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IMPACT OF DISTILLERY FACTORY EFFLUENT ON *CAPSICUM FRUTESCENCE* L.

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ABSTRACT

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 can be used for irrigation purpose after proper dilution.

INTRODUCTION

Among various environmental hazards, pollution of soil and water caused by various effluents, has become a serious problem. Many chemicals present in effluents have low biodegradability, which greatly influence humans directly or by affecting natural ecosystems (Chung et al. 1978). These chemicals find their way into the environment by affecting soil surface and may also be carcinogenic in nature (Rao et al. 1988).

The direct discharge of effluents change the physico-chemical and biological characteristics of soils. The development of simple low cost processes, coupled with reuse of effluents in agriculture, offers the most suitable solution in country like India (Shroff 1982). In addition to providing large quantity of water, some effluents contain considerable amounts of essential nutrients, which prove beneficial for plants. Studies have proved that properly diluted effluents can be used for irrigation (Sheela & Soumya 2004).

The present study has been undertaken to evaluate the effect of raw and diluted distillery effluent on seed germination, growth, chlorophyll and carotenoid productivity of the *Capsicum frutescence* plant.

MATERIALS AND METHODS

The sample of effluent was collected from the main outlet of the McDowell and HRB Company Ltd., Cherthala in plastic containers. The physico-chemical analysis of the effluent was carried out in the laboratory.

Petri dish method was followed for germination and early seedling growth studies. Twenty seeds of *Capsicum frutescence* were taken in triplicate at room temperature. 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 Petri dishes for germination and moistened with 15 mL of different concentrations of the effluent. After 4 days, the data on the germination were collected and length of the radicle was recorded.

For field studies, the seeds were allowed to grow in soil in polythene bags, and irrigated daily with different concentrations of the effluent (5, 10, 15, 20, 25, 30 and 40%). For control, distilled

water was used for irrigation. For each treatment three replicates were maintained. Length of the plant, length of 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°C for 5 days for recording dry weight. Samples of dry soil of each treatment were collected and analysed. Chlorophyll and carotenoid contents were estimated according to the standard method of Arnon (l949).

RESULTS AND DISCUSSION

The physico-chemical data reveal that the effluent is highly acidic in nature (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 level 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) and Swaminathan & Vaidheeswaran (1991). Radicle length increases up to 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 and presence of burned leaves are the other features observed. The plants did not flower and higher concentrations of the effluent proved to be lethal. The inhibiting effect at higher concentration is due to excess of total nitrogen, sulphates, dissolved and suspended solids present in the effluent. The presence of these nutrients in excess, proved injurious to plant growth as it affected water absorption and other metabolic processes in the plant. Soil analysis reveals that 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

Table 1: Physico-chemical analysis of the distillery effluent.

Parameter	Value
Colour	Dark brown
Odour	Aromatic
pH	4-4.5
BOD	50000 mg/L
COD	100000 mg/L
Dissolved solids	76000 mg/L
Sulphates	3500 mg/L
Ammonical nitrogen	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.

Concentration (%)	Germination (%)	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 ± 0.20	0.31 ± 0.29	0.38 ± 0.32	0.61 ± 0.41
80	0	0	0	0	0

Table 3: Effect of the effluent on growth, chlorophyll and carotenoid content of *C. frutescence* L.

Concentration %	Total length after days			Dry weight after 30 days (g)			Chlorophyll *a* mg/g	Chlorophyll *b* mg/g	Total Chlorophyll mg/g	Carotenoid mg/g
	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	11.4572	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	-	-	-	-	-	-	-	-	-

Table 4. Effect of effluent on soil.

Concentration %	pH	Conductivity mmhos/cm	N %	P kg/ha	K kg/ha
Control	6.7	1.26	0.28	110	95
5	6.6	1.26	0.30	110	114
10	6.6	1.35	0.33	110	226
15	6.6	2.2	0.40	110	380
20	6.5	2.52	0.42	110	380
25	6.5	3.82	0.44	110	380
30	6.4	4.09	0.45	110	380
40	6.3	4.09	0.45	110	380
50	6.2	4.15	0.48	110	380
60	5.9	4.38	0.55	110	380
70	5.8	4.60	0.65	110	380
80	5.6	4.62	0.70	110	380
90	5.3	4.73	0.73	110	380

promoting plant growth in lower concentration. Several authors have reported similar results, where soil was treated with various effluents (Rajaram & 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 are toxic, but can be used for irrigation purpose after proper dilution.

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