European Journal of Biotechnology and Bioscience

www.biosciencejournals.com

E J B B

European Journal of Biotechnology and Bioscience

ISSN: 2321-9122
www.biosciencejournals.com
EJBB 2014; 2 (3): 1-4
Received: 16-08-2014
Accepted: 30-08-2014

Sumangala Rao
Department of Microbiology, Vaagdevi Degree and PG College, Hanamkonda, Warangal, Telangana, India.

Pallam Naresh Kumar
Department of Microbiology, Vaagdevi Degree and PG College, Hanamkonda, Warangal, Telangana, India.

P. Harindar Reddy
Department of Botany, Vaagdevi Degree and PG College, Hanamkonda, Warangal, Telangana, India.

Md Inayat
Department of Botany, Vaagdevi Degree and PG College, Hanamkonda, Warangal, Telangana, India.

Correspondence:
Sumangala Rao
Department of Microbiology, Vaagdevi Degree and PG College, Hanamkonda, Warangal, Telangana, India.

Study on effect of raw and diluted tannery effluent on the seed germination and seedling growth of selected crops

Sumangala Rao, Pallam Naresh Kumar, P. Harindar Reddy, Md Inayat

Abstract
In this study tannery effluents were physicochemically analyzed and their effect on seed germination and seedling growth of some important crops like wheat, jowar, maize, black gram, green gram, red gram, lentil and horse gram was analyzed. The effluent showed beneficial results at lower concentration (20%, 40%) but inhibitory effects at higher concentration (60%, 80%, 100%). Increase in effluent concentration showed decrease in seed germination and shoot elongation. Different physicochemical factors like PH, color, Odour, temperature, DO, BOD, COD, total solids of the effluent were also analyzed. It was found that values obtained were apart from optimum that requires preventing pollution of water bodies after effluent addition. It is concluded that if properly treated and diluted effluents are used for crop growth, the problem of disposal of effluents and also irrigation water needs can be solved.

Keywords: Tannery effluent, Seed germination, Seedling growth, Irrigation.

1. Introduction
Water pollution is a matter of great concern due to the addition of large amounts of waste materials to the water bodies. The major cause of water pollution is industrial wastes though agricultural and municipal wastes play a role. Most of the industries dump their toxic effluents and pollute different water bodies. These effluents contain toxic organic and inorganic suspended or dissolved solids, which have adverse effects on environment and human health. [1] Industrial effluents so produced cause contamination of soil, water and air, which are associated with many diseases and may be the reason for current decreased life span as per estimation by WHO, 2003 [2].
Leather industry like majority of industries is water based and generates large amount of waste water during curing, soaking, liming, detaining, bating, picking, degreasing and tanning. This effluent if not treated poses a significant threat to the environment as it contains high concentration of salts and chromium. [3] Due to the addition of such pollutants to the soil, plants come under stress and it may affect plant physiology and even seed germination [4]. It is reported that growth and yield of plants grown in soil using raw effluents for irrigation has been considerably decreased [5].
These tannery effluents, if diluted and sedimented, can be used for irrigation purposes. In several arid and semiarid regions, water shortage is limiting factor, thus in agriculture effluent is being used. This alternative use of diluted effluent for irrigation not only solves its disposal problem, but also will serve as natural fertilizer for several crops if used at proper concentration [6]. Though effect of several industrial effluents has been studied, effect on plants selected in the project work has not been reported. Hence the present investigation is on effect of leather effluents on seed germination and growth of important crop plants.

2. Materials and Methods:
2.1 Collection of tannery effluents: Four different types (purified effluent, starting material, chrome effluent and sodium-lime effluent) were collected from the outlet of tannery industry at Warangal, Telangana, in polythene bottles and stored in dark and room conditions for further uses.

2.2 Physico-chemical analysis: physiochemical characteristics like color, PH, dissolved oxygen, total dissolved solids (TDS), biological oxygen demand (BOD), chemical oxygen demand (COD) were analyzed as per methods described by APHA (2005). Water analysis was done taking three replicates.

