Biological Forum — An International Journal, **2**(2): 1-3(2010) **ISSN : 0975-1130**

Physiological and biochemical studies on the effect of waste water on selected crop plants

B.R. Bamniya, Vidhya Kapasya and C.S. Kapoor

Department of Environmental Sciences,
Mohan Lal Sukhadia University. Udaipur, (RJ)

ABSTRACT : The increasing pace of industrialization in public and private sectors along with urbanization, population explosion and green revolution are reflected in varying degree of pollution of water, soil and air. The present study has been carried out to understand the effect of waste water on biochemical contents of *Brassica oleracea, Spinacia oleracea*. The physico-chemical analysis of waste water showed that it was basic in nature and brownish in colour. The higher amount of Alkalinity, COD, TDS were also present in the wastewater. The wastewater severally affects crop plants and soil properties when used for irrigation. The pigment analyses viz. chlorophyll 'a', chlorophyll 'b', total chlorophyll, protein, amino acid, sugar contents were analyzed in present study

Keywords : Waste water irrigation, Biochemical response, sewage

INTRODUCTION

With development of industries and other chemical processing units the pollution of water has become a greater environmental concern because polluted water has adverse effect on the flora and fauna of the particular area. Industrial waste disposal and water pollutants are sources of toxic metal in the environment. One of the possessing problem facing metropolitan areas today is disposal of large volume liquid and solid wastes generated by urban & industrial activities. Use of effluents without treatment may be toxic or harmful for economic crop plants. Use of industrial or municipal waste water for irrigation purpose is a common practice (Singh *et al.*,2004; Feign *et al.*, 1991). The effluent not only affects the plant growth but also deteriorate the soil properties when used for irrigation. In the present study effect of waste water on selected crop plants in term of growth, yield and biochemical parameters are studied. Whether Ayad river effluent could be utilized for irrigation of crop plants like Brassica oleracea, Spinacia oleracea..

MATERIAL AND METHOD

Description of a study area. The 'city of lakes' *i.e.*, Udaipur is situated about 600 m above the mean sea level and is located among the lush green hills of Aravali ranging between 24°35′ N latitude and 73°42′ E longitude. The Ayad river is a tributary of the Berch river. It originates in the hills of Udaipur district of Rajasthan in western India and flows through the city of Udaipur before it joins the Bearch.

Water samples were collected from Ayad river of Udaipur city in plastic cans brought to the laboratory. The Physio-chemical parameters of the effluents were analyzed by APHA (1971) method and further this water is used in plantation of crop plants as Brassica oleracea, Spinacia oleracea in pots. Biochemical parameters studied were amount of chlorophyll a, chlorophyll b, total chlorophyll, carotenoid using (acetone-soluble pigments) spectrophotometer Systronix UV-VIS 108 model (Jensen *et al.*, 1978) Total carbohydrate and total protein of the plant

Table 1 : Physicochemical analysis of Ayad river waste water used for irrigation.

Parameters	Mean	SD	Is standards for irrigation
pH	7.83	0.485077	5.5-9.0
TDS	1050	139.1941	2100
Chloride	143.71	50.58173	600
Alkalinity	256.6667	60.27714	—
Total hardness	457	89.43713	—
COD	136.6667	1.154701	—
Nitrate	0.670333	0.387402	20
Phosphate	0.102	0.072333	—

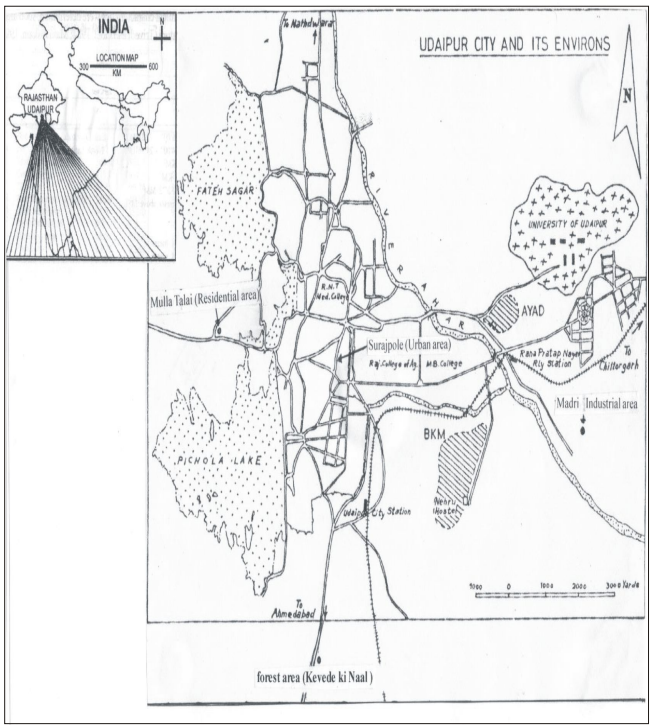

Fig. 1. Map of the study area showing different study sites.

samples as a soluble fraction were also determined (Dubois *et al.*, 1951, Lowry *et al.*, 1951). Various data obtained were subjected to correlation and regression studies and results were discussed on comparative basis.

