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# Physico-chemical analysis of textile industry effluents and impact of this effluents on seed germination and seedling growth of some cultivated crops

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**Abstract**
In this study textile industry effluents was physico-chemically analyzed and their effect on seed germination and seedling growth of some important crops like Ridge Gourd, Amarnaths, Black Gram and Black Mustard were studied. The Textile industry effluent was collected from Tusuka jeans limited which is situated at Konabari, Gajipur. Concentrations used for the effluents were 0%, 25%, 50%, 75%, 100%. Minimum relative toxicity percentage was in 25% concentration and increases gradually as the concentration increases. High total dissolved solid (TDS) resulted in decrease in optimal crop production. At lower dilutions the crops showed favorable effect on seed germination, seedling growth, shoot length and root length.

**Keywords:** Industrial effluents, seed germination, seedling growth, shoot length, dilution

## 1. Introduction

Bangladesh is an agricultural country. Ridge Gourd, Amarnaths, Black Gram and Black Mustard are the most important vegetables of Bangladesh. Periphery and urban areas are used by farmers for cultivation of these vegetables. Now a days textile industry effluents are discharging to agricultural crops without any treatment. Treating waste effluent is very much significant for cultivation of crops and environment. Moreover, the economy of Bangladesh is predominantly based on agriculture but, in the race towards industrialization, industries are taking place in a gradual increasing phase. The important industries are chemical pharmaceutical, lather tanning, textiles, oil refinery, paper, fertilizer, sugar and so on. Effluent generated by industries are one of the major sources of pollution. Contaminated air, water and soil by effluents from the industries are associated with many disease (WHO, 2002) [13] and this could be part of the reasons for the current shorter life expectancy (WHO, 2003) [14] when compared to the developed nation. Presently less than 10% of the effluent generated is treated and the rest of the untreated waste water is discharged into the nearby water bodies. The use of industrial effluents for irrigation has emerged in the recent past as an important way of utilizing waste water, taking the advantage of the presence of the considerable quantities of N, P, K and Ca along with other essential nutrients (Niroula 2003) [6]. But there can be beneficial and damaging effects of waste water irrigation of crops including vegetables (Raman *et al*. 2002, Saravanamoorthy and Ranjithakumari, 2007) [9, 11]. Therefore it is necessary to study the impact of these effluents on crop system before they are recommended for irrigation (Thamizhiniya *et al*. 2009) [12]. The present investigation was carried out to study the impact of untreated effluents from textile industry effluent situated at industrial estate on seed germination and early growth of four selected plant crops.

## 2. Materials and methods

### 2.1 Collection of the Effluents

The effluents used in this study were collected in a pre-cleaned plastic bottles. The effluents were stored at 4 ˚C temperature to avoid there changes of physico-chemical properties. Various physico-chemical characteristics were analyzed at the organic chemistry research laboratory of Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh.

### 2.2 Characterization of the Effluent
The physico-chemical properties of the effluent samples were analyzed according to standard procedures [1]. The results were given in Table1

### 2.3 Collection of Seed Materials
The seed materials were collected from Surma Beeze Bhandar which is situated at Bandar Bazar in Sylhet city. Seed materials that were collected are Ridge Gourd, Amarnaths, Black Gram and Black mustard. Experimental set up was the same as described by Nawaz *et al*. (2006) [5].

### 2.4 Germination Study
The healthy and uniform seeds were selected and surface sterilized with 0.1% $HgCl_2$ and thoroughly washed with distilled water to avoid surface contamination. The germination test was carried out in a sterile petridishes of 9, 10, 11, 12 cm in size placing a double ring filter paper on each petridishes. Different concentration such as 0%, 25%, 50%, 75% and 100% of collected waste water were made with respect to the distilled water and stored for seed treatment. The waste water of each concentration was added to each petridish of respective treatment daily in such an amount just to allow the seeds to get favorable moisture for germination and growth. The control was treated with distilled water only. 20 seeds of each agricultural crops were placed in the petridishes. The petridishes were set at organic chemistry research laboratory at room temperature (30±2) ˚C. The experiment extended over a period of nine days to allow the last seed germination and measurement of the root and shoot length. The results were determined by counting the number of germinated seeds, measuring the length of primary root and main shoot on the 9th day of the experiment. The data were subjected to analysis of Duncan's Multiple Range Test (DMRT) [2].The ratio of germination and elongation were calculated as suggested by Rao and Kil [19] and by A.T.M Rafiqul Hoque [3].

