RESEARCH PAPER:

Effect of distillary spent wash on germination rate of wheat, chickpea and Fenugreek

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SUMMARY

Distillery spent wash is an effective organic liquid manure derived from distillery industries. A laboratory work was undertaken to assess the waste water quality parameters of treated distillery effluent and the effect of various concentrations *viz.*, 0, 25, 50, 75 and 100% on seed germination and germination value of three selected seeds *i.e.* wheat (*Triticum aestivum*), chickpea (*Cicer arietinum*), and fenugreek (*Trigonella foenum-graceum*). The high value of TS (4605 mg/l), BOD (587.4 mg/l) and COD (2611.20 mg/l) indicated the high inorganic and organic load. Germination percentage decreased with increasing concentration of effluent in all the tested seeds, whereas the germination speed, germination value increased from control to 25% and 50% concentration and decreased from 50% to 75% and 100% effluent. To estimate the probable liquid fertilizer benefit, studies on subsequent dilutions is needed to corroborate the present study.

Key words :
Distillery effluent, Physico-chemical analysis, Seed germination, wheat, Chickpea, Fenugreek

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Diverse nature of agro-based industrial effluents from various industries are disposed off in to soil and water bodies, which have been causing major pollution problem. To economize the irrigation water, industrial effluents are now days commonly used for irrigation purpose. So, it is relevant to understand the response of crops to industrial effluents dependent on it. Distillery effluent contains appreciable amounts of macro and micronutrients such as K, N, Fe, Cu, Zn and B which are essential for plant growth. Several researchers have shown that the use of distillery effluent in agriculture for soil amendment or as a supplement to irrigation water in a judicious way improved crop growth, and physical, chemical and biological properties of soil. Pathak *et al.* (1999), suggested dilution of distillery effluent so as to bring down its BOD to 1000 mg L^{-1} before application in standing crop of rice and wheat for higher yield and improved soil properties. Deverajan *et al.* (1994), showed that distillery effluent could be safely used as liquid manure if applied at a rate of 125–250 cubic m ha^{-1}. The distillery effluent is mixture of organic and inorganic nutrients and has been reported to have a beneficial effect on seed germination (Subramani *et al.*, 1999). According to Ramana *et al.* (2002) the sensitivity of the plants varies from species to species to the effluent salinity. A laboratory experiment was designed to know the effect of different concentrations (0-100%) of distillery effluent on seed germination in some vegetation species like wheat (*Triticum aestivum*), chickpea (*Cicer arietinum*) and fenugreek (*Trigonella foenum-graceum*).

MATERIALS AND METHODS

The effluent was collected from the Madhukar Co-operative Distillery, Faizpur (M.S.), India where over diluted effluent has been released by the factory. The physico-chemical properties of the effluent were analyzed following the procedure of APHA (1995). To bio-assay the concentration of the effluent, control (tap water), 25%, 50%, 75% and 100% concentrations were made by diluting the effluent with distilled water in the ratio of 0:1, 1:3, 1:1, 3:1 and 1:0, respectively. Forty seeds each of wheat (*Triticum aestivum*), chickpea (*Cicer arietinum*) and fenugreek (*Trigonella foenum-graceum*) were sterilized by 0.1% of mercuric chloride solution to remove the microbes after thorough wash with water. Seeds were then spread on the sterilized Petri dishes lined with filter paper. The seeds were irrigated with equal volumes (15 ml) of different concentrations of distillery effluent at an interval of 24 hours. For each treatment, three replicates and in each replicate 40 seeds were taken for the germination experiment.

The seeds germinated were counted and removed from the Petri dish until there was no further germination. Criterion for germination was visible protrusion of the seed coat and was expressed in percentage. The methods followed for the data recording, calculations and analysis were speed of germination, peak value and germination value (Maguire *et al.*, 1962).

Speed of germination = No. of seeds germinated/ Day of first count + No. of seeds germinated/ Day of final count (Czabator, 1962).

Peak value = Cumulative percentage germination on each day/ No. of days elapsed since initial imbibitions.

Germination value = Peak value × Germination percentage.

ANOVA analysis was made using statistical software-'Analyse- it (220 version)'.

RESULTS AND DISCUSSION

The physico-chemical analysis of the distillery effluent is given in Table 1. Effluent of distillery was wine red brown in colour with unpleasant odor of Indol, Sketol and other sulpher compounds (Santiago and Bolan, 2006). The temperature of distillery effluent was 29.0^{0}C. The average pH value of the distillery effluent was 6.2. The range of dissolved oxygen in the distillery effluent was nil, while the recommended BIS range is 4-6. The absence of dissolved oxygen is possibly due to high organic load. The average value of total suspended solids in distillery effluent was 269 mg/l which is far from the BIS recommended range which is 100 mg/l. The value of biological oxygen demand in distillery effluent was 587.4 mg/l and the recommended value of BIS is 30 mg/l. This indicates high organic load. The chemical oxygen demand value of the distillery effluent was 2611.20 mg/l while the recommended level by BIS is 250 only. This high amount is due to high organic load. From Table 2, it is evident that there was variation in germination percentage. The speed of germination, germination value of tested vegetation also vary with respect to different concentrations of effluent. The germination percentage diminishes gradually with elevation in concentration. It varies from vegetation to vegetation as mentioned in Table 2. While in case of wheat, the speed of seed germination increased with increase in concentration from control to 25% effluent concentration, while the same concentration irrigated seeds caused stagnant speed of germination in chickpea and increased speed of germination in fenugreek (Fig. 1, 2 and 3). Further increase in effluent concentration after 50% concentration caused a common diminishing effect on the germination speed on each elevation in concentration. The pattern of germination value was increasing from control to 25% and stagnant from 25% to 50% and diminished from 50% to 75% and 100% effluent concentration in case of wheat, while the pattern was diminishing in case of chickpea as per elevation in concentration and in case of fenugreek germination value decreases from 0 to 25% concentration. At further elevation in concentration, it declined while the germination value diminished from control to 100% concentration in a steady way. The fenugreek is highly sensitive to the effluent treatment and the effluent is promotive for chickpea at their arranged dilutions. One way ANOVA analysis of the speed of germination and germination value showed $P < 0.05$. At 0.05 level of significance, there was a significant difference of the responses of seed germination by the effluent on 25% concentration, 50% concentration and 75% concentration irrigation in all the seeds. At lower concentration of effluent the speed of germination, germination values were higher than the responses at higher concentrations. Elevated electrical conductivity at higher concentration, than preceding concentration showed the higher salt content. The cause

