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EFFECT OF DAIRY AND TEXTILE WASTE WATERON GROWTH OF PLANT WHEAT

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ABSTRACT

Present investigation was carried out to assay the effects of effluents on seedling growth &plant growth of wheat *(Triticumaestivum* L).For that purpose textile effluent and dairy effluent were chosen.Concentrations used for both the effluents were 0, 25, 50, 75 &100%.Minimum relative toxicity percentage was in 25% concentration and increases gradually as the concentration increases. Textile effluent has more relative toxicity. Number of seeds also decreases with the increase in concentration.Irrigation with high TDS (Total Dissolved Solids) resulted in decrease in optimal crop production.

Keywords: Seedling growth, dairy, textile effluent, wheat.

INTRODUCTION

Wheat is grown on more than 240 million hectares, larger than for any other crop. World trade in wheat is greater than for all other crops combined. With rice, wheat is world's most favoured staple food.In 2009, world production of wheat was 682 million tons, making it the second most-produced cereal after maize (817 million tons) and with rice as close third (679 million tons)[1].Wheat normally needs 110 and 130 days between planting and harvest, depending upon climate, seed type, and soil conditions. Pollen formation from the mother cell and the stages between an thesis and maturity are susceptible to high temperatures, and this adverse effect is made worse by water stress. The two biggest wheat producers are China and the European Union, followed currently by India, then USA[2].

Amongst global resources, water is emerging as perhaps the most critical but misused natural resource[3].With certain limitations, one has to turn to non-conventional resources to meet the irrigation water demand. Among others, one of the most important irrigation as well as nutrient resources is industrial waste water, which consists of about 95% water and there set as organic and inorganic nutrients[4].At higher pollution levels, root system is extremely lost and at maturity, plants yield are much reduced[5-7].Waste water from industries also destroys our productive land by adding chemical compounds to these soils. Delayed germination and earlier leaf senescence are the two most important parameters which correspond to the final yield loss at the end of the season[8].Physico-chemical characteristics and fertilizing efficiency of dairy effluent is highly alkaline in nature and contains large amounts of suspended and dissolved solids resulting in high BOD (3892 mg/l) and COD (9682 mg/l) [9].Dairy effluent has deleterious effects on agriculture and ecosystem when they are directly disposed off[10].Seed germination is a critical stage that ensures reproduction and controls the dynamics of plant populations, so it is a critical test of probable crop productivity[11].

An attempt has been made to understand the effect of Dairy &Textile mill effluent on seedling & plant growth in wheat.

EXPERIMENTAL

The study was carried out by systematic collection of Textile and Dairy effluent (untreated)in 2 litres of polythene bottles.The samples were collected from the inlets of Textile industry (Haryana) and Dairy industry (Alwar District).The collected samples were analyzed for pH, BOD, COD, TDS, SS, oil and grease, calcium, magnesium, iron, manganese, copper, etc. Effluent were collected and stored in a clean polythene bottles that had been pre-washed with 10% nitric acid and thoroughly rinsed with de-ionized

water and then standard methods were used for the analysis of effluents.The effluents were stored at 4°C during storage period so as to avoid any change in its characteristics[12].
Standard methods were used for analysing water and waste water[13].

Petridish Experiment
For the germination experiments, certified healthy and equally sized seeds of wheat *(Triticumaestivum*L.) were sterilized with 0.1% $HgCl_2$. After repeated washings with sterilized distilled water, seeds were soaked in the same water for 4hrs. Then 10 sterilized seeds were arranged in sterilized petri dishes, lined with double layer of filter paper. Triplets of each concentration were taken. Plates were labelled as per type, concentration of the effluent[14].These were then supplied with respective effluent concentration and incubated for three days at 26±2°C for germination. Daily observations were made for the germinated seeds[14]. The 25, 50, 75 and 100% concentrations of untreated effluents were prepared while tap water was taken as control. The germination % was observed in each Petridis for 48 hours[15].The growth parameters like germination, plumule andradicle length and number of lateral roots were observed on 14th and 21stday after seedling emergence. During the germination period, the growth parameters like germination %, root length, shoot lengths were measured and noted.
Relative toxicity (%R.T.) of each industrial effluent on the seed germination and seedling growth of each vegetable was calculated to determine the degree of inhibition over control, by using the following formula[16].
R.T. %={(x-y)/x}* 100
Where,
x = Germination percentage or seedling length in control at particular hour of incubation.
y = Germination percentage or seedling length in the presence of effluent at the same hour of incubation

Pot Experiment
3 pots were used for each treatment (25, 50, 75& 100% of Dairy and Textile effluents).Pots were irrigated with the effluent every 15 days. Ten seeds were sown in every pot. Only healthier one was retained. Maturation period was 5 months. Plant height was measured at maturity. Weights of plant roots and shoots were taken from each pot at the end. The number of seeds in each pod was counted.
Samples were dried and weighed. These weights and height were compared with the plant grown in standard conditions.

RESULTS AND DISCUSSION

There is 100% seed germination in the controlled system after 48 hours. In case of effluent treatment, maximum germination percentage was in 25% concentration and decreases gradually as the concentration increases. The inhibition of seed germination occurs at higher levels of total solids; due to excess amount of the salinity and conductivity of the effluent prevent the seed germination& growth, being absorbed by seed while soaked in the different concentrations of effluent before germination[14].Germination percentage was suppressed at 100%, due to osmotic pressure because of high dose. Osmotic pressure of the effluent at higher concentration of total salts makes inhibition more pronounced & prominent[17].Suppression of germination at higher concentrations (above 50%) of effluent, may be due to high levels of total dissolved solids which enhance the salinity and conductivity of the solute absorbed by the seeds before germination[18].Radicle and plumule lengths (Table-2) decrease as concentration of effluent increases. Effect is prominent in the case of textile effluent.

