Acta Ciencia Indica, Vol. XLV C, No. 1-4, 57 (2019)

EFFECT OF BREWERY WASTE ON GERMINATION OF *RAGI (ELEUSINE CORACANA. L. GAERTN*

P.C. MOHANTY, MRS. SANJUKTA PATNAIK AND DR. P.K. MISRA*

Department of Chemistry, Ravenshaw University, Cuttack-3, Odisha.

RECEIVED : 30 December, 2019

The paper reports effect of 100%, 75%, 50% and 25% concentrations of brewery waste on germination of seeds of ragi in laboratory conditions. The germinatgion was slower and trhe percentage was lower in higher concentration of wastes. The values were lower than control. The same was true for radical and plumule length but the differences were narrowed down after 48 hours and it is concluded that application of untreated brewery waste had only marginal effect on germination behaviour of ragi.

INTRODUCTION

Rapid increase in the growth of Industries has led to a substantial increase in liquid waste produced that needs to be treated. Use of waste water in irrigation is very common practice. Earlier, attempts have been made to study effect of various industrial wastes on plant growth and soil properties. (Behra and Mishra, 1982; Bhatnagar *et al*., 1986; Saltai *et al.*, 1979; Sahai *et al*., 1985; Singh, 1982; Sahai, 1983; Renu and Shrivastava, 1988; Trivedy and Chinde, 1983. The effect of sludge on seed germination has also been studied (Wollan *et al*., 1978). The effect of sugar factory effluent on soils and crop plant (Ajmal and Khan (1983) and the effect of brewery effluent on agricultural soil and crop plants, (Ajmal & Khan, 1984) are reported.

The present study is undertaken to assess the potential of brewery waste, on germination of a commonly grown crop which is important crop plant of this area. The experiment is carried out in laboratory using peteri plates for different dilutions of the waste.

MATERIALS AND METHODS

The Waste :

The brewery waste is collected from Choudwar, Cuttack. The waste is similar to that of distillery effluent but pollution load is much less. Effluent is highly biodegradable with high quantityt of BOD and COD. The waste is amenable to biologicala treatment. The typical waste characteristics range were pH 7.5-7.0, TDS 153-940 mg/l, Sodium 32-440 mg/l, Potassium 44-232 mg/l. Table 1 gives general characteristics of the Brewery waste which is used in the present study and dilutions of the waste and their characteristics are presented in Table 2.

PCM019072/C20

Table 1. Physico-chemical characteristics of brewery effluent (Used in the present study).

Parameters	Range	Average
pH	7.5 – 7.5	7.5
Tot. Solids	162-960	546.7
Tot. Diss. Solids	153-940	528.85
Tot. Sus. Solids	09-238	94.85
Diss. O_2	0.0-0.0	0.0
B.O.D.	90-640	231-0
C.O.D.	640-2400	1245.7
Hardness	36-144	125.42
Calcium	8.8-144	16.93
Magnesium	0.97-292	11.25
Chlorides	7.1-260	54.32
Sodium	32-440	128.57
Potassium	44-232	110.8

All the values are in mg/l except pH.

Table 2. **Physico-chemical characteristics of brewery effluent and tap water (control) used in the present study).**

Parameters	Control	25%	50%	75%	100%
pH	7.0	7.0	7.5	7.5	7.5
Tot.Solids	38.0	194.0	610.0	790.0	941.0
Tot. Diss. Solids	11.0	159.0	572.0	750.0	840.0
Tot. Sus. Solids	27.0	35.0	38.0	40.0	101.0
Diss. O_2	7.6	4.4	3.6	1.6	0.0
B.O.D.	2.4	280.0	300.0	380.0	400.0
C.O.D.	40.0	80.0	96.0	160.0	800.0
Hardness	92.0	300.0	320.0	340.0	500.0
Calcium	13.62	48.09	64.12	80.16	260.0
Magnesium	14.12	43.83	38.92	48.79	73.05
Chlorides	29.82	71.0	82.2	99.4	884.0
Sodium	13.0	53.0	90.0	396.0	1200.0
Potassium	0.94	1.76	2.9	4.2	5.2

All the values are in mg/l except pH.

EXPERIMENTAL PLANNING

The present study of effect of germination on 'ragi' was carried out in large Petri-plates. Where germination percentage, length of plumule, and radical were observed every day.

The dilution of brewery waste were prepared by using tap water, as 25% concentrations, 50% concentration, 75% concentration and 100% (pure waste). Tap water served as control.

