	Dry X_2	612.17	527.76	537.86	428.16

Table 6: Chlorophyll content of *Cicer arietinum*

S.No.	Treatment	Total Chlorophyll (mg/gm)	a fraction of Chlorophyll (mg/gm)	b fraction of chlorophyll (mg/gm)
1.	Control	0.4684	0.3884	0.0800
2.	40%	0.4983	0.4095	0.0888
3.	60%	0.5260	0.4420	0.0840
4.	100%	0.3682	0.3150	0.0532