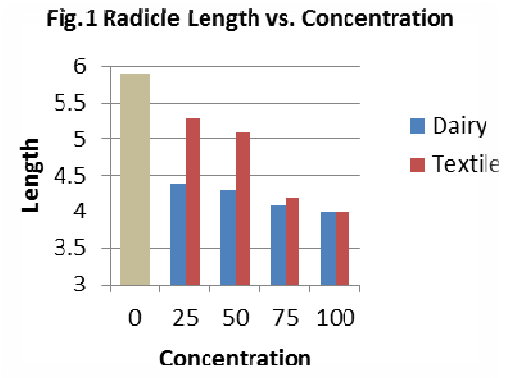
Table-1: Physical and chemical parameters of Dairy & Textile effluents

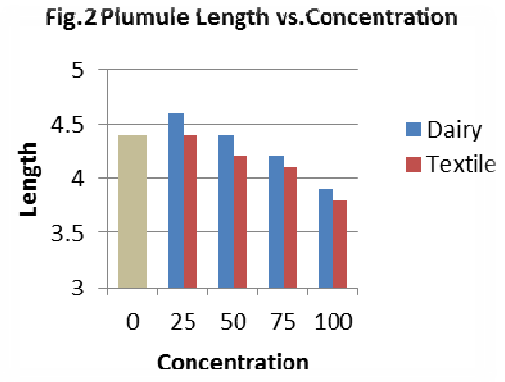
S.No.	Parameters	Dairy	Textile	Standards
1.	Colour	Milky	Brownish-Black	
2.	Odour	Unpleasant	Unpleasant	
3.	pH	6.9	8.3	5.5 to 9.0
4.	TDS (mg/L)	1792	2352	2100

5.	SS (mg/L)	90	270	200
6.	BOD (mg/L)	430	350	100
7.	COD (mg/L)	1110	770	
8.	Oil & grease		60	10
9.	Iron (mg/L)	2.074	0.37	
10.	Manganese (mg/L)	0.221	0.070	
11.	Sodium (mg/L)	760	520	
12.	Potassium (mg/L)	35	24	
13.	Calcium (mg/L)	73.8	62.4	
14.	Magnesium (mg/L)	52.7	61.5	
15.	Total Hardness as $CaCo_3$ (mg/L)	400	408	
16.	Chloride (mg/L)	185	378	
17.	Sulphate (mg/L)	0.077	348	

Table-2: Variation of radical & plumule length under different concentrations

	Length(cm)			
Concentration (%)	Dairy Waste Water		Textile Waste Water	
	Radicle	Plumule	Radicle	Plumule
25	4.4	4.6	5.3	4.4
50	4.3	4.4	5.1	4.2
75	4.1	4.2	4.2	4.1
100	4.0	3.9	4.0	3.8
Standard Water	Radicle 5.9		Plumule 4.4	





The high TDS (total dissolved solids) value of effluents seems to be responsible for germination inhibition and subsequent seedling growth because they disturb the prolific relation of seed with water and thus reduce the amount of water absorbed. On the other hand, the high TDS (total dissolved solids) value would retard seed germination by enriching the salinity and conductivity of the solutes being absorbed by the seeds prior to its germination. However, at its lower (below 10 %) concentration the effluent did not affect seed germination and its quality parameters, whereas higher (beyond 25 %) concentration decreased the seed quality parameters of wheat.

Relative Toxicity Percentage

Table-3: Relative Toxicity for different concentrations.

	Relative toxicity % after 24 hours		Relative toxicity % after 48 hours	
Concentration (%)	Dairy Waste Water	Textile Waste Water	Dairy Waste Water	Textile Waste Water
25	7.63	10.99	1.9	3.34
50	10.17	13.43	2.5	5.84
75	13.33	14.14	5.0	7.5
100	27.67	19.13	17.9	10.3

Minimum Relative toxicity percentage (Table-3)was with 25% concentration and increases gradually as the concentration increases. Textile effluent has more relative toxicity, although, at 100% concentration, dairy effluent caused more toxicity.

Table-4: Weights, Lengths & No. of Seeds of fully grown plant under different concentrations

Concentration	Weight(g)		Length(cm)			
(%)	Total	Feed	Total	Feed	Stem	No. of seeds
25 ($D_{1/4}$)	1.35	0.80	42.20	4.60	37.60	29
50 ($D_{1/2}$)	0.96	0.23	36.80	4.50	32.30	20
75 ($D_{3/4}$)	0.74	0.20	32.60	4.00	28.60	17
100 (D_1)	0.44	0.15	25.60	3.30	22.30	14
25 ($T_{1/4}$)	0.81	0.40	40.00	4.70	35.30	20
50 ($T_{1/2}$)	0.66	0.23	36.50	4.20	32.30	16
75 ($T_{3/4}$)	0.54	0.23	30.30	3.50	26.80	15
100 (T_1)	0.52	0.18	29.20	3.00	26.20	12
0	1.51	0.90	43.20	4.60	38.60	33

Where, D for Dairy effluent and T for Textile effluent

Weights, lengths & number of seeds (Table-4) decreases as the concentration of effluent increases but the effect is more in case of textile effluent. Irrigation with high TDS (Total Dissolved Solids) resulted in decrease in optimal crop production.

CONCLUSION

Based on the foregoing data, it may be concluded that Textile effluent has more relative toxicity than Dairy effluent. Irrigation with high TDS (Total Dissolved Solids) results in decrease in optimal crop production.

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