International Journal of Pharma and Bio Sciences V1(1)2010

EFFECT OF TEXTILE MILL EFFLUENT ON GROWTH AND GERMINATION OF BLACK GRAM - *Vigna mungo* (L.) Hepper

*J. ALBINO WINS[1] AND M. MURUGAN[2]**

[1]Department of Biotechnology, Holy Cross College, Nagercoil, Tamil Nadu
[2]Department of Biotechnology, Sri Sankara Arts and Science College, Enathur

****Corresponding Author*** : muruganbt@gmail.com

ABSTRACT

The effect of textile effluent was studied with respect to germination and growth of black gram *Vigna mungo* (L.) Hepper. In lower concentration the germination ratio and growth are relatively higher than the control, but gradual decrease in the germination of seeds, seedling growth with increase in effluent concentration was observed. The best germination and seedling growth was observed in 25%concentration with growth promoting effect, and significantly better than control. Beyond 25% effluent, root and shoot length decreased. Thus the textile mill effluent can be safely used for irrigation purposes with proper treatment and dilution at 25%.

KEY WORDS

Effluent, plant growth, Black gram and seed germination

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 generated by the industries is one of the sources of pollution. Contaminated air, soil, and water by effluents from the industries are associated with heavy disease burden (WHO, 2002) and this could be part of the reasons for the current shorter life expectancy in the country (WHO, 2003) when compared to the developed nations.

Untreated effluent are highly toxic to the plant, fish or other aquatic organisms at higher pH and the sulphide in the effluent are of environmental concern (WHO, 2000) 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. The same is applicable to other parameters such as BOD, COD, that has been identified to raise health issue if water available for human use is not of the required level (WHO, 1993). Textile industries are major sources of these effluents (Ghoreishi and Haghighi, 2003) due to the nature of their operations which requires high volume of water that eventually results in high wastewater generation.

Seed germination is a fascinating process. The industrial effluents possess various organic and inorganic chemical compounds. The presence of these chemicals will show detrimental effects on the

EFFECT OF TEXTILE MILL EFFLUENT ON GROWTH AND GERMINATION OF BLACK GRAM - *Vigna mungo* (L.) Hepper

development of plant, germination process and growth of seedling. Earlier reports suggested that effluents from industries inhibit seed germination and seedling growth. In this study, an attempt has been made to understand the effect of textile mill effluent on seed germination and seedling growth in black gram (*Vigna mungo*).

Table : 1

Effluent Characteristics from Textile Industry

Sl. No	Process	Effluent composition	Nature
1	Sizing	Starch, waxes, carboxymethyl cellulose (CMC), polyvinyl alcohol (PVA), wetting agents.	High in BOD, COD
2	Desizing	Starch, CMC, PVA, fats, waxes, pectins	High in BOD, COD, Suspended Solids, dissolved solids (DS)
3	Bleaching	Sodium hypochlorite, Cl2, NaOH, H2O2, acids, surfactants, NaSiO3, sodium phosphate, short cotton fibre.	High alkalinity, high Suspended Solids
4	Mercerizing	Sodium hydroxide, cotton wax	High pH, low BOD, high DS
5	Dyeing	Dyestuffs urea, reducing agents, oxidizing agents, acetic acid, detergents, wetting agents.	Strongly coloured, high BOD, DS, low Suspended Solids, heavy metals.
6	Printing	Pastes, urea, starches, gums, oils, binders, acids,thickeners, cross-linkers, reducing agents, alkali.	Highly coloured, high BOD, oily appearance, Suspended Solids slightly alkaline, low BOD

Source: PRG, 1998.

EFFECT OF TEXTILE MILL EFFLUENT ON GROWTH AND GERMINATION OF BLACK GRAM - *Vigna mungo* (L.) Hepper

MATERIALS AND METHODS

The effluent was collected from Madura Textile Mills, Vickramasingapuram, Tirunelveli district, Tamil Nadu, from the discharge point using BOD bottles and sterile containers for laboratory analysis. Physical and chemical parameters like pH, total solids, total dissolved solids, total suspended solids, BOD, COD, Chlorides, total chromium, sulphate, nitrate, zinc, phenolic substances, oil and grease concentration of the effluent were studied using gravimetrical method (APHA, 1998). The seeds of black gram were surface sterilized with 0.1% mercuric chloride for 2-3 minutes, washed in running tap water for 3 min and in distilled water for 2 min and dipped in different concentration (25, 50, 75 and 100%) of textile mill effluent with three replicates. After 24 hours, the seeds were transferred to germination towels and allowed to germinate for 5 days. During the germination period, the growth parameters like germination %, root length, shoot lengths were measured and noted.