**Fig 1:** Scheme of germination for textile industry effluent

### 3. Results
The physico-chemical properties of the effluent was given in table-1. The color of the textile effluent was greenish in colour, alkaline in nature and contained large amounts of suspended and dissolved solids. The growing image was shown in fig. 1.

**Table 1:** Physico-chemical parameters of the effluents

| S. No. | Parameters | Values | Standards |
|---|---|---|---|
| 1 | Color | Greenish | Colorless |
| 2 | Odor | Unpleasant | Odorless |
| 3 | Temperature (˚C) | 28 | 40 |
| 4 | pH | 10.1 | 5.5-9 |
| 5 | Electrical conductivity (mS) | 0.625ms | 0.3 |
| 6 | Total solids (mg/l) | 1000 ppm | 3500-4000 |
| 7 | Total Suspended Solids (mg/l) | 500 ppm | < 50 |
| 8 | Total Dissolved Solids (mg/l) | 500 ppm | < 3000 |
| 9 | Dissolved oxygen (mg/l) | 8.07 ppm | 5-6 |
| 10 | Biochemical Oxygen Demand (mg/l) | 3.49 ppm | < 20 |
| 11 | Chemical Oxygen Demand (mg/l) | 30 | < 150 ppm |

### 3.1 Germination percentage
The germination percentage of different crops was affected by different concentrations of textile industry effluent which are furnished in table 2

The outcome Germination test is given below

Here,

$C_0$ = Seeds of receptor plants grown in distilled water only (control)

$C_1$ = Seeds of receptor plants grown in waste water of 25% concentration

$C_2$ = Seeds of receptor plants grown in waste water of 50% concentration

$C_3$ = Seeds of receptor plants grown in waste water of 75% concentration

$C_4$ = Seeds of receptor plants grown in waste water of 100% concentration

A = Number of seeds in each petri dish

B = Number of seeds Germinated

C = percent of germination

D = Percent of inhibitory effect.

(-ve inhibitory effect and +ve indicates stimulatory effect)

### Calculation of D
D can be calculated by using the following equation as,

$D = \frac{C2-C1}{C1} * 100$ [for the first value D] and $D = \frac{C3-C1}{C1} * 100$ [for the second value of D]

Where, c1, c2 and c3 are the first, second and third value of C [e.g germination percentage]

Other values of D were calculated in the same way

**Table 2:** Effect of textile industry effluent on seed germination

| Treatment | Ridge Gourd | | | | Black Gram | | | | Amarnaths | | | | Black mustard | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D |
| $C_0$ | 20 | 10 | 50 | - | 20 | 17 | 85 | - | 20 | 13 | 65 | - | 20 | 15 | 75 | - |
| $C_1$ | 20 | 15 | 75 | 50 | 20 | 18 | 90 | 5.88 | 20 | 14 | 70 | 7.69 | 20 | 18 | 90 | 20 |
| $C_2$ | 20 | 14 | 70 | 40 | 20 | 15 | 75 | -11.7 | 20 | 11 | 55 | -15.4 | 20 | 16 | 80 | 6.66 |
| $C_3$ | 20 | 12 | 60 | 20 | 20 | 14 | 70 | -21.42 | 20 | 10 | 50 | -23.0 | 20 | 13 | 65 | -13.3 |
| $C_4$ | 20 | 11 | 55 | 10 | 20 | 12 | 60 | -29.41 | 20 | 09 | 45 | -30.7 | 20 | 11 | 55 | -26.6 |