RESULT

The physico-chemical parameters of Ayad river waste water (Table-2) reveled correlation between different parameters of waste water. pH shows positive correlation with TDS, Cl, hardness, COD, phosphate and negative correlation with alkalinity or nitrite. Correlation between TDS & Cl was (0.993), TDS and hardness (0.956), TDS & COD (0.933) and TDS & phosphate (0.998) means positive correlation. Negative correlation between TDS & alkalinity was (–0.446), TDS or nitrate (–0.933). Chloride showed negative correlation with only nitrite (–0.886) and positive correlation with all other parameters. Correlation between alkalinity and hardness was (0.9970) and alkalinity and nitrate (0.095) or between alkalinity and COD was (–0.095) or alkalinity & phosphate (–0.5). Hardness showed positive correlation between COD (0.997) or phosphate (0.937) or negative correlation with (–0.997) correlation between COD and Phosphate was (0.909) and below COD & nitrite was (–1) nitrite showed negative correlation with phosphate (–0.909). Nitrate show negative correlation with Phosphate. From the results of biochemical parameters studied (table–3) we see that total chlorophyll content (0.01632 mg/g), chlorophyll a (0.00526 mg/g), chlorophyll b (0.0069 mg/g) and carotenoids (0.368 mg/g) were present in these amount in treated crop plant Brassica oleracea. In the control crop Brassica oleracea total chlorophyll content was recorded (0.0248 mg/g), chlorophyll a (0.0101 mg/g), chlorophyll b (0.0271 mg/g). Total carbohydrate content (1.2 mg/g) present in treated Brassica oleracea & (0.76 mg/g) in control crop. In treated crop total protein was (3.26 mg/g) & in the control crop (4.83mg/g). Total amino acid content was recorded in treated crop (0.84 mg/g) & In the control (2.22 mg/g). Total chlorophyll content (0.0174 mg/g), chlorophyll a (0.0163 mg/g), chlorophyll b (0.0118 mg/g) and carotenoids (0.0464 mg/g) were present in these amount in other treated crop plant Spinaccia oleracea. In the control crop was recorded total chlorophyll content (0.0496 mg/g), chlorophyll a (0.0294 mg/g), chlorophyll b (0.0305 mg/g), carotenoid (0.1832 mg/g) Total carbohydrate content (0.74 mg/g) present in treated & (0.90 mg/g) in control crop. In treated crop total protein was (3.58 mg/g) & in the control crop (4.13 mg/g). Total amino acid content was recorded in treated crop (0.53 mg/g) & in the control (2.06 mg/g).

Table 2 : Correlation coefficient between some physicochemical water parameters of Ayad River Udaipur.

Parameter	pH	TDS	Cl	Alkalinity	Hardness	COD	Nitrate	phosphate
pH	1							
TDS	0.990	1						
Cl	0.999	0.993	1					
Alkalinity	– 0.566	– 0.446	0.545	1				
Hardness	0.907	0.956	0.917	0.997	1			
COD	0.874	0.933	0.886	– 0.095	0.997	1		
Nitrate	– 0.874	– 0.933	– 0.886	0.095	– 0.997	– 1	1	
Phosphate	0.996	0.998	0.998	– 0.5	0.937	0.909	– 0.909	1

Table 3 : Biochemical analysis of plant leaves of waste water irrigated plants.

Plant	Treatment	Total chl (mg/g)	Chl-a (mg/g)	Chl-b (mg/g)	Carotenoid (mg/g)	Carbohydrate (mg/g)	Protein (mg/g)	Amino acid (mg/g)
Brassica oleracea	Ww	0.01632	0.00526	0.0069	0.368	1.2	3.26	0.84
Control	0.0248	0.0101	0.0271	0.088	0.76	4.83	2.22	
Spinaccia oleracea	Ww	0.0174	0.0163	0.0118	0.0464	0.74	3.58	0.53
	Control	0.0496	0.0294	0.0305	0.1832	0.90	4.13	2.06

DISCUSSION

Total carbohydrate content is higher in wastewater-irrigated crops than control. Chlorophyll b content was also affected at higher concentrations as compared to chlorophyll a. The chlorophyll content is higher in control crop plants. It may be due to the breakdown of chlorophyll during stress or due to inhibition of chlorophyll biosynthesis. Studies have been show that stress induces the decline in protein contents in plants but increase in soluble sugar content (Rong Guo *et al.*, 2007; Hsu & Kao 2003). The amino acid content is lower in irrigated plants than control. It can be concluded that the wastewater reduced the crop growth. It is suggested that wastewater have to be diluted before it is used for irrigation. After dilution, the effluent characteristics will become within the prescribed limits and pollution load of the effluent decreased. The effluent at lower concentration

can serve as a liquid fertilizer for the cultivation of agricultural crops.