RESULTS AND DISCUSSION

The Physical and chemical characteristics of the textile effluent were tabulated in table :2. The percentage of seed germination showed dramastic variation with respect to different concentrations of the effluent (Table 3). At lower concentrations the germination and growth parameters were high and subsequently higher concentrations show minimal growth rate and germination rate. The inhibition of seed germination occurs at higher levels of total solids, due to excess amount of the salinity and conductivity of the effluent prevent the seed germination, being absorbed by seed while soaked in the different concentrations of effluent before germination (Handus, 1976; Singh and Mishra, 1987; Neelam and Sahai, 1988). In this study, the textile mill effluent enhances the growth of seedling at 25%. But higher concentrations of effluent inhibit the growth of seedling as well as the percentage of germination. The similar results have been described in different crops (Neelam, 1986; Rajaram and Janardhanan, 1988; Vijayakumari and Kumudha, 1990; Jabeen and Saxena, 1990; Gautam and Bishnoi, 1990; Tiwari, 1991; 1993Madhappan, 1993; Vijayarengan and Lakshmanachary, 1993; Kannabiran and Pragasam).

EFFECT OF TEXTILE MILL EFFLUENT ON GROWTH AND GERMINATION OF BLACK GRAM - *Vigna mungo* (L.) Hepper

Table : 2

Physical and Chemical Characteristics of textile mill effluent

Characteristics	Concentration
pH	9.5
Total solids (mg/l)	1040
Total dissolved solids (mg/l)	1010
Total suspended solids (mg/l)	230
BOD (mg/l)	250
COD (mg/l)	1390
Chlorides (mg/l)	420
Total chromium (mg/l)	4.5
Sulphate (mg/l)	13
Nitrate (mg/l)	12.5
Zinc (mg/l)	0.8
Phenolic substances (mg/l)	0.06
Oil and grease (mg/l)	3.6

Table 3

Effect of textile mill effluent on seed germination, root and shoot length of V.mungo (n=15)

Concentration Of effluent (%)	Germination %	48hrs		72hrs		96hrs	
		Root length (cm)	*Shoot length (cm)*	*Root length (cm)*	*Shoot length (cm)*	*Root length (cm)*	*Shoot length (cm)*
0	65	0.90	1.19	1.19	2.72	2.41	3.40
25	75	1.18	1.34	1.96	2.75	2.49	3.63
50	60	0.80	1.17	1.70	2.69	2.30	3.10
75	50	0.75	1.16	1.18	2.41	2.18	2.60
100	45	0.31	1.15	1.02	2.20	1.65	1.53

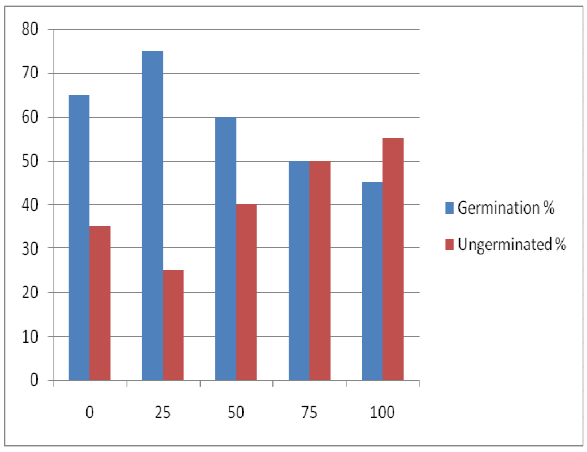
EFFECT OF TEXTILE MILL EFFLUENT ON GROWTH AND GERMINATION OF BLACK GRAM - *Vigna mungo* (L.) Hepper

In this present study the Germination ratio, length of root and shoot are noted and tabulated in the above table -3. From the above table the growth was maximum in lower concentrations was noted.