**Table 3:** Effect of textile industry effluent on root length

| Treatment | Ridge Gourd | | | Black Gram | | | Amarnaths | | | Black mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | A | B | C | A | B | C |
| $C_0$ | 1.98 | - | - | 8.70 | - | - | 1.5 | - | - | 2.5 | - | - |
| $C_1$ | 1.86 | 93.93 | -6.06 | 5.85 | 67.24 | -32.75 | 1.10 | 73.73 | -26.7 | 2.3 | 92 | -8 |
| $C_2$ | 1.67 | 84.34 | -15.6 | 4.05 | 46.55 | -53.44 | 1.05 | 70 | -30 | 2.10 | 84 | -16 |
| $C_3$ | 0.98 | 49.49 | -50.5 | 1.98 | 22.75 | -77.24 | 0.8 | 53.33 | -46.7 | 1.8 | 72 | -28 |
| $C_4$ | 0.67 | 33.83 | -66.1 | 1.5 | 17.24 | -82.75 | 0.5 | 33.3 | -66.7 | 0.5 | 33 | -80 |

The outcome of root elongation test is given below
Here, A = Root length in cm, B = Relative elongation ratio
C = % of inhibition (-ve indicates inhibitory effect and + ve indicates stimulatory effect)

**Table 4:** Effect of textile industry effluent on shoot length

| **Treatment** | Ridge Gourd | | | Black Gram | | | Amaranths | | | Black mustard | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | A | B | C | A | B | C |
| $C_0$ | 6 | - | - | 20.5 | - | - | 2 | - | - | 7.5 | - | - |
| $C_1$ | 5.7 | 95 | -5 | 10.5 | 51.21 | -48.78 | 1.8 | 90 | -10 | 6.5 | 86.7 | -13.3 |
| $C_2$ | 5.10 | 85 | -15 | 8.64 | 42.14 | -57.85 | 1.6 | 80 | -20 | 5.85 | 78 | -22 |
| $C_3$ | 4.8 | 80 | -20 | 6.54 | 31.90 | -68.09 | 1.5 | 75 | -25 | 5.0 | 66.7 | -33.3 |
| $C_4$ | 2.05 | 34 | -65 | 4.5 | 21.95 | -78.04 | 1.2 | 60 | -40 | 4.8 | 64 | -36 |

The outcome of shoot elongation test is given below
Here, A = shoot length in cm B = Relative elongation ratio
C = % of inhibition (-ve indicates inhibitory effect and +ve indicates stimulatory effect)

