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Research Paper

Impact of Sugar Industry Effluent on Germination of Seeds of Green Gram (Vigna Radiata Variety Lgg 460)

Environment

KEYWORDS : LGG 460 green gram, sugar industry effluent, seed germination

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ABSTRACT

This study was undertaken to evaluate the effect of sugar industry effluent on locally cultivated variety of green gram LGG 460. The physicochemical parameters like pH, TDS(510mg/l), BOD(550mg/l), COD(680mg/l), EC(1.056), chloride(162mg/l), sulphate(12) were analysed. The chemical parameters indicate that there is high organic and inorganic content, high amount of suspended solids and acidic load. Regular use of this effluent adversely affect the soil and crop yield. A study was conducted to know the effects of different concentrations (20, 40, 60, 80, 100) of sugar industry effluent on seed germination of green gram LGG 460. The study reveals that the germination efficiency is reduced due to low pH 6.5 and other chemical parameters of effluent water. In low concentrations the seeds thrive better and at high concentrations the seeds are affected. Germination rate decreased with increasing concentration of effluent.

Introduction

Industrialization leads to deterioration of environment. An integral part of industrial activity is the production of effluent. Sugar industries which play an important role in economic development of our nation are also discharging a large amount of waste water as effluent. Diverse sugar industry effluents disposed of in soil and water cause major pollution problems in terrestrial ecosystem. Sugar industries cause organic pollution. Sugar industry effluents, when not treated properly, have an unpleasant colour and odour. They are released into the environment. The industrial effluents are generally considered harmful but sometimes used for irrigating various crops, (Nath et al., 2009 and Malaviya et al., 2007) in order to meet the demand of water. Green gram is one of the important pulse crop in India. It has been reported that Green gram has been cultivated in India since ancient times. Seed germination is a critical stage that ensures reproduction and controls the dynamics of plant populations, thus it is a critical test of probable crop productivity. In view of such perspectives, the present investigation was conducted to evaluate the impact of different concentrations of Sugar industry effluent on seed germination. Effluent water is diluted in two ways. One by using potable water and other by using distilled water. The experiment was conducted twice with two different types of diluted water.

MATERIALS AND METHODS

Materials: Materials used for this study were LGG 460 variety green gram seeds, effluent water, distilled water

Source of seeds: Seeds were obtained from AP Seed Corporation, Govt. of Andhra Pradesh through the Office of ADA, Gannavaram area

Sugar industry effluent: For the present study, sugar industry effluent was collected from a nearby sugar industry in Krishna district. The sample was collected in a pre cleaned tin and bottles. Standard procedure (BIS) was followed for the collection and analysis of sugar industry effluent. The physico-chemical properties of the effluent namely pH, Electrical Conductivity, Dissolve Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolve Solids (TDS), Total Suspended Solids (TSS), Total Hardness (TH), Sodium, Potassium, Calcium, Magnesium, Chloride and Sulphate were analyzed.

3. Experimental Set-Up

10 Seeds of green gram were taken into a container. Plant seeds were spread on equal distance in container and sugar industry effluent water was taken in different concentrations. Then the water is poured into the container and left there for 24 hours so that seeds can start germination. After that the water is drained out and the data is recorded. Parameters like germination percentage was recorded on different periods of growth. First recording was done after 12hr. and subsequent recordings were taken after 1day interval till 5th day. Visible radical growth and emergence of hypocotyls and the cotyledons was noted to determine germination. The same experiment was done in two ways one with 10 number of seeds soaked in effluent water diluted with pot water and another with 50 number of seeds with effluent water diluted with distilled water.

