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Impact of Dye Effluent on Seed Germination of Blackgram (Vigna Mungo.l.hepper)

KEYWORDS: dye effluent, black gram, seed germination

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ABSTRACT *In this present research work we attempted to study the impact of dye effluent at various concentrations (4%, 8%, 10%, 12% &16%) on seed germination of black gram for a period of fifteen days. The Physico-chemical properties such as color, odour, pH, temperature, BOD, COD, TSS, TDS, iron, calcium, magnesium, sulphate and chloride of the effluent were analyzed. There was gradual decrease in the shoot and root length of the seedlings with increase in the dye effluent concentrations.*

INTRODUCTION

Industrial pollution is one of the problems presently facing in India and several efforts are being vigorously pursued to control it in various industries spanning length and breadth of the country. Effluent is an out flowing of water or gas from a natural body of water or from a human-made structure. Effluent is defined by the United States environment protection agency as "waste water –treated or untreated-that flows out of a treatment plant, sewer, or industrial outfall. Effluent waste water from an industrial facility may carry a broad and variable range of contaminants including BOD, COD, color, phenols, cyanide, sanitary waste and a host of complex chemicals. Untreated effluents are highly toxic to the plants, fishes or other aquatic organisms at higher pH and the sulphide in the effluents are of environmental concern because they can lead to poor air quality of an area if not properly taken care of thus becoming threat to vegetation, human and materials (WHO, 2000).

Indian dyeing and dye stuff industry has grown over 50% during the last decade. India is now the second largest producer of dyes and dye intermediates in Asia after China. Today there are about 50 units in the organized sector and 1000 units in the small scale, with a total annual production of 1, 30, 000 tons per annum or about 7% of the world production. Dyeing industries are usually categorized under the small-scale industries in India. The small-scale industries in India generate about 3900 million liter of waste water per day; about 12% of this is contributed by dyeing and textile units.

Irrigation with raw dyeing factory effluent at different concentration drastically reduced the germination of crops germination and decreased the chlorophyll, carbohydrate and protein contents and the biologically treated effluent enhance the yield and quality of many cereals and pulses. This effluent when passed through by ash can is safely used for afforestation (Ramachandran, 1994).

Waste water from dye houses can have strong impacts on the aquatic environment. Due to its complex chemical structure, dye is one of the most difficult constituent in the textile waste water to treat. Worldwide, dye waste water has become one of the main sources of severe pollution problems due to the greater demand for textile products and the proportional increase in production and applications of synthetic dyes (Dos Santos et al., 2007). In arid and semi-arid regions of our country where shortage of water becomes limiting factor in agriculture, the effluent mixed polluted water is used for irrigational purpose by farmer (Singh et al., 1985). As this polluted water is being used for irrigation to cultivate the crops, it is necessary to conduct experiments to find out their impact of these effluents on agricultural crops before they are recommended for irrigation. Hence in this present research we analyzed the physico chemical properties and the impact of dyeing effluent on the seed germination and seedling growth of black gram (Vigna mungo L. Hepper).

MATERIALS AND METHODS

Sample Collection

The effluent was collected directly from the outlet of the common effluent treatment plant, Tirupur. The sample was collected in air tight plastic bottles and filtered through ordinary filter paper to remove large suspended particles.

Effluent dilution

Dilution is one of the main processes for reducing the concentration of substances. Dye effluent was diluted to different concentration for experimental purposes (0 %, 4 %, 8 %, 10 %, 12 % and 16 %)

Seed sterilization

It was washed with tap water then with distilled water. After it was treated with 0.2% Mercuric chloride for 2 minutes and washed with water to remove contamination of seed coat, prior to germination studies.

Experimental Design

Sterilized Petri plates prepared with filter paper and known volume of different concentration of dye effluent (0 %, 4 %, 8 %, 10 %, 12 % and 16 %) was poured into different Petri plates marked with the concentration. 20 seeds were placed especially in sterilized Petri plate. The effluent (50ml) was irrigated periodically at every 24 hours.

Germination of Black gram

Number of seeds responded for germination was observed on 15th day and growth was observed. The shoot length of the seedlings was recorded at every 48 hours for 15 days. Fresh and Dry mass, shoot and root length of the seedlings were determined after 15 days. The seedlings were uprooted and washed thoroughly with distilled water and length of shoots and root length were measured. The plants were dried under natural conditions at the open roof top garden for 2 hours. The fresh weight was taken and the plants were then packed in paper envelopes and oven dried for 36 hours at 70° C. The dry weight of the seedlings was also recorded. The values were tabulated.

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Physico-chemical analysis of Effluent Sample
Physico-chemical parameters of the dye effluent such as color, pH, Temperature, BOD, COD, Total solids (TS), Total suspended solids (TSS), Total dissolved solids (TDS), Hardness and other chemical constituents were estimated using the standard methods (APHA,1998).

RESULTS AND DISCUSSION

The dyeing effluents used for the study was dark pink in color and bad smell.

Values for various parameter of the effluent are given in Table 1 and Table 2.
At higher concentration, the germination percentage was gradually decreased from 4 % – 16 % raw effluent. It may also be due to the disturbance of the osmotic relation of the seed and water, thus reduced the amount of absorbed water and retarded seed germination by enhanced salinity and conductivity of the solutes. Furthermore, the germinated seeds will not get any oxygen due to organic and inorganic chemicals present in the effluent. Similar findings were noted by Goel and Kulkarni., (1994), Chandraseker et al., 1998 and Kaushik et al., 2005.

