Remarking

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Impact of Paper Mill Effluent on Nodulation in *Pisum sativum* L.

Abstract

A study was conducted to find the effect of different conc. of paper mill effluent on nodule formation in pea. The study revealed that effluent up to 75% conc. enhanced the production of nodule, but there was no nodule formation at 100% conc. Simultaneously a study was conducted to find out the effect of different conc. of three different chemicals (Ferric alum, Bleaching powder and Caustic soda) used in processing of paper in M/s Jammu Paper mill Ltd. on nodulation.

Keywords: Paper Mill Effluent, Nitrogen Fixation, Nodulation, Leguminous Plants.

Introduction

Industrial waste is considered as potential water resource because it contains a considerable amount of nutrients which may prove beneficial for plant growth (Sahai, *et.al.*, 1985, Mishra and Behera , 1991) and hence the use of wastewater in agriculture is gaining importance. A large number of wastes viz dairy waste (Scott ,1962), food processing waste (Fisk , 1964), meat processing waste (Cohen, 1982) tannery waste (Mohlman, 1926) ;pulp and paper mill waste(NEERI, 1979, Bellings , (1959) has been successfully used for irrigation of crops with or without any treatment. However, indiscriminate use of industrial effluent may reduce crop growth.

M/S Jammu paper (P) Ltd. Is the first unit of J&K state which is manufacturing white duplex board. This industry consumes a large amount of water (Trivedy and Raj , 1992). Nearly 80-85% of the water is discharged by this industry as effluent. This industry utilizes three main chemicals in the manufacturing of paper viz Bleaching powder, Ferric alum and Caustic soda. Presence of these chemicals in the effluents may affect the soil and in turn the growth of plants . (Baruah *et.al.* 1996)

Aim of the Study

The present study was conducted with an aim to analyze the physico-chemical properties of effluents from the Paper Mill industry and to determine the minimum conc. at which Ferric Alum, Bleaching Powder, Caustic Soda and the untreated effluent of paper mill is detrimental to nodulation in *Pisum sativum* L., a legume.

Materials and Methods

The effluent was collected in clean plastic container at the point of disposal outlet from paper mill located at Baribrahmana Jammu. Immediately after collection, the effluent was brought to laboratory. The physicochemical characteristics of various parameters *i.e.* p_H , electrical conductivity, total suspended solids, total dissolved solids, total hardness and alkalinity were estimated as per methods of APHA (1985).

The soil sample used for experiment was collected from Botanical garden Jammu University. It was then spread out thinly on the floor for drying.

Seeds of pea were procured from Directorate of Agriculture Jammu. The seeds were sown in polythene bags.

The Paper mill effluent was considered as 100% concentration. From effluent of this 100% conc. 25%, 50%, 75% level of effluent conc. were prepared using tap water. 10 seeds were sown in each bag. 32 sets

of polythene bags were made. 4 sets for different conc. of effluents, 1 set for control and 27 sets for different conc. of three chemicals. The number of nodules was recorded at the interval of 15 days in different conc. of effluent,control and different conc. of three different chemicals.

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Results and Discussions

The physico-chemical characteristics of paper mill effluent are presented in Table 1. and it revealed that most of the parameters were with in permissible limits. The quality and composition of effluent depend upon the type of industry.

According to Agarwal, (2005) the color of effluent is usually estimated by visual method and depends upon the chemicals or the raw material used in processing. The color of untreated effluent was milky white. Total suspended solids were higher than total dissolved solids. The effluent was slightly alkaline. Alkalinity of the water is the capacity to neutralize strong acids and is characterized by presence of (OH) ions (Sexana, 1954). The mean value of electric conductivity was 6.79M mhos. The ability to transmit electric current depends upon the conc. of charged ions present in water (Trivedy and Goel, 1986). The mean value of P_H was 7.6. The mean value of hardness was 362 mg/l which is within permissible limits, so it has no adverse effect. The total hardness of water is the sum of alkaline cations present in it. Hardness is primarily due to the presence of carbonates and bicarbonates (Trivedy and Goel 1986).