4. Results and Discussion:

The physico-chemical parameters analyzed are given in the following table:

Sl. No	Parameters	Values
1	Colour	Light Black
2	Odour	Unpleasant
3	pH	6.56
4	Turbidity (NTU)	94
5	Total Suspended Solid mg/l	250
6	Total Dissolved Solid mg/l	510
7	Total Solids mg/l	760
8	Oil & Grease mg/l	4.0
9	Total Residual Chlorine mg/l	ND
10	Total Kjeldahl Nitrogen(as N) mg/l	8.2
11	Free Ammonia(as NH_3) mg/l	1.8
12	Biochemical Oxygen Demand (3 days at 27°C) mg/l	550
13	Chemical Oxygen Demand mg/l	680
14	Copper (as Cu) mg/l	0.019
15	Zinc (as Zn) mg/l	0.057
16	Selenium (as Se) mg/l	ND
17	Dissolved Phosphate (as P) mg/l	2.5
18	Sulphide (as S) mg/l	1.1
19	Sodium (as Na) mg/l	95
20	Potassium(K) mg/l	30
21	Sulphate(SO_4) mg/l	12

Germination Percentage

Germination refers to the initial appearance of the radical by visual observation. Its percentage was calculated by using the following formula:

$$\text{Germination percentage} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

Germination percentage values of green gram under sugar industry effluent diluted with pot water irrigation are presented in (Table1) and germination percentage values of green gram under sugar industry effluent diluted with distilled water are presented in (Table 2). The germination percentage varies in different effluent concentrations. It was found to be (100% germination in control and up to 60% concentration, 90% germination in 70 and 80% concentration 80% in 90 and 100%

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effluent water diluted with potable water) respectively. When the pot water is used for dilution, the seeds were not affected. But in the second experiment conducted by using effluent water diluted with distilled water seed germination was critically effected. At lower concentrations germination was not affected by effluent water. But in high concentration variation was seen clearly. Even the seed cover is not opened and the colour of seed also changed to black. The higher concentration didn't favour the seed for germination. The presence of extreme high acidic load inhibited the germination and declined the germination percentage. he mechanism involved in delayed germination might be linked with the reduced activity of several enzymes (Agarwal and Hemalatha, 1992). It may be also due to the amount of TDS responsible for retardation of germination and subsequent growth of young seedlings which would disturb the osmotic relation of the seeds with effluent water and thus reduce the amount of water absorbed (Akbar et al., 2009). The increase in germination percentage over control at lower concentrations indicates the stimulation of physiologically inactive seeds of the lot due to the treatment as suggested by (Lenin and Thamizhiniyan, 2009). It may also be due to the reduction in level of toxic metabolites by dilution and better consumption of nutrients present in the effluent (Kannan, 2001).

TABLE 1

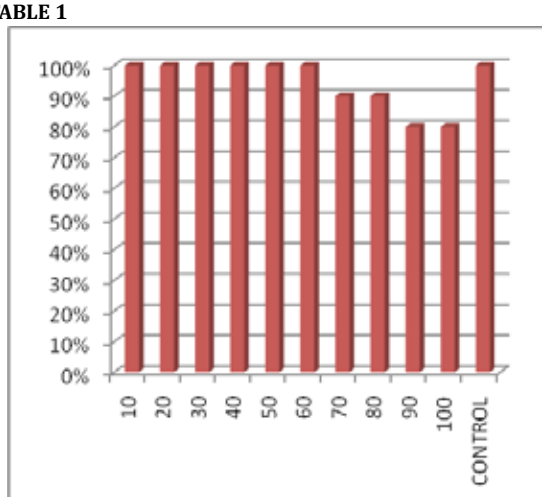
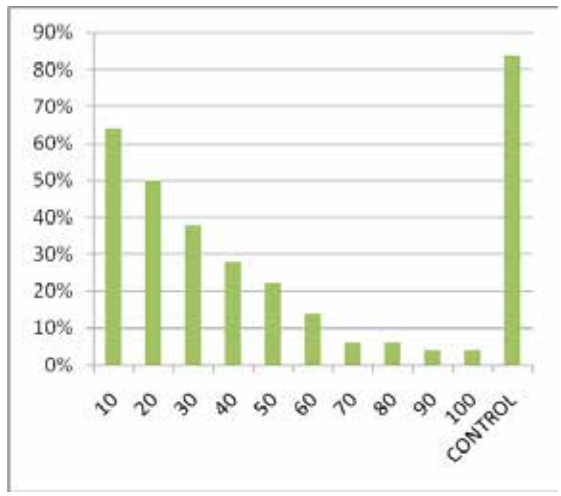


TABLE 2



5. CONCLUSION

It can be concluded that sugar industry effluent is one of the alternative resource to meet the water demand for agriculture practices. On the basis of the above experiment it can be suggested that sugar industry effluent should be treated to reduce the concentration of pollutants . Then the effluent can be used for irrigation purpose in cultivating crops only after proper dilutions. Diluted effluent water is not effecting the rate of germination.