2.3 Pot culture experiment: healthy seeds of test plants (wheat, maize, jowar, green gram, black gram, red gram, horse gram and lentil) were washed with sterilized distilled water and soaked in water for 4-5 hours. Six pots with clean soil were used for each concentration. Ten seeds were sown in each pot. Five different concentrations (20%, 40%, 60% 80% and 100%) of raw effluents were prepared. While tap water was used as control. Pots were supplied with respective effluent concentrations (100 ml) daily. The rate of germination and seedling growth were observed daily (7-10 days). Na-lime effluent was selected for study on plants. Replicas of each concentration were taken during the germination period; growth parameters like germination, shoot lengths were measured and noted.[7,8] Mean and standard deviation were performed using the statistical package on Microsoft excel version 2007.

3. Results

The physico-chemical parameters of four different types of effluents collected from leather industry are presented in table 1. Of the four effluents, chrome effluent is highly acidic in nature and others alkaline. It is found that all effluents have high TDS, BOD, and COD, and are above those values permissible by the Indian standards.

Table 1: Physico –chemical parameters of effluents.

Type of effluent	color	Odour	PH	COD	BOD	TDS
1. Starting material	Green	Strongly pungent	9	820 mg/L	580 mg/L	850 mg/L
2. Purified effluent	Light green	pungent	9	850 mg/L	540 mg/L	590 mg/L
3. Chrome effluent	Dark greenish blue	pungent	3	2960 mg/L	1850 mg/L	1050 mg/L
4. Na-Lime effluent	Grey	Light pungent	8	760 mg/L	458 mg/L	750 mg/L

There was 100% seed germination in controlled system except for maize, black gram, jowar and lentil when 70-80% germination was observed. In case of effluent treatment, maximum germination percentage was in 20% followed by 40% and decreased gradually as the concentration increased. Germination percentage was suppressed at 100% effluent. Results shown in Table 2.

Table 2: Effect of Na-Lime effluent on percentage germination of seeds.

S. No.	Name of the plant	Germination percentage					
		control	20% effluent	40% effluent	60% effluent	80% effluent	100% effluent
1	Wheat(*Triticum aestivum*)	100	100	100	80	60	50
2	Maize (*Zea mays*)	75	30	0	10	20	10
3	Jowar(*Sorghum bicolor)*	80	50	70	40	40	40
4	Green gram(*Vigna radiata)*	90	90	100	30	20	20
5	Red gram(*Cajanus cajan)*	100	100	90	80	80	70
6	Black gram(*Vigna mungo)*	80	30	10	10	0	0
7	Horse gram(*Macrotyloma uniflorum)*	100	100	90	50	50	50
8	Lentils (*Lens culinaris)*	80	40	40	20	20	20

Seedling growth on day 10 revealed remarkable effects of effluents. Results expressed in table 3. Shoot length of plants tested differed with different concentration of leather mill effluent. Lower concentration (20-40%) exhibited higher shoot lengths. Especially 20% effluent showed almost equal lengths as in control pots.

In higher concentrations (60%, 80% and 100%) showed reduced length of seedling which confirms the toxic effects of concentrated effluents on various plants. Of cereals wheat and Maize showed highest shoot lengths, while Jowar with least length of the grams used, Red gram, Green gram and Lentils exhibited higher shoot length. Green gram with medium length and Black gram with least shoot length at 20% concentration and almost equal to that of control plants.

Table 3: Effect of Na –Lime effluent on seedling growth on day '10'.

S. No.	Name of the plant	Height of seedlings in cms (mean ± SD)					
		Control	20% effluent	40% effluent	60% effluent	80% effluent	100% effluent
1	Wheat	11.9±0.9	7.2±0.56	6.5±0.2	5.6±0.3	4.8±0.8	4.5±0.2
2	Maize	10.8±0.2	10.2±0.1	7.2±0.2	7.3±0.4	7.4±0.4	7.5±0.3
3	Jowar	2.5±0.2	2.1±0.2	2.4±0.4	2.2±0.2	1.8±0.3	0.5±0.2
4	Green gram	9.3±0.6	9.5±0.7	6.2±0.4	5.4±0.6	5.2±0.2	4.9±0.2
5	Red gram	15.5±0.3	15.3±0.4	11±0.6	11±0.2	10±0.5	4.8±0.6
6	Black gram	2.2±0.2	2.6±0.1	1.8±0.6	1.6±0.1	1.6±0.8	1.5±0.4
7	Horse gram	10.2±0.2	10.7±0.6	8.3±0.5	6.2±0.3	6.4±0.3	3.6±0.3
8	Lentils	15.8±0.8	15.2±0.6	12±0.4	10.2±0.6	5.8±0.2	5.4±0.1

However in all the plants shoot length decreased as the concentration of the effluent decreased exhibiting weekend growth at 100% effluent concentration.