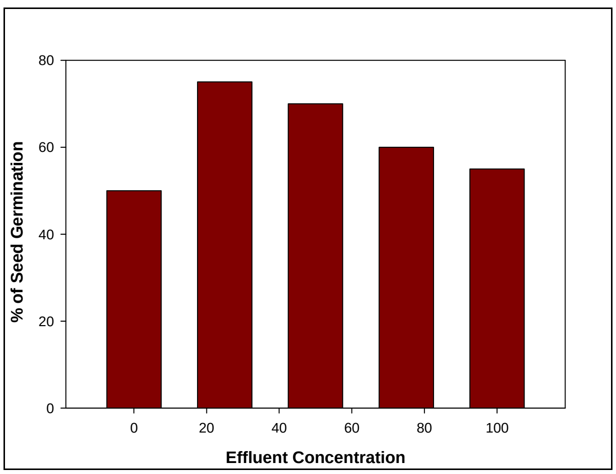


**Fig 2:** Variation of Seed Germination with effluent concentration in case of Ridge Gourd

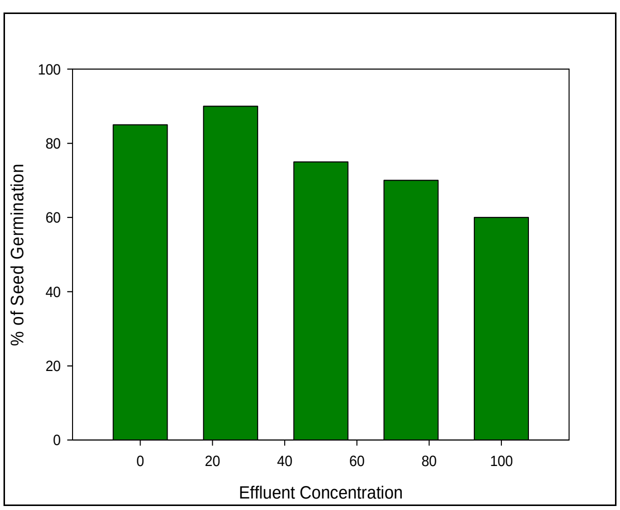


**Fig 3:** Variation of Seed Germination with effluent concentration in case of Black Gram

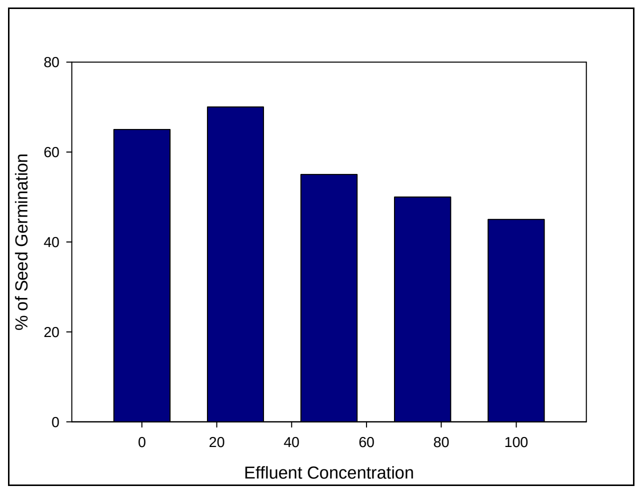


**Fig 4:** Variation of Seed Germination with effluent concentration in case of Amarnathus

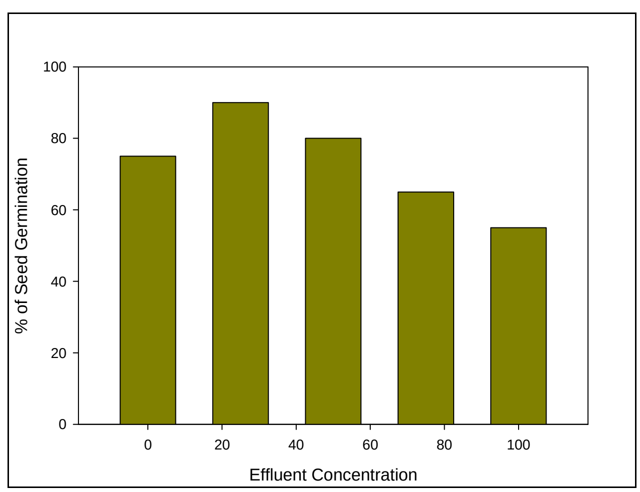


**Fig 5:** Variation of Seed Germination with effluent concentration in case of Black Mustard

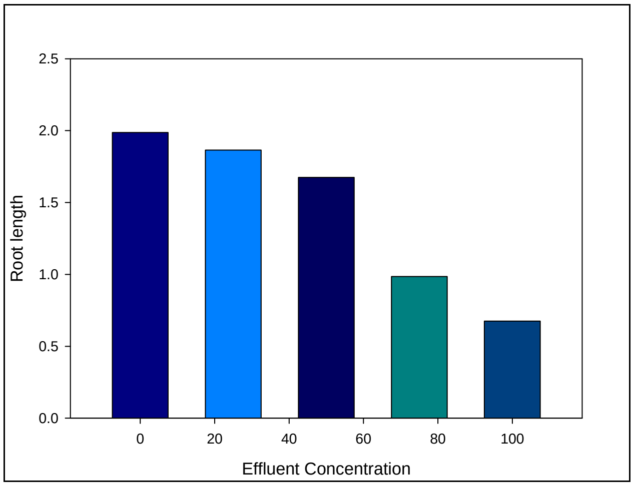


**Fig 6:** Variation of root length with effluent concentration in case of Ridge Gourd

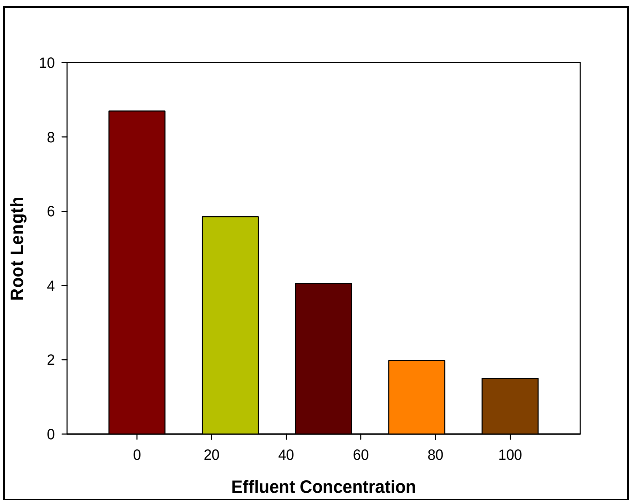


**Fig 7:** Variation of root length with effluent concentration in case of Black Gram

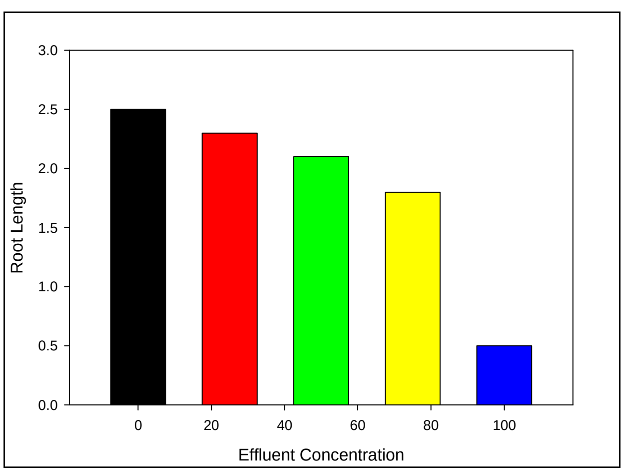


**Fig 8:** Variation of root length with effluent concentration in case of Amarnaths

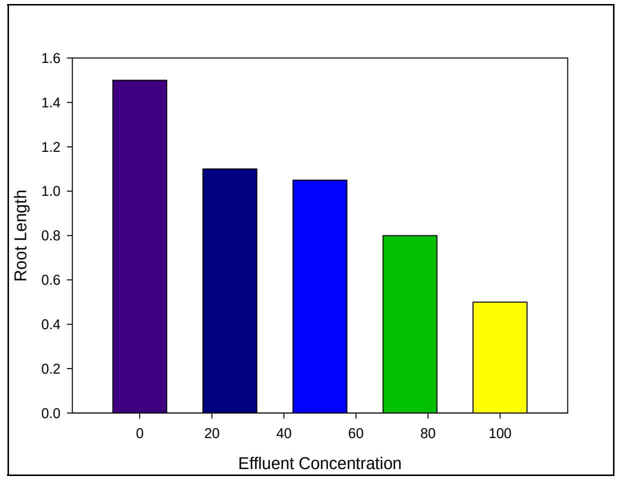


**Fig 9:** Variation of root length with effluent concentration in case of Black Mustard

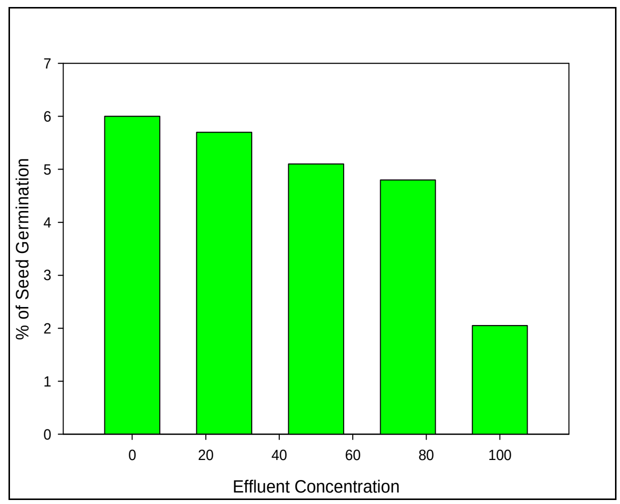


