

Distillery effluent effect on Growth of *Achyranthes aspera* L.

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ABSTRACT

A field work was undertaken to study the physico-chemical and biological parameters of treated distillery effluent and the effect of various concentrations such as (0, 5, 10, 20, 40, 60, 80 & 100%) on plant growth *i.e.* seed germination, root length, shoot length, length of leaves, chlorophyll content in the *Achyranthes aspera*. The effluent could not be directly applied to the field because of its excessive TDS, BOD and COD values and large quantities of soluble and suspended organic matter. The effluent was filtered through muslin cloth and diluted 2.5 times and thereafter, various dilutions were prepared by diluting it with tap water.

Key words : *Achyranthes aspera* L., effluent, plant growth.

***Achyranthes aspera* L.:** It is an erect or procumbent, annual or perennial herb about 1-2 m in height, belonging to the family Amaranthaceae. It has a woody base, stems angular, is ribbed, and simple or branched from the base. Leaves thick, flower greenish, white, numerous in axillary or terminal spike up to the 75 cm long. Seeds are rounded and reddish brown in colour. Traditionally, the plant is used in Asthma and cough. It is also useful in liver complaints, rheumatism, scabies and other skin diseases.

Water is the most essential natural resource and is responsible for existence of life on this planet. It is worthwhile to mention

that the advent of global industrialization has caused severe scarcity of water because of its heavy consumption followed by global industrialization which has brought along with it serious environmental hazards. The disposal of industrial effluents is one of the most challenging problems being faced by the environmentalist. As reported by Swaminathan & Yaidheeswaran⁷ effluent from dye industry increased the germination and chlorophyll content of groundnut seedlings, at low concentration. Valdes *et al.*⁸ observed and increase in soil organic matter by 1% when it was mixed with sugar factory effluent. The studies conducted by

Joshi *et al.*⁴ show that treated waste water contains various mineral nutrients, which are quite useful for the plant growth. Bishnoi & Gautam² studied the effect of various concentrations of dairy effluents on seed germination and seedling growth of some kharif crops and noted that with increasing concentration, the percent germination decreased gradually. They concluded that the diluted effluent could be used as liquid fertilizer as it promotes seedling growth. The distillery effluent is a mixture of organic and inorganic nutrients and has been reported to have a beneficial effect on seed germination⁶. The effluent in the lower concentrations enhanced the growth of corn and rice Kumar and Bhargava⁵ cautioned about the deleterious effects of higher concentration of effluents by decreasing the growth of crops. This gave a new direction the studies *i.e.* effluents should be used after proper dilutions.

Present studies have been undertaken for assessing the suitability of various dilutions of effluents in Industrial area in Raisen District of Madhya Pradesh. Effluent released by distillery as a potential liquid fertilizer. The distillery industry is closely linked with the fermentation industry. A field experiment was designed to know the effect of different concentration (0-100%) of distillery effluent on various growth parameters in *Achyranthes aspera*.

The present study was conducted at the industrial area in the Raisen District of Madhya Pradesh. Effluent sample was collected from the outlet point of a tank of

ETP of distillery in previously cleared and dried polyjar, which were sealed immediately and then labeled. Samples were analyzed for various physico-chemical and biological parameters as per the standard methods of APHA¹. For microbiological in studies effluent samples were collected aseptically in pre sterilized glass bottles. They were immediately inoculated on suitable culture medium. Encouraged with the results of the studies on physico-chemical and biological characteristics of the effluents (Table-1), laboratory experiments were conducted to evaluate the impact of different dilutions of effluents say 0, 5, 10, 20, 40, 60, 80 & 100% on growth of *Achyranthes aspera*.

The Soil was irrigated with different dilutions of diluted distillery effluent. Ten seeds of *Achyranthes aspera* were sown in the soil. Seedlings were observed and calculated after about 10 days. Growth parameters were recorded first after two months and then after four months.

The following parameters were studied

- Seedling
- Length of leaves
- Shoot length
- Branching
- Total growth of plants
- Chlorophyll content

Table - 1. Physico-Chemical and Biological study of effluent

S.No.	PARAMETER	UNITS	OBSERVATION	
1	PHYSICAL PARAMETERS	TEMPERATURE	°C	22.70
2		pH	-	7.70
3		CONDUCTIVITY	dS/m	10.11
4		SALINITY	ppt	5.70
5		TOTAL SOILDS	mg/L	3630.00
6		TOTAL DISSOLVED SOILDS	mg/L	667.00
7		TOTAL SUSPENDED SOILDS	mg/L	2963.00
8	CHEMICAL PARAMETERS	CHLORIDES	mg/L	1250.00
9		SULPHATES	mg/L	646.05
10		TOTAL HARDNESS	mg/L	2055.00
11		TOTAL NITROGEN	% age	0.05
12		TOTAL PHOSPHORUS	ppm	3.90
13		DISSOLVED OXYGEN	mg/L	0.70
14		BOD*	mg/L	580.00
15		COD**	mg/L	36000.00
16		TOTAL ALKALINITY	mg/L	3700.00
17		SODIUM (Na)	ppm	65.40
18		POTASSIUM (K)	ppm	260.40
19	CALCIUM (Ca)	ppm	546.60	
	BIOLOGICAL PARAMETERS	STANDARDPLATE COUNT OF		
20		BACTERIA	CFU/ml	>300
21		FUNGI	CFU/ml	1.00
22		AZOTOBACTER	CFU/ml	Nil