The seeds of 'ragi' were produced from a certified seed dealer and were well prepared for the experimental studies. After that these seeds were soaked in respective concentration of the water for '24' hours (25%, 50%, 75%, 100% waste). These seeds were put in large sized Petri-plates on a filter paper, already soaked in corresponding concentrations of the waste with the replicates of respective of each and control at room temperature. The number of seeds germinated was recorded every-day and the filter papers were kept moist by adding extra amount of waste if necessary. The observations were noted daily (after a period of '24' hrs.) for the parameters like germination percentage, length of radical, length of plubule.

Effect on germination, radical length and plumule length

The germination was recorded noticeable only in forty eight hours. In control maximum germination is observed from the very beginning and trend is followed by the value in least concentration of the waste. However, these differences narrowed down on the last day of observation. Thus a mild adverse effect of brewery waste on seed germination is apparent. The Table 3.

The length of radical data is shown in Table-4. In the first '24' hours the length of radical was in control as well as in 25% concentra- tions. In other concentrations it was below 0.8 cm. The differences were more or less nullified in later day's and the final daya of observation.

The maximum values were obtained in control, while the values were lesser in higher concentrations. The differences were, however, not marked in the all concentration (Table 4).

In case of plumule length, the best growth was obtained in maximum concentration of the wastes on all days of observations. After '168' hours of length of plumule was 1.3 cm in 100% it went on declining with dilutions of the waste and minimum was found in control (0.8 cm.) in overall period of observation. Fig. 3 shows effect of waste water on the length of plumule. The differences are given in Table 5.

Table 3. Difference in Per cent germination of Ragi with difference concentrations of brewery waste anad control.

Hours	Control	25%	50%	75%	100%
24	20	–20	–10	–10	–15
48	73	–10	–13	–18	–20
72	78	–3	–5	–8	–8
96	78	–3	–5	–8	–5
120	78	–3	–3	–5	–5
144	78	–3	–3	–5	–5

Table 4. **Difference in length of radical of gram with dilution of brewery waste and control.**

Hours	Control	25%	50%	75%	100%
24	1.1	0.0	–0.4	–0.3	–0.5
48	2.4	–0.3	–0.3	–0.8	–0.5
72	3.3	–0.5	–0.3	–0.4	–0.3
96	3.6	–0.2	+0.1	–0.4	0.0
120	4.4	–0.4	0.0	–0.8	–0.1
144	5.2	–0.8	–0.2	–1.3	+0.3

Table 5. **Difference in length of plumule of gram with dilution of brewery waste and control.**

Hours	Control	25%	50%	75%	100%
24	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0
96	0.4	–0.2	–0.1	–0.1	+0.1
120	0.6	–0.2	–0.1	–0.1	+0.1
144	0.7	+0.3	+0.4	+0.4	+0.5
168	0.8	+0.3	+0.4	+0.4	+0.5

Discussion

It is clear from this study that 'Brewery waste' delayed the germination in 'Ragi'. Thabaraj (1962), Somashekar (1984), Trivedy and Shinde (1983) have reported retardation in germination percentage with different wastes, however, in present study the effect was only marginal. Ajmal *et al*. (1984) have found that the dairy waste was promotary for germination of 'Pearl millet' even upto 100%. Similar results were reported by Jerath and Sahai (1982) in seed germination of '*Zeamays*' treated with fertilizer factory effluent.

The germination in control was quick but was low in the treated sets upto 48 hours. The seeds take up water during germination to hydrolytes the stored food material in order to activate enzymatic action. As absorption takes place by osmosis, the salt content outside the seed may act as limiting factor which may be responsible for seed germination. Further more high salt content may be another factor inhibiting seed germination and root growth (Adriano *et al*., 1973).

The waste water irrigation of Brewery affects adversely the length of radical but again the effect was only marginal. However, promotary effect was noted on plumule growth. The study may have significance in view of large number of breweries using waste water for irrigation in their premises. Table 6 gives summary of available results on effect of waste water irrigation on germination of various crops. Most of the studies conclude that germination is higher indiluted wastes. Regardation and reduced germination is common the concentrated wastes.