**Fig 10:** Variation of shoot length with effluent concentration in case of Ridge Gourd

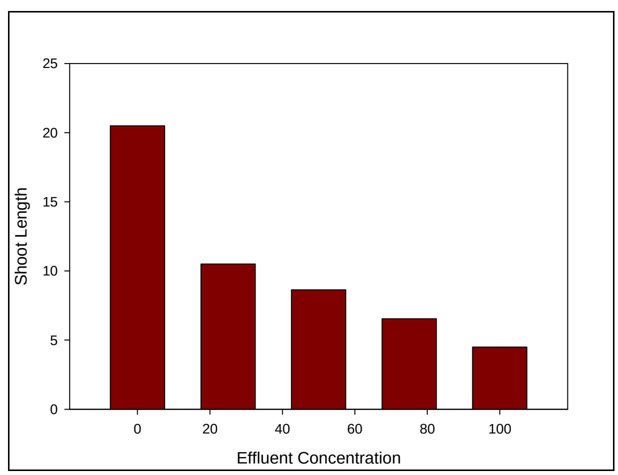


**Fig 11:** Variation of shoot length with effluent concentration in case of Black Gram

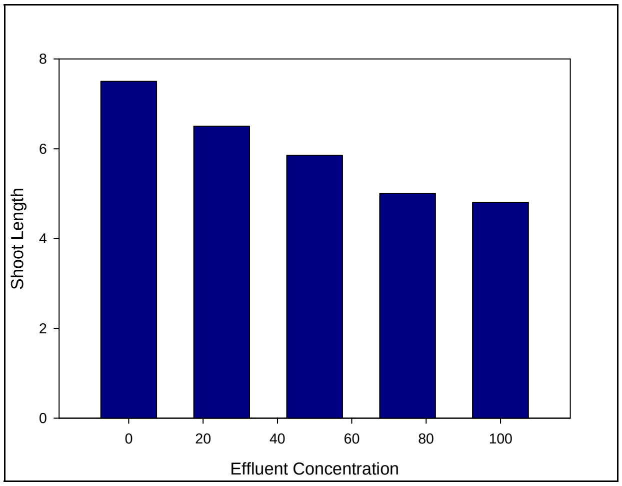


**Fig 12:** Variation of shoot length with effluent concentration in case of Amarnathus

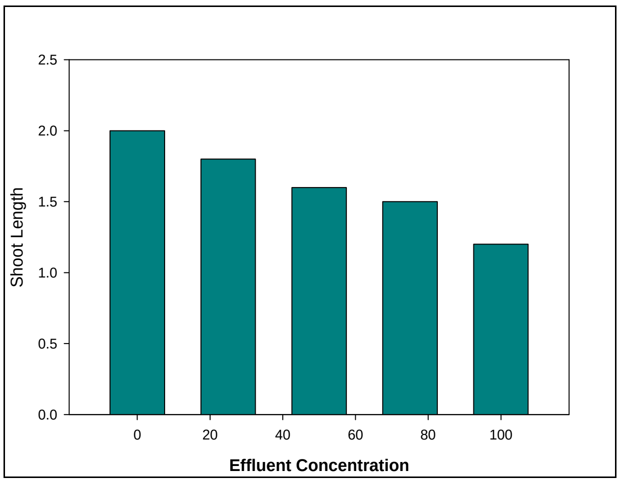


**Fig 13:** Variation of shoot length with effluent concentration in case of Black Mustard

## 4. Discussion

Textile industry effluent was chosen for the experiment and its effect was investigated on seed germination, root length, shoot length etc. According to Rodosevich *et al.* (1997) [10] seed germination control plants populations, ensure reproduction and crop productivity. From the experimental outcome we may bioassay that the maximum seed germination was recorded at 25% and minimum at 100% of effluent concentrations, as compared to control in all case. It means that high concentration of the effluent is not suitable for these species. Subramani*et al.* (1998) [20] reported a progressive decrease in seedling growth with the increasing concentration of fertilizer factory effluent. Similar finding have been reported by Bera *et al.* (1996) [21] the lower concentration of tannery effluent had a marked growth promoting effect while higher concentration of effluent showed reduction in seed germination, seedling growth and chlorophyll content in some crops. Reduction in seed germination percentage at higher concentration of effluent may be due to the higher amount of solids present in the effluent, which causes changes in the osmotic relationship of the seed and water. Thus reduction in the amount of water absorption takes place, which results into retardation of seed germination due to, enhanced salinity. Impact of textile industry effluent on root length was furnished at table 3. The root length was decreased with increasing the concentration of the effluent. The same result was found in case of shoot length