4. Discussion

The results obtained indicate that, effluents at suitable concentrations increase germination of seeds and could be recommended for application as irrigation for various crops.

Due to the presence of considerable quantities of nitrogen and phosphorus along with some essential elements, the use of waste waters for irrigation is gaining importance. The effect of industrial effluents on rice and black gram seed germination and seedling growth has been reported [9]. There are reports on beneficial effects of diluted municipal sewage on fox foil millet in Iran.[10] Promoting effect of dairy effluent on paddy seed germination, seedling growth and dry matter production was studied [11]. Effect of industrial effluent on growth of barley was initiated [12] and emphasized that lower concentration of effluent was harmless. Effect of distillery effluent on rice and maize were also studied [13].

As the above reports strongly support the use of effluents for irrigation, in the present investigation effect of leather industry effluent has been tested on various crop plants. When grown in 100% effluent there was significant inhibition of seed germination and seedling growth, which may be due to osmotic pressure caused with high concentration of nutrients [11]. But lower concentration especially 20% effluent is very effective, supported seed germination and seed growth in all the plants tested. The seed germination and seedling growth were reduced with increasing concentration of effluent.

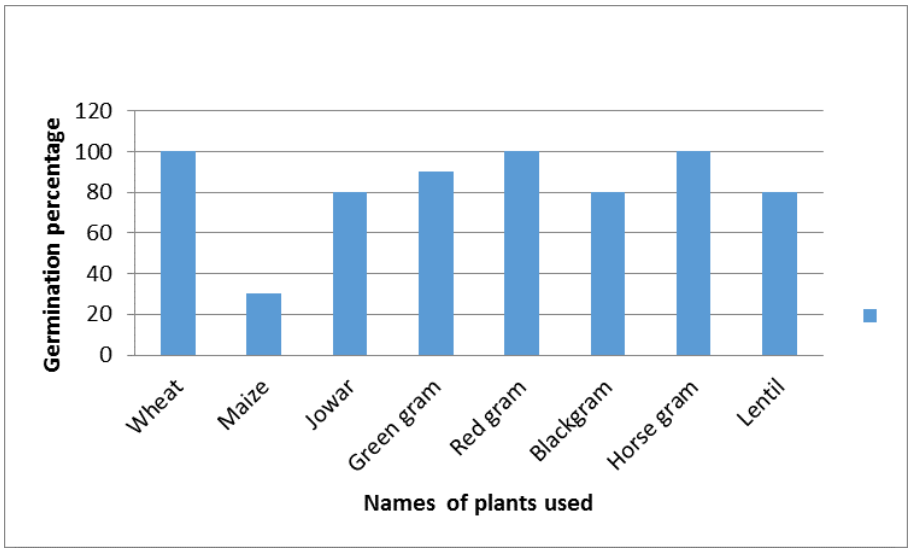

Fig 1: Differences in rate of seed germination of plants at 20% dilution of Na-lime effluent.

Plants exhibited differential responses to different concentrations. At 20% dilution, Wheat Redgram and Horse gram exhibited 100% germination. (Fig 1). In some plants like Wheat, Jowar, Horse gram, Green gram, Red gram and Lentils, even 40%, 60% and 80% concentration supported good growth, which shows that, some organic matter present in polluted water may compensate the negative effect of toxic materials in it. In effluent fed agriculture, nutrients flow from waste water into the plants accelerates the crop production and eventually leads to reclamation of effluent water. Maize, Redgram, Horse gram and Lentil have shown good growth compared to others at 20% dilution (Fig 2). Many crops utilize the major nutrients for their growth[14]. Thus it shows that when diluted effluent turns to utilizable nutrients, it enhances plant growth.