REFERENCES

1. Adriano, .D., Chang A.C., Praff, P.T., and R. Sharpless. Effects of soil application of Diary manure on germination and emergence of some selected crops. *J. Environ. Qual* **2** : 396-9 (1973).
2. Ajmal, M. and Khan, A.U., Effects of Brewery waste on agricultural soil and crop plants *Environmental Pollution* (Series A) **34**(4): 341-51 (1984).
3. Ajmal, M. and Khan, A.U.M. Effects of vegetable Ghee manufacturing factory effluent on soil and crop plants *Environmental Pollution* (Series A) **34**(A): 367-79 (1984).
4. Ajma, K. and Razi Uddin. Effects of chemicals manufacturing factory effluent on soil and crop plant. Personnel Communication.
5. Ambaht, R.S. and Tripathi, B.D. Assessment of effluent of a chemicals and fertilizers factory for irrigation of agricultural land. *The Jr. of Sci. Research* Vol.**24**(1): 83-87 (1978).
6. Azad, A.S., Arora, B.R.Singh Bijay and Sekhon, G.S. Effect of sewage waste waters on some soil properties. *Indian J Ecol.* **14**(1): 7-13 (1987).
7. Bhatnagar, A.R. Pathak, K.C. and Dodia, P. Effect of sugar factory effluent of germination and growth of the rice *Orjza sativa. Environ. Ecol.* **4** : 218-220 (1986).
8. Bahera, B.K. and Mishra, B.N. Effect of Industrial effluent on rice seedlings. Analysis of pigments, proteins, nucleic acids and 2, 6 dichloroindophenol bill reaction of rice seedlings *Environ. Res* **31:**2 (1983).
9. Hinsely, T.D. and Sosewitz B. Digested sewage sludge disposal on cropland, *J. Wat. Poll. Control Ped* **4** (B) : 822-828 (1969).
10. Juwarkar, A.S., Bhalkar, D.V. and Subrahmanyam, P.V.R. Effect of Pulp and Paper mill waste water on soil properties. *India J. Environ. Hlth.* Vol.29, No.**4** : 313-321 (1987).
11. Lunt, H.A. Digested sewage sludge for soil improvements. *Bull Conn. Agri. Exp. Sin.* No.622 (1959).
12. Marumkar, C.V. and Chavan, P.D. Influence of water pollution on germination of gram (*Gicerargentina)* p.233-249 In. (Trivedy, R.K. and Goel, P.K. edited) *Current Pollution Researchers in India Env. Publications*. Karad (1985).
13. Neelam & Sahai, R. Effect of fertilizers factory effluent on seed germination and growth behaviour of *Vigna radiate Environment & Ecology* **3** : 307-311 (1985).
14. NEERI. Utilization of Pulp and paper mill waste water for agriculture. Report by *NEERI*, Nagpur (1979).
15. Rajamna, G and Oblisami, G. Effects of Paper factory effluent on soil and crop plant. *Indian J. Environ. Health* **21**(2) **:** 120-130 (1979).
16. Raza, S.H. and Vijaya Kumari, N. Impact of distillery effluent spent wash on seed germination, morphological characters, yield, and Pigment concentration of *Trigonella foenumgraceum L Personal Communication*.
17. Renu, Rani and Shrivastgava, M.K. Effect of Distillery waste on seed Germination of Wheat. *Environment and Ecology*. **6**(1): 214-216 (1988).
18. Sahai, R., Agarwal, N. and Khosala, N. 1979. Effect of Fertilizer Factory effluent on seed germination seedling growth and chlorophyll contgent of *Phaseolus radiates L. Trop Ecol.* **20 :** 155-162.
19. Sahai, R. Shukla, N. Jabeen S. and Saxena, P.K. 1985. Pollution effects on growth behaviour of *phaseolus radiatus L. Environ. Pollu. Series* A. 37(2).
20. Sahai, R. and Neelam. Effect of fertilizer factory and distillery effluents on the seed germination, seedling growth, Pigment content and Biomass of *Phaseolus Radiatus Linn*. 1987. *Indian J. Ecol.* **14**(1) : 21-25 (1987).
21. Singh, D.K., Kumar and Singh, V.P. Studies of pollutional effects of sugar mill and distillery effects of sugar mill on seed germination and seedling growth of three varieties of rice. *J Environ. Biol.* **6:** 31-35 (1985).
22. Somashekhar, R.K., Gowada, M.T., Shethiggar, S.L.H. and Srinath, K.P,. Effects of Industrial effluents on crop plants *Indian J. Environ. Health* **26**(2): 136-146 (1984).

23. Thabraj, G.J., Bose, S.M. and Nayudamma, Y. Utilization of tannery effluent for irrigation purposes *Ind J. Environ Health* **6** : 18-36 (1962).
24. Trivedy, R.K. and Shinde D.B. Effect of Distillery waste Irrigation on Soil Characteristics 1983. *Pollution Research Volume* (2): 71-76 (1983).
25. Wollen, E. Davis, R.D. and Jenner, S. Effects of Sewage sludge on seed germination. *Environ. Pollu.* **17** : 195-205 (1978).
26. Wong, MaHa, Lan W.M. and Yip. S.W. Effects of sludge extracts on seed germination and root elongation of crops. *Environmental Pollution (*Series-A) 25(2): 370-372 (1981).

❑