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PHYSICO-CHEMICAL ANALYSIS AND EFFECT OF DISTILLERY EFFLUENT ON SEED GERMINATION OF WHEAT (*Triticum aestivum*), PEA (*Pisum sativum*) AND LADY'S FINGER (*Abelmoschus esculentus*)

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ABSTRACT

A laboratory work was undertaken to assess the waste water quality parameters of treated distillery effluent and their effect of various concentrations like 0%, 25%, 50%, 75% & 100% on seeds germination, speed of germination, peak value and germination value of three selected seeds i.e. Wheat (*Triticum aestivum*), Pea (*Pisum sativm*) and Lady's Finger (*Abelmoschus esculentus*). Where the high value of T.S. (4285), B.O.D. (544.5) and C.O.D. (2433) indicates the high inorganic and organic load. Germination percentage decreases with increasing concentration of effluent in all the tested seeds, where as the germination speed, peak value and germination value increases from control to 25% and 50% concentration and decreases 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.

Keywords: wheat, pea, lady's finger, distillery effluent, physico-chemical analysis, seeds, germination.

INTRODUCTION

Diverse nature of agro-based industrial effluents from various industries are disposed off in to soil and water bodies, which has been causing major pollution problem. To economize the irrigation water industrial effluents are now a days commonly used for irrigation. So it is relevant to understand the response of industrial effluents to crops dependent on it. In this relation efforts have been made a cross the effect of industrial effluents on seed germination of crops like: Behera and Mishra (1982), Singh *et al.* (1985), Choudhray *et al.* (1987), Gautam *et al.* (1992), Agarwal *et al.* (1995), Kumar and Rai (2001), Santiago, M. *et al.* (2006), Saliha, B.B. (2003), Raman, S. (2002). Germination is a critical stage which ensures reproduction and consequently controls the dynamics of population, so it is a critical test for the probable crop productivity Radosevich *et al.* (1997). The distillery effluent is mixture of organic and inorganic nutrients and has been reported to have a beneficial effect on seed germination Subramani, A. *et al.* (1999). Nevertheless the sensitivity of the plants varies from species to species to the effluent salinity, Raman, S. (2002). A laboratory experiment was designed to know the effect of different concentration (0-100%) of distillary effluent on seed germination in some vegetations like Wheat (*Triticum aestivum*), Pea (*Pisum sativum*) and Lady's Finger (*Abelmoschus esculentus*).

MATERIALS AND METHODS

The treated effluent was collected from the Lords distillary, Nand Ganj, Ghazipur (U.P.), 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, 25%, 50%, 75% and 100% was 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 of Lady's Finger (*Abalmoschus esculents*), Wheat (*Triticum aestivum*) and Pea (*Pisum sativum*) were sterilized by 0.1% of mercuric chloride solution to remove the microbes after thorough wash; seeds were spread on the sterilized petri dishes lined with filter paper. The seeds were irrigated with equal volume (~5ml) of different concentrations of distillery effluent, for each treatment three replicates and in each replicate 40 seeds were taken were recorded at a fixed interval at a fixed time 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 Maguire (1962);

Speed of germination = No. of seeds germinated/Days of first count +---+ No. of seeds germinated/Days of final count.

Peak value and germination value Czabater (1962);

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

Germination value = Peak value × Germination percentage.

and ANOVA and Bonferroni analysis was made using SPSS software ver. 10.0.

RESULTS AND DISCUSSION

The Physico-chemical analysis of the distillery effluent is given in Table-1. Effluent of Distillary was red brown in colour with unpleasant odour of Indol, Sketol and other sulphur compounds Santiago, M. *et al.* (2006), temperature of distillery effluent was 28.5^{0}C. The average