*BOD=Biological Oxygen Demand **COD=Chemical Oxygen Demand

Table-2. Effects of various soil-effluent mixtures on cutting sprouting & growth of *Achyranthes aspera* on laboratory scale from distillery

S. No.	PARAMETER		UNITS	DILUTIONS							Control Soil
				5%	10%	20%	40%	60%	80%	100%	
1	Percent Germination		%	80	80	80	80	90	80	70	80
2	After two Month of Seedling	No. of leaves		24	27	28	24	22	23	23	20
3		Shoot length	Cm	14	13.3	14.1	11.5	15.7	11.6	15.5	14.2
4	After Four Months of Seedling	No. of leaves		44	47	45	46	47	44	46	38
5		Shoot length	Cm	25.2	23.6	22.4	20.5	25.3	25.4	20.5	25.1
6		Branching	Number	5	4	3	4	5	3	3	5
7	Root length		Cm	10.2	11.4	10.0	10.5	13.0	11.1	7.2	10.0
8	Total growth of plants		Cm	27.5	24.2	24.0	23.3	36.5	26.9	24.9	24.3
9	Chlorophyll content (Absorbance value)		620 nm	0.484	0.49	0.535	0.586	0.737	0.563	0.57	0.42

Properties of the effluent :

The physico-chemical and biological analysis of the distillery effluent is given in Table-1. Effluent of distillery was reddish brown in colour with an unpleasant odour. The temperature of distillery effluent was 22.7°C. The average pH value of the distillery effluent was 7.70. The range of Dissolved oxygen in the distillery effluent was 0.7. The low D.O. (Dissolved Oxygen) was possibly due to high organic load. The average value of total solid in distillery effluent was 3630 mgk. The value of B.O.D. in distillery was

found to be 580.0. This indicates high organic load. The C.O.D value of the distillery effluent was 36000mg/microbiological parameters were bacterial count >300 CFU/ml fungi one and azotobacter nil CFU/ml.

A perusal of the result given in the Table-1 reveals that conductivity, salinity, TDS total solids, total suspended solids, D.O., B.O.D, & C.O.D were above the permissible limits. Effluent is rich in potassium that is a major plant nutrient besides containing minor amounts of two other major nutrients, nitrogen and phosphorus.

Smaller amounts of other minor plant nutrients such as calcium, magnesium, sulphate and chloride are present. However pH and nutrients were within permissible limits suggesting thereby that this effluent can be a good liquid fertilizer.

Effect of different dilutions of effluent on growth of Achyranthes aspera :

Various parameters, which include the growth and health of plants, were evaluated after 2 and 4 months of seed germination. Thus after 2 months, the maximum leaf No. of 28 was observed in the field irrigated with 20% of effluent and minimum in case of control soil *i.e.* leaf No. 20. Interestingly nearly similar trend was noticed after 4 months of seed germination maximum leaf No. 47 in the irrigated plants with 10% effluent and a minimum leaf No. of 38 in case of control soil. After 2 months of seed germination the shoot lengths of the plants were found to be maximum *i.e.* 15.7cm in case of plants irrigated with 60% effluent and minimum in case of plants grown in 40% effluent *i.e.* 11.5cm. After 4 months of seed germination the plants showed considerable shoot growth. The plants grown in the soil treated with 80% effluent showed the maximum shoot length *i.e.* 25.4 cm and minimum *i.e.* 20.5cm was observed in the ones treated with 40% effluent. Maximum branching was noticed in the plant grown 5%, 60% and control soil. The root length of each plant was measured and it was

maximum 13.0cm in soil irrigated with 60% effluent. Whereas a minimum of 7.2cm was recorded in the case of plants grown in the soil irrigated with 100% effluent. Total growth of plant maximum was 36.5 cm treated with 60% effluent and minimum *i.e.* 23.3 cm was observed treated with 40% effluent. The maximum absorbance at 620nm was 0.737 cm in case of plants grown in soil treated with 60% effluent and a minimum of 0.42cm in case of the plants grown in control soil.

A careful analysis of the parameters evaluated show that in general there was a rising trend in various parameters such as chlorophyll content, Plant height in the plant grown in soil treated with 5, 10, 20, 40, 60% effluents maximum value being in the last case after which there was a sequential fall in the plants grown with 80 & 100% effluents. Length of leaves, shoot length, root length & total growth of plants showed fluctuations, though it was in favour of plants treated with 60% dilution. Thus it may be concluded that the effluents with 60% dilution have the maximum potential for healthy growth of *Achyranthes aspera* and is recommended to be used as a potential liquid fertilizer.

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