The decrease in germination percentage might be due to the reduction in level of toxic metabolites by dilution and better utilization of nutrients present in the effluent. The reduction in germination percentage at higher concentration may also be due to the excess amount of minerals and nutrients present in the effluent (Kumar, 1999). Reduction in seed germination percentage at higher amounts of solids present in the osmotic relationship of the seed and water. The reduction in the amount of water absorption takes place with results in to reduction of seed germination due to enhance effluent salinity.The fresh weight (FW) and dry weight (DW) of plant samples grown in various concentration of effluent were presented in Table: 2. FW and DW were also increased at lower concentration and decreased at the higher concentration of dye effluent. The presence of optimum level of nutrients in the lower concentration of dye effluent might have increased the FW and DW of crop plant. The reduction in dry weight of plant material may be due to the poor growth under effluent irrigation (Balashouri and Prameela Devi., 1994).

The high yield of plant at lower concentration might depend on the enhanced low concentration of pigments, sugar and protein (Pragasam and Kannabiran, 2001).The decreased in shoot length, root length,fresh weight and dry weight were recorded. It may be due to the presence of toxic pollutants in the effluent. The same result affects the respiration of the root (Sing et al., 1995).

Table: 1 Physico chemical characteristics of dye effluent

Parameters	Effluent (mg/l)
color	pink
Odour	Bad odour
Temperature	30° C.
BOD	1 1100
COD	1188
TDS	400
Hardness	256
Calcium	110
Magnesium	65
Sulphate	310
Chloride	460
TS	45

Table: 2 Effect of dye effluent on seedling growth, fresh and dry weight in Black gram

Concentration %	Fresh weight (g)	Dry weight (g)	Shoot Length (cm)	Root Length (cm)
Control	0.60	0.20	13	5.5
4	0.55	0.14	10.5	4.1
8	0.42	0.10	7.4	3.2
10	0.22	0.08	6.5	2.4
12	0.19	0.03	2	0.5
16	0.12	0.02	1.8	0.2

CONCLUSION

In India, the abundance of soils with low organic matter content, favors the use of industrial wastewaters containing organic matter as an organic amendment and nutrient supply to soil. Although the benefits of waste water use in irrigation are numerous but precautions should be taken to avoid short and long-term environmental risks related). So it is essential to treat the dyeing industrial effluents before their use in agricultural fields.

REFERENCE

Amthussalam, A., M. N. Abusbacker and N. J. Jayabal, 2002. Growth and physiological activity of green gram under effluent stress. Ind. Poll. Con., 118-119. | | APHA (1998) Standard methods for the examination of water and waste water.20th edition,American Public Health Association.Water Pollution Control Federation ,Washington,DC. | | Dos Santos. A. B., F.J. Cervants, and J. B. Van Lier, 2007. Review paper on current technologies for decolourisation of textile wastewaters: perspectives for anaerobic biotechnology, Bioresourse Technology, vol. 98, no 12, pp. 2369-2385. | | Singh, D. K., D. Kumar, V. P. Singh and J. Environ, 1985, Growth and physiological activity of green gram under effluent stress. Biol., pp: 6 – 31. | | Tiwari, P. Elecy and C.B. InduBhahia, 1993. Growth and physiological activity of green gram under effluent stress, Geobiosis, pp: 20-27. | | | WHO, 2000, WHO Air Quality Guidance, 2nd Ed. World Health Organization, Europe Regional Office, Copenhagen | | Balashouri, Prameela Devi, 1994. Growth and physiological activity of green gram under effluent stress J. Eco. Environ. Mon., pp :4-115. | | Chandraseker, W., A. Subramani and S. Saravanan, 1998. Growth and Physiological Activity of Green gram Under Effluent Stress., J. Ind. Poll. Cont., pp: 14-73. | | Dos Santos. A. B., F.J. Cervants, and J. B. Van Lier, 2007. Review paper on current technologies for decolourisation of textile wastewaters: perspectives for anaerobic | Biotechnology, Bioresourse Technology, vol. 98, no 12 ,pp. 2369-2385. | | Goel, P. K., S. M. Kulkarni 1994. Effects of sugar factory waste on germination of gram seed (ciceraeritinum L.). J. of Environ.and pollution 1:35-53. | | Kaushik, P., V.K. Tuli,P.Singh and V. Gupta, 2005. Effect of textile effluents on growth performance of wheat cultivars. Biores. Technol., 96, 1189- 1193. | | Kumar, A, 1999. Growth and physiological activity of green gram under effluent stress, Adv. Plant Sci., pp: 2 – 261. | | Pragasam, A. and B. Kannabiran, 2001. Growth and physiological activity of green gram under effluent stress, Adv. Plant Sci., pp: 14-547. | | Ramachandran, K, 1994. Studies on the effect of dyeing factory effluent oil soils and adjoining ground water. M. Sc. (Ag.) Thesis submitted to Tamil Agricultural University, | Coimbatore, India. | | Singh, D. K., D. Kumar, V. P. Singh and J. Environ, 1985, Growth and physiological activity of green gram under effluent stress. Biol., pp: 6 – 31. | | Tiwari, P. Elecy and C.B. InduBhahia, 1993. Growth and physiological activity of green gram under effluent stress, Geobiosis, pp: 20-27. |