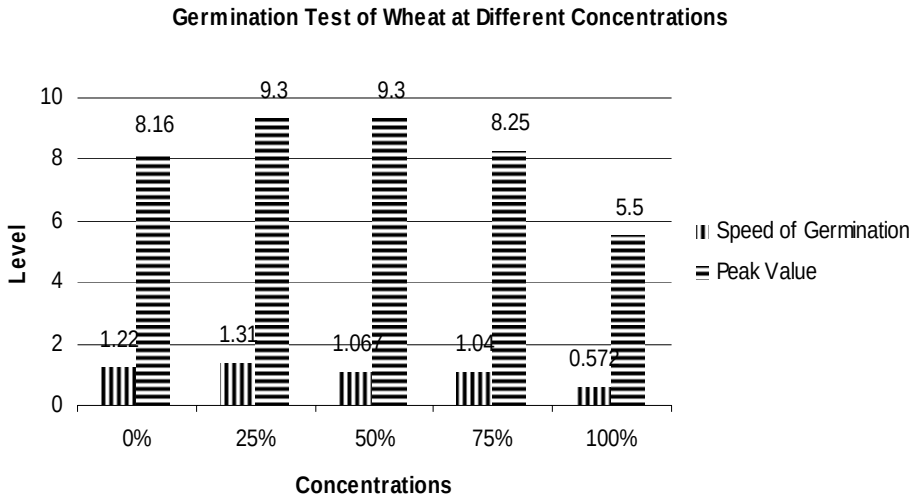
pH value of the distillery effluent was 6.4. The range of Dissolved Oxygen in the distillery effluent is nil, meanwhile the recommended BIS range is 4-6. The absence of D.O. is possibly due to high organic load, the average value of total solid in distillery effluent is ~255 far from the BIS recommended range that is 100. The value of B.O.D. in distillery effluent is 544.4 and the recommended value of BIS is about 30. This indicates high organic load. The C.O.D. value of the Distillery effluent was 2433.3 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, peak value and germination value of tested vegetation also varies with respect to different concentration 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 increases with increase in concentration from control, 25% concentration, while the same concentration irrigated seed causes stagnant speed of germination in pea. And increased speed of germination in leady finger, further increase in effluent concentration after 50% concentration causes a common diminishing effect on the germination speed on each elevation in concentration. The pattern of peak value and germination value is increasing from control to 25% and stagnant from 25% to 50% and diminishes from 50% to 75% and 100% effluent concentration in case of wheat, while the pattern is diminishing in case of pea as per elevation in concentration and in case of lady's finger peak value decreases from 0 to 25% concentration and again maintain it at 50% concentration and at further elevation in concentration, it decline while the germination value diminishes from control to 100% concentration in a steady way. While the mean germination percentage is maximum in case of wheat ~88%>in case of Pea 84%> and in case of Lady's Finger it is 83%. The average peak value, germination value and germination speed is (9.67, 854, 1.52) > (8.10, 726, 1.04) > (6.9, 575, 0.79) for Pea, Wheat and Lady's Finger, respectively. It indicates the leady finger is highly sensitive to the effluent treatment and the effluent is promotive for Pea at their arranged dilutions. ANOVA analysis and multiple comparison test (Bonferroni Test) of the speed of germination, peak value and germination value shows $P < 0.5$ level of significance and there is 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, peak value and germination values are higher than the responses at higher concentrations. Elevated electrical conductivity at higher concentration, than preceding concentration shows the higher salt content. In the same manner the osmotic pressure of different concentration is higher as illustrated in figures presented below. Regarding the effect of higher osmotic pressure on seed germination Rodger *et al.* (1957) reported that higher osmotic pressure which causes retardation of germination. The cause of higher osmotic pressure is 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, S. *et al.* (2002), Pandey and Sony (1994). In concluding remarks we can say that it is the salt concentration that has been governing the seed germination, it varies from crop to crop because each have its own tolerance to the different salt concentrations.

