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IMPACT OF DISTILLERY FACTORY (Mc. DOWELL AND H.R.B. CO. LTD., CHERTHALA) EFFLUENT ON *CAPSICUM FRUTESCENCE*, L.

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ABSTRACT

A An attempt has been made to study the effect of distillery effluent on germination, growth and pigment productivity of *Capsicum frutescence*, L. The effluent was highly acidic and rich in total dissolved solids, suspended solids, potassium and sulphates. Higher concentrations (>5%) of effluent were found to be toxic but however, can be used for irrigation purpose after proper dilution.

INTRODUCTION

Among various environmental hazards, soil and water pollutions caused by various effluents have become a serious problem. The chemicals present in the effluent have low biodegradability, which greatly influence man by affecting natural ecosystem (Chung *et al*. 1978). These chemicals find their way to the environment by affecting soil surface and are considered carcinogenic (Rao *et al*. 1988).

The direct discharge of effluent changed the physico-chemical and biological characteristics of the soil. The development of simple low cost process, coupled with reuse of effluents in agriculture, offers the most suitable solution in country like India (Shroff, 1983). In addition to providing large quantity of water some effluent contain considerable amount of essential nutrients, which prove beneficial for plants. Studies have proved that properly diluted effluent can be used for irrigation (Sheela and Soumya, 2004).

The present study has been undertaken to evaluate the effect of raw and diluted effluent upon the seed germination, growth, chlorophyll and carotenoid productivity of the plant. To understand the effect of effluent on soil, analysis of the soil used for growing the experimental plants and the control plant is included in the study .

MATERIALS AND METHODS

The sample of effluent was collected from the main outlet of the factory in plastic containers. The physico-chemical analysis of the effluent was carried out in the laboratory.

Petridish method was followed for germination and early seedling growth studies. Twenty seeds were taken in triplicate at room temperature, which were repeated thrice. Surface sterilized seeds were soaked for 24 hrs in various concentrations of the effluent (5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80 and 90%). For control, distilled water was used. Seeds were placed on filter paper in sterilized pertridishes for germination and moistened with 15mL of different concentrations of the effluent. After 4 days, the data on the percentage of germination was documented and the length of the radicle was recorded.

For field studies, the seeds were allowed to grow in soil in polyethylene bags, and irrigated daily with different concentrations of the effluent (5, 10, 15, 20, 25, 30 & 40%). For control, distilled water was used for irrigation. For each treatment three replicates were maintained. Length of the plant, length of the petiole and number of leaves were recorded at 10 days interval. After the completion of growth, the plants were uprooted and dried in hot air oven at 100^{0}C for 5 days for recording dry weight. Samples of dry soil of each treatment were collected and soil analysis was done. Chlorophyll and carotenoid contents were estimated according to the standard method adopted by Arnon (l949).

RESULTS AND DISCUSSION

The physico-chemical data reveals that the effluent is highly acidic in nature

Table 1

Physico-chemical analysis of the effluent

Parameter	
Value	
Colour	Dark brown
Odour	Aromat-
ic	pH
4-4.5	BOD
5000 mg/L	COD
10000 mg/L	Total suspended solids
5000 mg/L	Dissolved solids
76000 mg/L	Sulphates
3500 mg/L	Ammonical nitrate
500 mg/L	Potassium
7813.16 mg/L	Percentage of alcohol
37	

Table 2

Effect of effluent on germination and radicle length of *C. frutescence*, L.

Conc. (%)	Germ. (%)	Radicle Length (cm)			
		4th day	5th day	6th day	7th day
Control	70	0.71 ± 0.45	0.87 ± 0.49	1.5 ± 0.65	2.5 ± 0.84
5	70	0.87 ± 0.49	1.7 ± 0.69	2.7 ± 0.87	2.9 ± 0.91
10	70	0.78 ± 0.37	0.8 ± 0.47	1.2 ± 0.58	2.1 ± 0.77
15	70	0.77 ± 0.48	0.98 ± 0.52	1.5 ± 0.65	1.9 ± 0.73
20	50	0.34 ± 0.31	0.68 ± 0.44	1.1 ± 0.56	1.7 ± 0.69
25	50	0.31 ± 0.29	0.64 ± 0.42	1.07 ± 0.55	1.6 ± 0.67
30	50	0.24 ± 0.26	0.61 ± 0.41	0.91 ± 0.50	1.4 ± 0.63
40	50	0.21 ± 0.24	0.51 ± 0.38	0.71 ± 0.45	1.1 ± 0.56
50	30	0.14 ± 0.20	0.44 ± 0.35	0.61 ± 0.41	0.91 ± 0.50
60.	30	0.15 ± 0.20	0.41 ± 0.34	0.42 ± 0.34	0.81 ± 0.48
70	10	0.14 ± 0.2	0.31 ± 0.29	0.38 ± 0.32	0.61 ± 0.41
80	0	0	0	0	0