## 5. Conclusion

This study concluded that physico-chemical parameters such as pH, electrical conductivity, COD, TS, TDS, and TSS were relatively high in textile industry effluent and severely affected seed germination. The untreated effluent could possibly lead to soil deterioration and low productivity. The effect vary from crop to crop because each plant species has its own tolerance of the different effluent concentrations. So as the effluents are toxic, finally it is suggested that long term experiments should be conducted to explore the effect of wastewater on above suggested aspects before its use for irrigation.

## 6. References


1. American Public Health Association (APHA) Standards methods for the examination of water and waste water. 17thedn. Washington, DC, 1989.
2. Duncun DB. A significance test for difference between rank treatments between rank treatments in an analysis of variance, Virgina Journal of science. 2,171-189.
3. Hoque ATMR. Suppressive effects of aqueous extracts of AzadirachtaIndica leaf on some initial growth parameters of six common crops, Asian Journal of Plant Sciences, 2003;2(10):738-742.
4. Kaliyamoorthy J, Influence of Pharmaceutical Effluents on Seedling Vigour, Dry Matter Production of Horse Gram (Dolichosbiflorus. L.), International Journal of Modern Plant & Animal Sciences, 2013; 1(2):58-66.
5. Nawaz S. Effect of industrial effluents on seed germination and early growth of Cicerarientum, Journal of Bioscience. 2006; 6:49-54.
6. Niroula B. Comparative effects of industrial effluents and sub-metropolian sewage of biratnagar on germination and seedling growth of rice and black gram, Our Nature, 2003; 1:10-14.
7. Panasker DB, Pawar RS. Effect of textile mill effluent on growth of Vignaunguiculata and Pisumsativum seedlings, Indian Journal of Science and Technology.2012; 4:266-272.
8. Panasker DB, Pawar RS. Effect of textile mill effluent on growth of Sorghamvulgare and Vignaaconitifolia seedlings, Indian Journal of Science and Technology. 2011; 4:273-278.
9. Ramana S. Effect of distillery effluent on seed germination in some vegetable crops, Biorecourse Technology, 2002; 82:273-275.
10. Rodosevich S. Weed Ecology, Implications for Management. Wiley Publishers, New York, USA, 1997.
11. Saravanmoorthy M, Ranjitha-Kumari B. Effect of textile waste water on morpho-physiology and yield on two varieties of peanut (Arachis hypogea L.), Journal of Agricultural Technology. 2007; 3:335-343.
12. Thamizhiniyan P. Sugar mill effluent toxicity in crop plants. Journal of Phytology. 1, 68-74.
13. WHO. Water Pollutants: Biological Agents, Dissolved Chemicals, Non-Dissolved Chemicals, Sediments, Heat, World Health Organization, CEHA, Amman, Jordan, 2002.
14. WHO. The World Health Report, Shaping the Future, World Health Organization, 1211, Geneva 27, Switzerland, 2003

15. Zille H. Effects of domestic and industrial waste water on germination and seedling growth of some plants, Current Opinion in Agriculture.2012; 1(1):27-30.
16. Lubello. Municipal-treated waste water reuse for plant nurseries irrigation.Water Research. 2004; 38:2939-2947.
17. Nath K. Phytotoxic effects of chromium and tannery effluent on growth and metabolism of Phaseolus Mungo Roxb, Journal of Environmental Biology. 2009; 30:227-234.
18. Pathak H. Soil amendment with distillery effluent for wheat and rice cultivation. Journal of Water, Air and Soil Pollution. 2009; 113:133-140.
19. Rao GM, Kumar NV. Impact of tannery effluents on seed germination of cicerarintum, Journal of environmental and pollution research, 1983; 5:232-233.
20. Subramani A, Sundermoorti P, Saravanan S. Journal of industrial pollution control. 1998; 15:281-286.
21. Behera K, Mishra N. Journal of environmental research. 1996; 28:10-20.