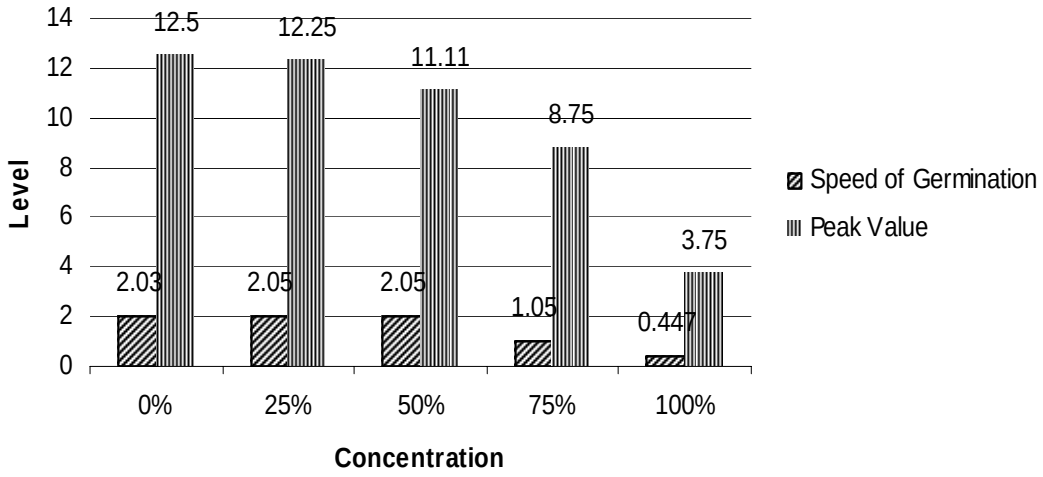
Table-1. The Physico-chemical characteristics of distillery effluent (Mean ± std. error of mean).

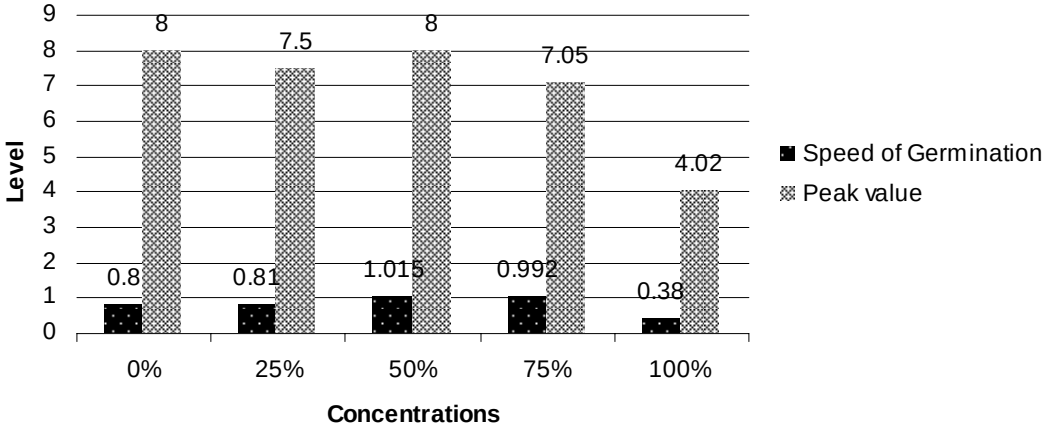
S. #	Parameters	Value	BIS
1.	T^0C	28.5±.23	40
2.	Colour	Reddish	None
3.	T.S.	4285±.005	2100
4.	T.D.S.	3980±.15	2100
5.	T.S.S.	255±.005	100
6.	pH	6.4±.003	5.5-9
7.	T. Alk.	1437.5±.29	-
8.	T. Hard	565±.005	300
9.	Ca Hard.	455±.005	-
10.	Calcium	182.2±.11	169
11.	Chloride	860.87±.40	600
12.	D.O.	Nil	4-6
13.	B.O.D.	544.5±.50	30
14.	C.O.D.	2433.38±.17	250