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Table-1

Physico-Chemical analysis of Effluent									
Parameters	Value	Permissible Limits (IS)							
Colour	Milky White	-							
Temperature	29c	-							
PH	7.6	-							
Electrical Conductivity	.79M mhos	300M mhos							
Alkalinity (as caco3)	68mg/l	200 mg/l							
Total hardness	362mg/l	600 mg/l							
Total solids	1642mg/l	1200 mg/l							
Total Dissolved solids	608mg/l	1000 mg/l							
Total Suspended solids	1034mg/l	200 mg/l							

Table-2

Average No. of Nodules of Plants in Different Concentrations of Effluent and Control from 30 to 90 Days

Conc.	No. of Nodules									
(ppm)	30 Days	45 Days	60 Days	75 Days	90 Days					
E 25%	8	29	31	39	_					
E 50%	4	27	28	33	_					
E 75%	_	13	15	17	_					
E100%	_	_	_	_	_					
Control	3	4	6	9	12					
E =Effluent										

Table-3							
Average No. of Nodules of Plants in Different Concentrations							
of Ferric Alum from 30 to 90 Days							

Conc.	No. of Nodules														
(ppm)	30	0 Days 45 Days			iys	60 Days		75 Days			90 Days				
	FA	BP	CS	FA	BP	CS	FA	BP	CS	FA	BP	CS	FA	BP	CS
250 ppm	-	-	-	2	6	5	4	40	7	36	47	6	42	53	12
500 ppm	-	-	-	2	8	-	3	35	3	14	39	5	18	40	10
750 ppm	-	5	1	4	14	1	8	37	3	17	43	8	25	43	9
1000 ppm	2	-	-	6	5	1	16	35	4	22	40	5	23	42	9
1500 ppm	2	5	1	1	7	-	11	8	5	25	17	2	28	43	6
2000 ppm	-	-	-	-	-	3	1	39	2	12	40	2	18	42	1
3000 ppm	-	-	-	-	1	-	4	15	1	8	18	-	10	21	3
4000 ppm	-	-	-	-	14	-	2	12	-	3	13	-	3	18	-
5000 ppm	-	-	-	1	4	-	2	8	-	2	6	-	5	11	-

FA Ferric alum ,BP Bleaching powder CS Caustic soda

The number of nodules of plants in different conc. of untreated effluent are presented in Table 2 and represented graphically in Fig. 1. The data revealed that number of nodules in effluent treated plants was more than control. This might be due to presence of growth enhancing substances in the effluent, which promote the nodule formation but with increasing conc. of effluent, the number nodule formation was reduced. But it was still higher than the control. This might be due to heavy load of such substances in higher conc. of effluents. The reason might be that only small quantity of such substances enhance nodule formation .The highest number of nodules observed in untreated effluent was (39) in 25% conc. and the lowest number was (17) in 75%conc. of effluent. At 100% conc, no nodule was observed. Similar results have been found earlier by LaxmiPrasuna, M.L. (2014) and Sharmila, S. ,Kalaichelvi ,K and Rajeshwari (2009). The reason might be the presence of huge amount of total suspended solids in higher conc. of the effluents. High

clog sprinkler nozzles and soil pores leading to anaerobic condition in root zone (Raghuveer, 1994). The aerobic conditions necessary for soil microbial processes are inhibited which interfered with the growth of secondary and tertiary roots and it is on these roots that the root nodules are present which help in fixation of atmospheric nitrogen. The number of nodules in different conc. of three different chemicals used in processing of paper

amount of suspended solids have the tendency to

three different chemicals used in processing of paper in paper mill are presented in Table 3 and represented graphically in Fig. 2 for Ferric alum, Fig. 3 for Bleaching Powder and Fig. 4 for Caustic Soda .The results revealed that the average number of nodules was highest (53) in 250 ppm in bleaching powder followed by Ferric Alum (42) in250 ppm and in Caustic Soda it was (12) in 250 ppm conc. At 90 days. The lowest number of nodules recorded in caustic soda (01) in 2000 ppm conc. At 90 days followed by Ferric Alum (02) in 5000 ppm at 75 days and (03) at 90 days in 4000 ppm, in bleaching Powder the lowest

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number was (06) in 5000 ppm at 75 days and (11)at 90 days.

The data indicates that for nodule production in this crop the three chemicals used behaved differently. The number of nodule production was more in plants treated with Bleaching Powder followed by Ferric Alum. In plants treated with Caustic Soda Vol-II * Issue- XI* April- 2016

the number of nodules was less as compared to other two chemicals. But all the three chemicals showed decreasing trend with increasing conc. The findings were very much in accordance with Malla and Mohanty (2005) and Rajeswari (2003).



Concentration (ppm) Fig .1 Number of nodules in different conc. of Effluent and Control



Concentration (ppm) Fig. 2. Nunber of nodules in different conc. of Ferric Alum

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Concentration (ppm) Fig. 4. Nunber of nodules in different conc. of Caustic Soda

Conclusion

It is recommended that effluent should not be released into receiving waters without treatment and the treatment plant should be based upon modern technology to further reduce the toxic chemicals, whether into the receiving waters or on the soil, so that it does not produce harmful results and could be safely and efficiently reused for at least irrigation purposes of the crops.

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