Table 1 : Physico-chemical characteristics of distillery effluent (N=3)

Parameter	Value (Mean±S.D.)	BIS
Colour	Reddish wine	None
pH	6.2±.003	5.5-9.0
Temp. ^{0}C	29.0±.23	40
TDS	4265±.15	2000
TSS	269±.006	100
T. Alkalinity	1352.2±.34	-
T. Hardness	658±.018	300
Calcium	195.42±.21	169
Sodium	357±.13	-
Sulphate	3271±.41	200
Chloride	785.57±.54	600
DO	Nil	4-6
BOD	587.4±.50	30
COD	2611.20±.17	250

All values are in mg/lit except temp. (in ^{0}C), pH and colour

Table 2 : Percentage of germination of seeds treated with distillery effluent (N=40)

Effluent concentration	Germination percentage (Mean±S.D.)		
	Wheat	chickpea	Fenugreek
Zero (Control)	97±0.51	98±0.12	93±0.13
25%	92±0.53	93±0.16	89±0.16
50%	84±0.23	86±0.39	81±0.57
75%	78±.23	81±0.15	72±0.005
100%	67±0.27	69±0.52	63±0.10

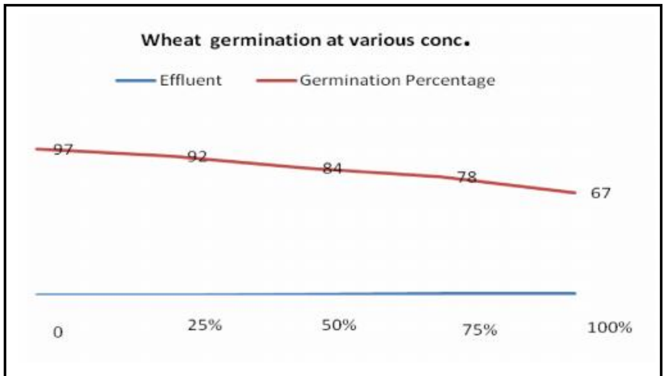

Fig. 1 : Wheat germination at various effluent concentrations

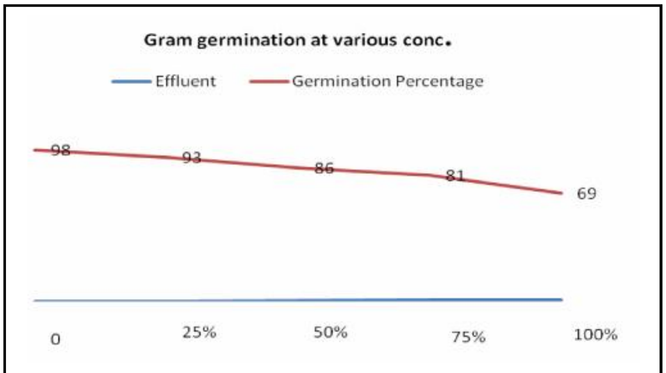

Fig. 2 : Chickpea germination at various effluent concentrations

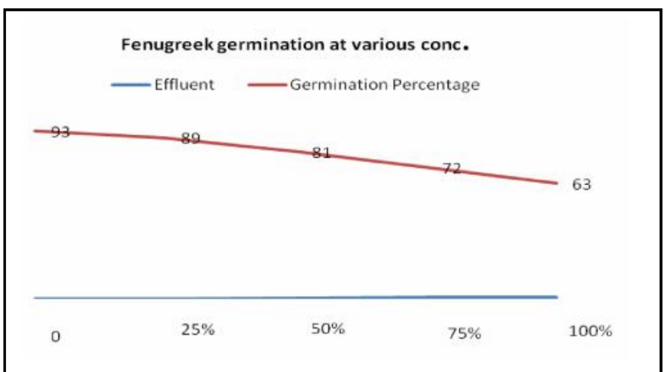

Fig. 3 : Fenugreek germination at various effluent concentrations

of higher osmotic pressure was the higher mineral salt content of the effluent seen in the form of higher electrical conductivity, the same type of finding has been reported by Ramana *et al.* (2002) and Pandey and Sony (1994). In concluding remarks it can be said that it is the salt concentration that has been governing the seed germination. It varies from crop to crop because each crop species has its own tolerance to the different salt concentrations.

Conclusion:

There is significant scope to improve water utilization in Indian distilleries through conservation by applying various concentration of spent wash for crop irrigation. Germination ratio of chickpea was more than wheat and fenugreek at 25 % of spent wash. By applying various concentrations of spent wash on plant species, a plot having 20-30 % concentration of spent wash observed showing good growth. In germination rate chickpea showed a high viability as compared to wheat and fenugreek.

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