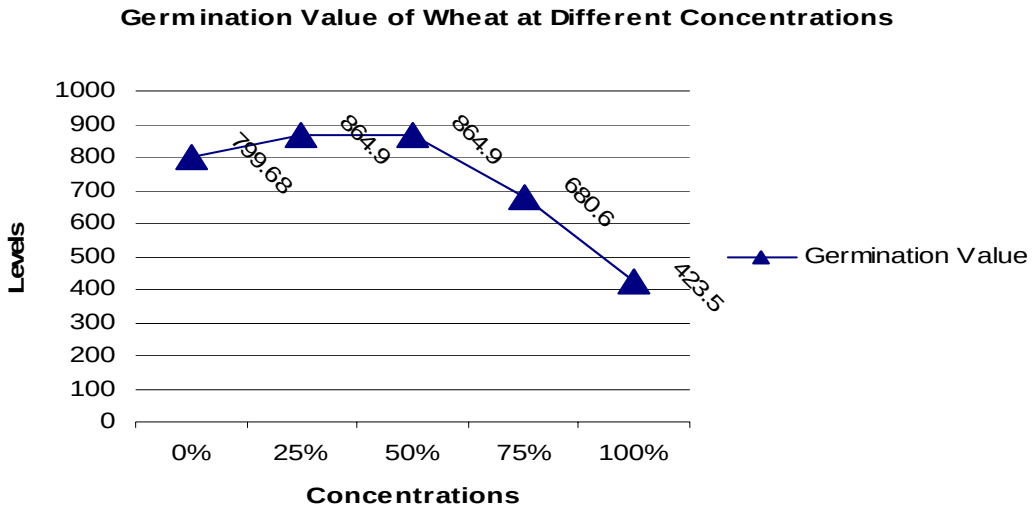
Table-2. Percentage germination treated with distillery effluent (Mean ± Std. error of mean).

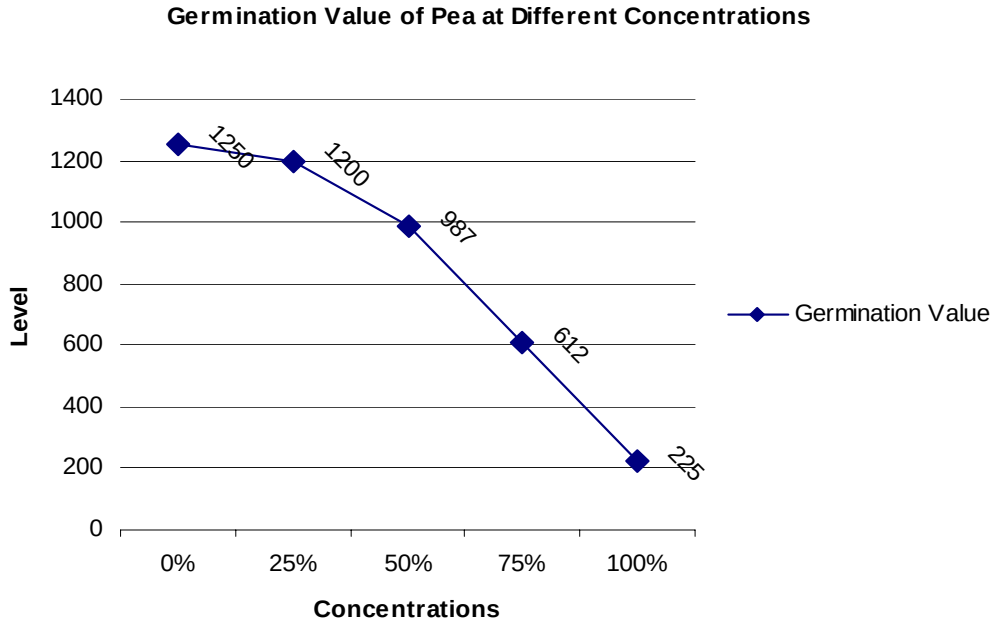
Effluent Concent.	Germination Percentage		
	Wheat	Pea	Lady's Finger
Zero	98±.57	100±.00	96±1
25%	93±.50	98±1	91±1
50%	89±.33	90±.33	79±.66
75%	82±.28	70±1.15	76±.005
100%	77±.20	65±1.52	73±1