At 25% concentration, the plant showed maximum root and shoot length after 96 hours than the control. But at higher concentration of effluent, the length of root and shoot were inhibited. This might be due to the presence of elevated amount of total dissolved solids. These solids may inhibit the uptake of necessary elements like Phosphorous, Magnesium etc. by plants (Thabaraj *et al*.,1964). Retardation of plant growth is also due to the presence high concentrations of toxic heavy metals and other toxic compounds (Sahai *et al*., 1986; Dolar *et al*.,1972). But, the presence of Potassium, Sodium, Calcium etc., in the diluted form influence the growth of plant in less concentrations (Rajannan and Oblisami, 1979; Agarwal et al., 1980; Mishra, 1987). In 96 hrs the root length was almost same in control and different concentrations of effluent except 100% concentration of effluent. It shows that the oraganic substance present in the effluent of textile mills supports the growth of plants with some limitations if excess amount of organic matters serve as toxic material and prevent the growth of experimental plant. The values are represented graphically in Graph 1, 2 and 3.

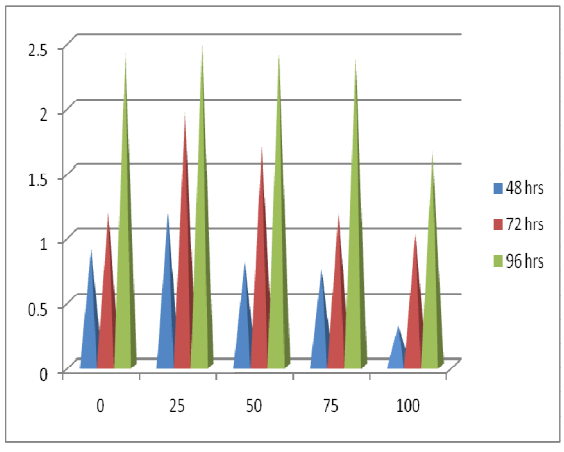
Graph 1

Effect of textile mill effluent on Seed Germination of V.mungo



Graph 2

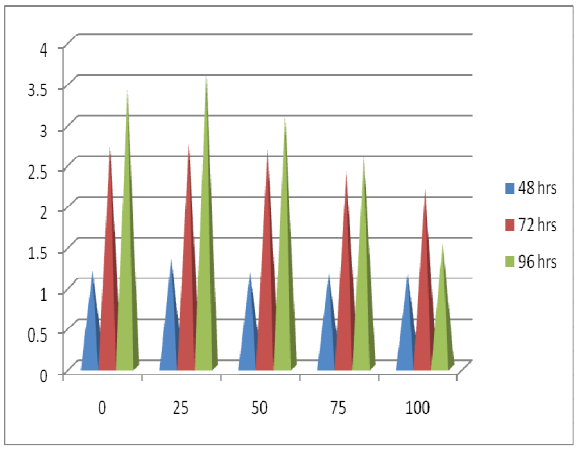
Effect of textile mill effluent on root length of V.mungo



EFFECT OF TEXTILE MILL EFFLUENT ON GROWTH AND GERMINATION OF BLACK GRAM - *Vigna mungo* (L.) Hepper

Graph 3

Effect of textile mill effluent on shoot length of V.mungo



The chemicals present in the textile mill effluent are not only poisonous to humans but also found toxic to the growth of plants and aquatic life (WHO, 2002) and they may result in food contamination (Novick,1999). So the concentration of these effluent must be diluted to 25% and then it can be used for other purposes like crop irrigation.

ACKNOWLEDGEMENT

The authors are grateful to The Principal and the Secretary of Sri Sankara Arts and Science College, Madras University, Enathur, Tamil Nadu, for providing laboratory facilities to carry out this work.