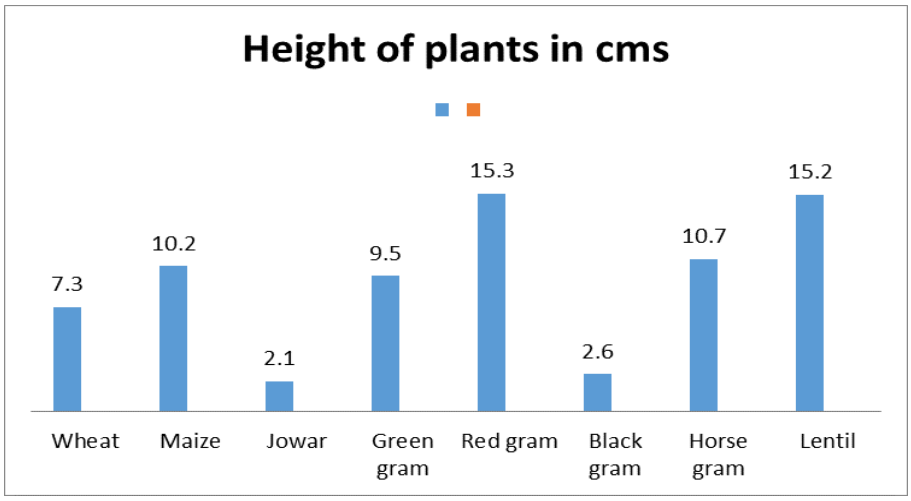

Fig 2: comparison of height of seedlings of plants selected at 20% dilution of Na-lime effluent.

5. Conclusion

The result of present investigation suggests that though tannery industry effluents employed characterized by high concentration of organic matter, can be used effectively at diluted concentration, as it improved the overall growth of test crops. Moreover irrigation with such effluents would minimize use of irrigation water.

6. Acknowledgement:

The author is very grateful to Mr. Ch Devendar Reddy, Secretary cum Correspondent and Mr. A. Sheshachalam, Principal, Vaagdevi Degree and PG College, Hanamkonda, for providing facilities to carry out the research work.

7. References:

1. Begum SA, Alum MJ, Rahman SS, Rahman MM. Effect of industrial effluents on the germination and seedling growth of three leafy vegetables. Bangladesh. J Sci Ind Sci 2010; 45(2):101-104.
2. Huma Z, Naveed S, Rashid A, Ullah A, Khattak I. Effects of domestic and industrial waste water on germination and seedling growth of some plants. Current opinion in Agriculture 2012; 1(1):27-30.
3. Babyshakila P. Effect of diluted effluent on soil properties. Advanced studies in Biology 2009; 1(8):391-398.
4. Kumar SS, Ghosh S. Effect of heavy metals on germination of seeds. Journal of Natural Science, Biology and Medicine 2013; 4(2):272-275.
5. Mythili K, Karthikeyan B. Bioremediation of tannery effluent and its impact on seed germination (Blackgram and Sunflower). Current Botany 2011; 2(8)40-45.
6. Rajendra BG, Uphade BK, Gadhave AG, Kuchekar SR. Effect of dairy effluent on seed germination and early seedling growth of soyabeans. Rasayan J Chem 2010; 3(1):137-139.
7. Vijayaragavan M, Prabhakar C, Sureshkumar J, Natarajan A, Vijayarengan P, Sharavanan S *et al*. Soil irrigation effect of sugar mill effluent on changes of growth and biochemical contents of *Raphanus sativus* L. Current Botany 2011; 2(7):09-13.
8. Varma l, Sharma J. Effect of Dairy and textile waste water on growth of plant wheat. Rasayan J Chem 2012; 5(3):351-355.
9. Niroula B. Comparative effects of industrial effluents and sub metropolitan sewage of Biratnagar on germination and seedling growth of Rice and Blackgram. Our Nature 2003; 1:10-14.
10. Asgharipour MR, Azizmoghaddam HR. Effects of raw and diluted municipal sewage effluent with micronutrient foliar sprays on the growth and nutrient concentration of foxtail millet in southeast Iran. Soudi Journal of Biological Sciences 2012; 19:441-449.
11. Dhanam S. Effect of dairy effluent on seed germination, seedling growth and biochemical parameter in paddy. Botany Research International 2009; 2(2):61-63.
12. Raia H, Kafeel Khan. Effect of industrial effluent on seed germination and seedling growth of Hordeum Vulgare L. (Barley). Indian J Sci Res 2010; 1(2):82-89.
13. Pandey SN, Nautiyal BD, Sharma CP. Pollution level in distillery effluent and its phytotoxic effect on seed germination and early growth of Maize and Rice. Journal of Environmental Biology 2008; 29(2):267-270.
14. Damodharan U, Reddy MV. Impact of sugar industrial treated effluent on the growth factor in sugarcane-Cuddalore. India Journal of sustainable Bioenergy Systems 2012; 2:43-48.