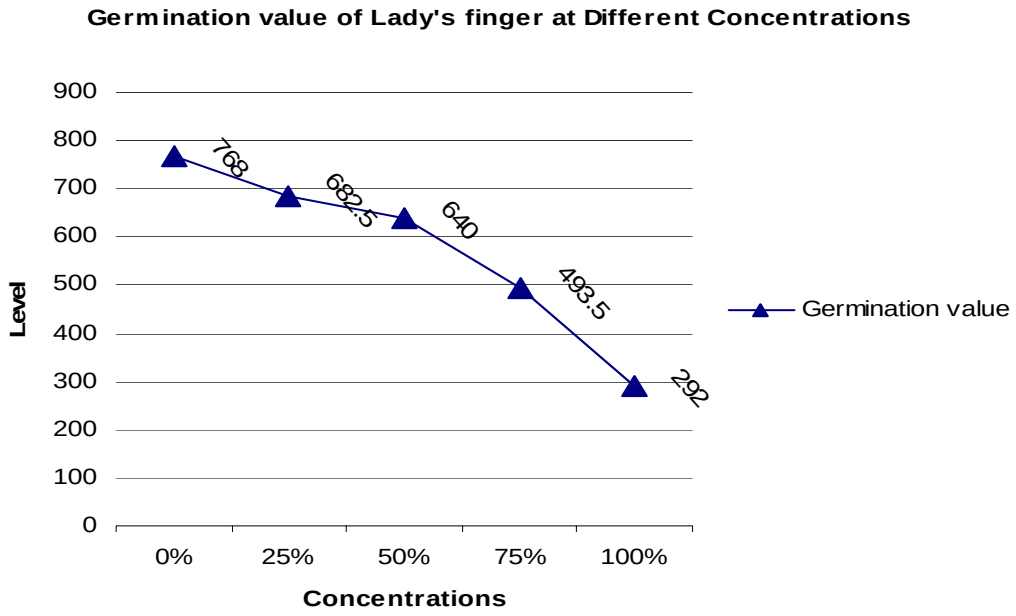


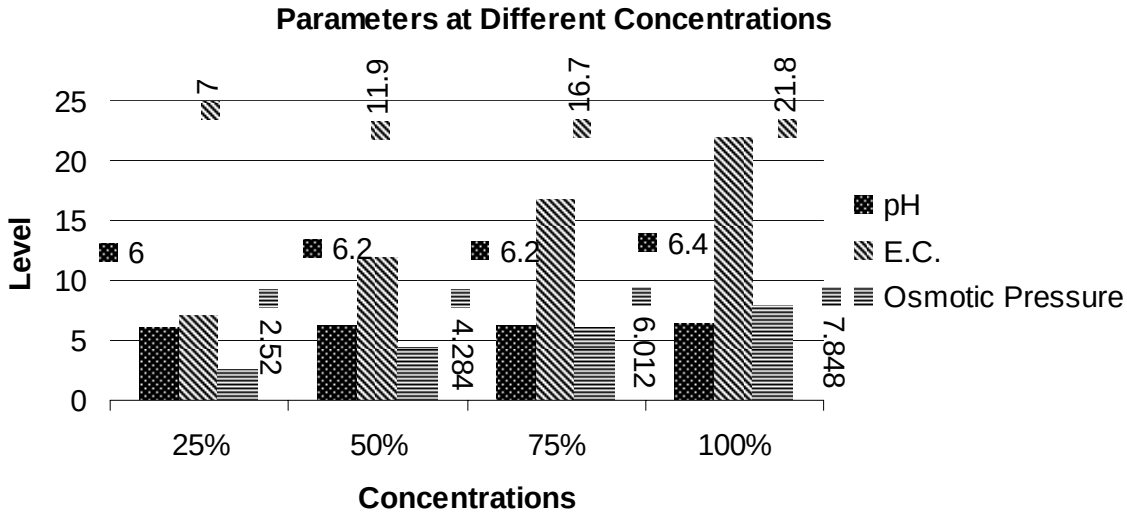












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