REFERENCES

1. Agarwal P K, Singh V P, Kumar D and Sharma R. Effect of effluent discharged by oxalic acid factory on growth and rate of production of wheat crop under varying level of N, P, K. Third All India Bot.Conference. J.Indian Bot.Soc.Sect.X Pollution, Vol.59 (1980).
2. APHA (American Public Heath Association). Standard Methods for the Examination of Water and Wastewater, WEF and AWWA, 20th Edition, USA (1998).
3. Dollar S G, Bovle I, Rand Keenev A D. Paper mill sludge disposal on solids: Effects of the yield and mineral nutrition of oats (*Avena sativa L.*). J.Environ.Qual. 1: 405-409(1972).
4. Elcey C and Tiwari D. Effects of distellry effluent on seed germination, early growth and chlorophyll content of millet crop. Geobios 18:134-136 (1991).
5. Gautam D D and Bisnoi S. Effect of Urmal dairy effluent on soil characteristics and plant growth in *Avena sativa Linn*. Geobios 17: 91-94 (1990).
6. Ghoreishi S.M. and Haghighi R. Chemical Catalytic Reaction and Biological Oxidation for treatment of non-Biodegradable Textile Effluent, *Chemical Engineering Journal*, 95, 163–169 (2003).
7. Handus A. Water uptake and seed germination of leguminous seeds under changing external water potential in osmoticum solution. J.Exp.Bot.27:480-489 (1976).
8. Jabeen S and Saxena P K. Effect of industrial effluent on growth behavior of *Pisum sativum*. Geobios 17: 197-201 (1990).
9. Kannabiran B and Pragasam A. Effect of distillery effluent on seed germination, seedling growth and pigment content of *Vigna mungo*(L)kepper (C.V.T.9). Geobios 20: 108-112 (1993).

EFFECT OF TEXTILE MILL EFFLUENT ON GROWTH AND GERMINATION OF BLACK GRAM - *Vigna mungo* (L.) Hepper

10. Madhappan K. Impact of Tannery effluent on seed germination, morphological characters and pigment concentration of *Phaseolus mungo L.* and *Phaseolus aureus L.* Poll.Res. 12: 159-163 (1993).
11. Neelam S and Sahai R. Effect of fertilizer factory effluent on seed germination, seedling growth, pigment content and biomass of *Sesamum indicum Linn*. J.Environ.Biol. 9: 45-50 (1988).
12. Neelam S. Effect of distillery effluent on the growth behavior, nitrogen content and nitrogen uptake of *Vigna radiate L.* (var.k.85%). J.Indian Bot.Soc.Abst.65 suppl p.93 (1986).
13. Novick R.. Overview and the Health in Europe in the 1990s, World Health Organization,Europe Regional Office, Copenhagen, EUR/ICP/EH/CO 02 02 05/6, pp 20 (1999).
14. Pollution Research Group (PRG). Waste Minimization Guide for the Textile Industry – A Step towards Cleaner Production, University of Natal, Draft Volumes 1 and 2 (1998).
15. Rajannan G and Oblisami G. Effect of paper factory effluent on soil and crop plant. Ind.J.Environ.Health 21:120-130 (1979).
16. Rajaram N and Janardhanan K. Effect of distillery effluent on seed germination and seedling growth of soyabean, rice and sorghum. Seed Res. 16: 173-177 (1988).
17. Shukla N and Pandey G S. Oxalic acid manufacturing plant waste waters: Effect on germination and seedling height in selected cereals. J.Environ.Biol. 12: 149-151 (1991).
18. Singh K K and Mishra L V. Effect of fertilizer factory effluent on soil and crop productivity. J.Water Air Soil Pollution 33: 309-320 (1987).
19. Thabaraj G J, Bose S M and Nayaidanma. Utilization of tannery effluents for agricultural purposes. Environ.Hlth.6: 18-36 (1964).
20. Vijayakumari K and Kumudha P. Effect of distillery effluent on seed germination and early seedling growth in some crop plant. Geobios 17: 206-211 (1990).
21. Vijayarengan P and Lakshmanachary. Effect of textile mill effluent on growth and development of green gram seedlings. Ad.Plant Sci. 6: 359-365 (1993).
22. WHO. Guidelines for Technologies for Water Supply Systems in Small Communities, World Health Organization, CEHA (1993).
23. WHO. WHO Air Quality Guidelines, 2nd Edition, World Health Organization, EuropeRegional Office, Copenhagen (2000).
24. WHO. Water Pollutants: Biological Agents, Dissolved Chemicals, Non-dissolved Chemicals, Sediments, Heat, WHO CEHA, Amman, Jordan (2002).
25. WHO. The World Health Report: Shaping the Future, World Health Organization, 1211 Geneva 27, Switzerland (2003).