

# Effect of paper mill effluent on seed germination and seedling growth of pea

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## SUMMARY

The present paper deals with the study of physico-chemical characteristics of a industrial effluent and its effect on the germination and growth of pea (*Pisum sativum* L.) It has been observed that effluent (100%) was detrimental for the growth of the plant. The untreated effluent can be used at lower concentrations for the irrigation of the crop without decrease in the biomass or the fruits but higher concentration is harmful to the crop since it contains many toxic elements which cause reduction in the growth parameters and yield of the plant.

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## Key words :

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Industrial activities generate large quantities of water containing alkaline calcium carbonate, sodium, potash, nitrates, aluminum etc. discharged either into an ecosystem or spilling over the agricultural fields directly or through irrigation canal or even entering into the groundwater leading to the deterioration of the land, agricultural crops or the soil system. Various raw material used are wood, bamboo, straw, bleaching powder, caustic soda, ferric alum, dyes etc. in the paper mills. The treatment used for industrial waste are almost the same as that of sewage. Different treatments such as preliminary treatment, primary, secondary, tertiary are also necessary in case of industrial waste treatment. It is impossible to select a well suited treatment for a particular effluent (organic, inorganic and chemical effluent) because of the fact that the quality of water is uniform as well as predictable and the pollutant present is known. In the present investigation an attempt was made to analyze the physico-chemical aspect of paper mill effluents and their effect on the growth parameters of pea (*Pisum sativum* L.)

## MATERIALS AND METHODS

The materials and methods includes the following aspects.

- Location of site
- Sampling

- Water analysis
- Plant growth

Sample of water for various examinations were collected from paper mill located in Bari-Brahmana, Jammu. Water samples were collected in plastic cans for analysis of physico-chemical characteristics of various parameters i.e. pH, electric conductivity, total dissolved solid, total hardness and alkalinity and were estimated as per the methods of APHA (1985).

Seeds of pea were procured from the Directorate of Agriculture, Jammu. The seeds were sown in polyethylene bags filled with garden soil and farmyard manure (1:1). Data on seed germination were recorded after 20 days and on other parameters of growth at different intervals of time.

## RESULTS AND DISCUSSION

The results of the above study are presented in Tables 1-3. The quality and composition of effluent dependent upon the type of industry. According to Agarwal (2005) colour of the water is usually estimated by visual method and depends upon the chemicals or raw material used.

Temperature is an important factor for its effect on chemicals and biological reaction in water. The mean value of temperature recorded was  $29 \pm 0.82^{\circ}$  C. Electric conductivity is an induction of dissolved solid

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and suspended solids. The mean value of electric conductivity was  $0.79 \pm 0.01 \mu$  mhos/cm. The ability to transmit an electric current depends on the concentration of charged ionic species in the water (Trivedy and Goel, 1986). The mean value of pH effluent collected from paper industry recorded  $7.6 \pm 0.5$  and this was with acceptable range for industrial effluent (ISI). Alkalinity of water is its capacity to neutralize strong acid and is characterized by the presence of hydroxyl ( $\text{OH}^-$ ) ions capable for combining with ( $\text{H}^+$ ) ions (Sexana, 1954). The mean value of alkalinity was  $68 \pm 3.5$  mg/l (Table 1).

**Table 1 : Physico-chemical parameters of effluent of the paper mill**

Sr. No.	Parameters	Mean values
1.	Colour	Milky white
2.	Temperature	29°C
3.	Conductivity	0.79M mhos $\pm 0.01$
4.	pH	7.6 $\pm 0.5$
5.	Alkalinity (as $\text{CaCO}_3$ )	68 $\text{mg l}^{-1}$
6.	Hardness	362 $\text{mg l}^{-1}$
7.	Suspended solid	1034 $\text{mg l}^{-1}$
8.	Dissolved solid	608 $\text{mg l}^{-1}$

In the present study, mean value of hardness ( $632 \pm 1.2$  mg/l) has no adverse effect. Total hardness of water is the sum of alkaline cation present in it. Hardness is mainly due to presence of carbonate, bicarbonate etc. (Trivedy and Goel, 1986).

The results (Table 2) showed that the germination rate in control was high (92%). Effluent inhibited seed germination. The reduction in the seed germination and growth of the crop plants by effluent irrigation which might be due to the high concentration of solid present in the effluent which might disturb the osmotic relationship of the seed and water, thus reducing the amount of absorbed water and retarded seed germination. Moreover high osmotic pressure caused due to high concentration of salts also retard seed germination. Similar results have been reported in *Zea mays* (Choudhary *et al.*, 1987) and *Cicer arietinum* (Dayama, 1987).

**Table 2: Effect of different concentrations of effluent on seed germination**

Effluent concentration (%)	Seed germination (%)
00	92
25	34
50	30
75	26
100	10

The shoot length in the control (15.6) was higher than the plants irrigated with effluent (Table 3). The 50% concentration of effluent was more suitable for root length as compared to higher concentrations of effluents. The reduction in root and shoot length in plants irrigated with effluent might be due to the stress caused by high salinity (Kumar and Chauhan, 1993). Secondary and tertiary roots attain more importance since it is on these roots that the root nodules are present which help in the fixation of

**Table 3: Effect of different concentrations of effluent on growth of plants after 30 days**

Parameters	Effluent concentration (%)				
	0	25	50	75	100
1. Shoot length	15.6	9.5	7.5	7.0	6.9
2. Root length	19.2	20.1	23.9	12.4	10.8
3. No. of primary roots	1.0	1.0	1.0	1.0	1.0
4. No. of sec. roots	49	56	64	20	39
5. No. of tertiary roots	21	29	31	71	93
6. Leaf number	24	20	20	16	12
7. Number of nodules	3.0	8.0	4.0	-	-
8. Tendrils	3.0	3.0	3.0	2.0	2.0
9. Pod number	40	11	6.0	3.0	2.0
10. No. of seeds/ plant	89	34	12	3.0	-

atmospheric nitrogen. Fifty per cent effluent promoted more number of secondary roots than the control, but increasing concentration decreased the root number. The nodules produced in the effluent treated plants up to 75 days but at this stage, the number was much more than the control except in cent per cent concentration of effluent where no nodules were produced. Similar results have been reported in other crops (Sahai and Srinivastava, 1986).

### Conclusion:

The present study concludes that the untreated effluent in lower concentration (up to 50%) can be used for irrigation of this crop without decrease in the biomass or the fruit production but higher concentrations of effluent is harmful to this crop since it contains many toxic elements which cause reduction in the growth parameters and yield of the crop.

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