REFERENCE

1.Ayyasamy P.M, Yasodha R, Rajakumar S, Lakshmanaperumalsamy P, Rahman Lee S. (2008). "Impact of sugar factory effluent on the growth and biochemical characteristics of terrestrial and aquatic plants" I. Bull. Environ. Contam. Toxicol., 81: 449- 454. | | 2.. Agarwal SK and Hemalatha G(1992), "Effect of nitrogenous fertilizer factory effluents on seedling growth and biochemical characteristics of Brassica juncea and cicer arietinum", Acta Ecol.,Vol.14,pp.53-60. | | 3.Akbar F Hadi, F Ullah Z and Zia M A(2009), "Effect of marble industry effluent on seed germination, post germination growth and productivity of Zea mays". Pak J of Biol Sci., Vol.10(22),pp.4148-4151. | | 4. Baruah A.K, Sharma R.N and Borah G.C. 1993. Impact of sugar mill an d distillery effluent on water quality of the River Galabil, Assam. Indian J.Environ. Hlth., 35: 288–293. | | 5,Doke, M.K., Khan, E.M., Rapoul, J. and Shaikh, A., 2011. "Physico-chemical analysis of sugar industry effluent and its effect on seed germination of Vignangularis", Vigna cylindrical and Sorghum cernum 5,7-11. | | 6. ETPI. 2001. Environmental technology program for industry "Environmental Report on Sugar Sector". Monthly Environmental News, 5(7): 11-27. | 7. Goel, P.K. 2000."Water pollution causes, effects and control". New Age International (P) Lts., Publisher. New Delhi, Press 269 | | 8. Jesudass, L and R. Akila. 1996. "Studies on the physico- chemical characteristics of the sugar factory effluent". International Journal of Ecobiotechnology, 16(11): 65-67. | | 9.Kannan A R and Upreti R K (2008), "Influence of distillery effluent on germination andgrowth of mungbean (Vigna radiata) seeds", Vigna unguiculata and Pisum sativum seedlings", Indian J. Sci. Technol., Vol. 4(3), pp. 266-272. | | 10.Malaviya P Kour R and Sharma N(2007), "Growth and yield responses of Capsicum annum L. to distillery effluent irrigation", Ind.J.Environ. Ecoplanning, Vol. 14,pp.643-646 | | 11.Nath,K.,Singh,D.,Shyam,S.,Sharma,Y.K.,2009. Phytotoxic effects of chromium and tannery effluent on growth and metabolism of Phaseolus mungo Roxb, Journal of Environmental Biology 30, 227-234. | | 12.Panasker D B and Pawar R S (2011b),"Effect of textile mill effluent on growth of Sorgham vulgare and Vigna aconitifolia seedlings", Indian J. Sci. Technol., Vol. 4(3) pp. 273- 278. | | 13.Ramasubramanian S (1993). Analysis of Industrial Effluent and their impact on the Growth and Metabolism of Phaseola mungo L.Communication in Soil Science and Plant Analysis, 24(17-18): 2241-2249. | | 14. Singh, D.K., Kumar, D., Singh, V.P., 1985 Studies of pollution effects of sugar mill and distillery effluents on seed germination and seedling growth in three varieties of rice. Journal of Environmental Biology 6, 31-35. | | 15.Subramani, A., Sundermoorti, P., Saravanan, S., Silvarju, M., Lakshmanchary, A.S., 1999. Impact of biologically treated distillery effluent on growth behaviour of green gram (Vigna radiate). Journal of Industrial Pollution Control 15, 281-286. | | 16.Trivedy, P.K. and G. Raj: Encyclopaedia of environmental sciences – Environmental Industrial Pollution Control, Vol. 9 Akashdeep Publishing House, New Delhi, India ,1992 |