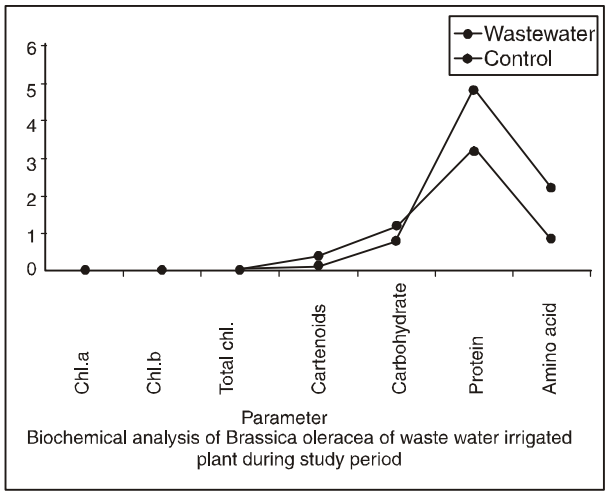

Fig. 1.

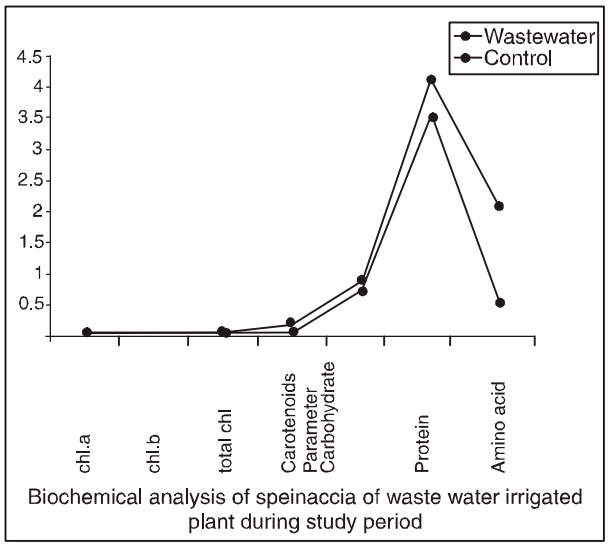

Fig. 2.

REFERENCES

APHA (American Public Health Association) (1988). Standard methods for the examination of water and waste water (20th ed.). Washington: APHA.

Dubois, M.,K. Gilles, J.K.; Hamilton, P.A.; Rebers and F. Smith. (1951). A colorimetric method for the determination of sugars. *Nature*, **168:** 167.

El Hadrami, A., M. Belaqziz, M. El Hassni, S. Hanifi and A. Abbad, (2004). Physiological characterization and effects of olive oil mill wastewaters fertirrigation on the growth of some Mediterranean crops. *J. Agron.*, **3:** 247-254.

Fazeli, M.S., Sathyanarayan, S., Satish, P.N., & Mutanna, L. (1991). Effects of Papers mill effluents on the accumulation of heavy metals in coconut tress near Najangud, Mysore District, Karnataka, India. *Environmental Geology and Water Sciences*, **17:** 47-50. dio:10.1007/BF01716073.

Fegin, A., Ravina, I., & Shalhevet, J. (1991). Irrigation with waste water irrigated sewage effluents: Management for environmental protection. Berlin: Springer.

Jenson, A. (1978). Chlorophylls and carotenoids, In-Hellebust, J.A. and J.S. Craigie (eds.) Handbook of Phycological Methods. 59-70, Camb. Univ. Press. London.

Lowry, O.H., N.J. Rosebrough, A.L. Farr and R.J. Randal. (1951). Protein measurement with the Folin-Phenol reagent. *J. Biol. Chem.***193:** 265-275.

Mapanda. F., Mangwayana, E.N. Myamangara, J., & Giller, K.E. (2005). The effects of long term irrigation using wastewater on heavy metal contents of soils under vegetable in Harare, Zimbabwe. *Agriculture Ecosystems & Enviornment,* **107:** 151-165.

Moore, S. and W.H. Stein (1948). Photometric method for use in the chromatography of amino acids . *J. Biol. Chem.* **176:** 367-388.

Paixao, S.M., E. Mendonca, A. Picado and A.M. Anselmo, (1999). Acute toxicity evauation of olive mill wastewaters: A comparative study of three aquatic organism. E*nviron. Toxicol.,* **14:** 263-269.

Paredes et al., (2005). Influence of olove mill wastewater in composting and impacts of the compost on Swiss chard crop and soil properties. *Int. Environ. Sci.* **31:** 305-312

Rong Guo, T., Guo Ping, Z., & Yan Hua, Z. (2007). Physiological changes in barley plants under combined toxicity of aluminum, copper and cadmium. Colloids and Surfaces. B. *Biointerfaces*, **57:** 182-188.

Singh, K.P., Mohem, D., Sinha, S., & Dalwani, R. (2004). Impact assessment of treated/untreated waste water toxicants discharged by sewage treatment plants on health, agriculture and environmental quality in the waste water disposal area. *Chemosphere,* **55:** 227-255. doi: 10.1016 j.Chemosphere. 2003.10.050