(Table 1). At higher concentrations (80% onwards) there was complete inhibition of seed germination (Table 2). The inhibition of seed germination at higher concentration of the effluent is due to the high levels of total dissolved solids which enrich the salinity and conductivity of the solute absorbed by seeds. High levels of dissolved solids also disturb the osmotic relation of seed, thus reducing the amount of absorbed water and oxygen, necessary for growth and development of young seedlings. These observations are in agreement with those of Neelam & Sahai, 1998 ; Swaminathan & Vaidheeswaran, 1991. Radicle length increases upto 5% concentration of the effluent (Table 2).

Field studies reveal that lower concentrations (5%) promoted growth. From 15% onwards the growth is retarded. Plants grown in 30% showed reduction in total length and dry weight (Table 3). The curled leaf tips, presence of burned leaves etc. are the other features observed. The plants did not flower. Higher concentrations of the effluent proved to be lethal. The inhibiting effect at higher concentration is due to the excess of total nitrogen, sulphates, dissolved and suspended solids present in the effluent. The presence of the above mentioned nutrients in excess, proved to be injurious to plant growth as it affected water absorption and other metabolic process in the plant. Soil analysis reveals that the

Table 3

Effect of effluent on growth, chlorophyll and carotenoid productivity of *C. frutescence*, L.

Conc. %)	Total length after days			Dry weight (g) after 30 days			Chlorophyll a mg/gm	Chlorophyll b mg/gm	Total Chlorophyll mg/gm	Carotenoid mg/gm
	10th	20th	30th	Leaf	Stem	Root				
Control	2.46 + 1.28	5.31 + 1.8	9.06 + 2.4	0.49	0.63	0.12	11.8136	10.1828	9.8938	0.5334
5	2.1 + 1.18	4.3 + 1.6	13.3 + 2.9	0.78	0.51	0.18	13.9581	11.7679	1.4572	0.6213
10	2.26 + 1.22	5 + 1.8	10.3 + 2.6	0.40	0.43	0.11	12.1068	10.083	9.8271	0.5032
15	2.46 + 1.28	4.5 + 1.7	9.1 + 2.4	0.32	0.28	0.10	10.0124	8.6792	8.428	0.3724
20	2.3 + 1.2	4.8 + 1.7	8.8 + 2.4	0.20	0.17	0.05	8.9055	7.5674	7.3615	0.3482
25	2.5 + 1.3	4.6 + 1.7	7.8 + 2.2	0.12	0.10	0.07	7.4179	6.4206	6.2357	0.3134
30	2.56 + 1.30	4.3 + 1.6	7.5 + 2.2	0.08	0.05	0.03	5.568	4.6896	4.565	0.2264
40	0	-	-	-	-	-	-	-	-	-

NPK content of the soil also increased significantly by effluent treatment (Table 4). Nutrients such as nitrogen, phosphorus and potassium present in the diluted effluent played a role in promoting plant growth in lower concentration. Several authors have reported similar results, where soil was treated with various effluents (Rajaram and Janardhanan, 1998).

The amount of chlorophyll and carotenoid was found to be increasing at lower concentration. Maximum chlorophyll and carotenoid contents were observed in plants treated with 5% and 10% effluent. The concentration of chemicals in this dilution is at the optimum level which favoured the biosynthesis of chlorophyll and carotenoid (Table 3). Madhappan (1993) also reported similar findings. The dry weight also decreases with increase of concentration of the effluent.

The present study clearly indicates that higher concentrations (>5%) of effluent were found to be toxic,but however, can be used for irrigation purpose after proper dilution.

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