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Research Article

# BIOCHEMICAL EFFECT OF INDUSTRIAL EFFLUENCE ON GERMINATING SEEDS OF *CICER ARIENTUM*

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**ABSTRACT**

Objective: The aim of the study was to evaluate the antioxidants in effluents and treated effluent from different industries and to asses' plant germination.

Methods: The effluent sample was collected from dye unit, cement factory, machinery waste effluent between 9 and 10 am. The effluent was collected in 5 liter plastic cans and analyses the effluent. The seeds of *Cicer arientum* were obtained from Tamilnadu Agricultural University, Coimbatore and the seeds were treated with different concentration of (10%, 20%, 30%, 40%, 50%, and 100%) and pure tap water as control to compare the effect of industrial effluents for 3 days. And also maintained seeds are soaked in treated effluent. It is grind well with a mortar and pestle to form a paste which is used in the biochemical analysis.

Results: Germination percentage was high in the control and it decreases beyond 30% dilution. At 100% effluent treatment the seed germination was completely inhibited. The amount of carbohydrate, protein and total free amino acids were comparable with control, their amounts were increased in the 30% effluent treated seeds. Most of the enzymes were stimulated and their activity was found to be enhanced in the 30% effluent treated seeds.

Conclusion: From this study it was clear that the industrial effluent rich in organic matter and plant nutrients are finding agricultural use as cheaper way of disposal.

**Keywords:** Industrial effluents, *Cicer arientum*, Seed germination.

## INTRODUCTION

Wastewater generation and its subsequent treatment is a major problem for every industry and for the society as well prior to the treatment, the waste water need to be monitored so as to be permitting their discharge into the local water resources. Pathogenic organism pollution has been recognized from the middle of nineteenth century when water transmitted disease had been demonstrated. Increasing awareness about the diseases caused by the microorganisms led to an increased demand for newer technologies for the treatment of industrial effluents [1].

The principal objective of wastewater treatment is generally to allow industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment. Irrigation with wastewater is both disposable and utilization and indeed is an effective form of wastewater disposal (as in slow-rate and treatment).

The industrial development over the last five decades has resulted in an exponential increase in the production and consumption of chemicals. Production use and disposal of numerous chemicals cause wide spread contamination of soils as well as ground waters and surfaces water. Indiscriminate applications, high persistence, unknown environmental pathway and pollutant's potential to bioaccumulation have resulted in severe repercussions, including the loss of food sources, mutagenic and carcinogenic effects to mankind [2].

Rapid industrialization, deforestation, oil spillage [3], exploitation of natural resources, unplanned construction of road and buildings, drains, house dust, service of aero planes, motor cars, production of metals from ores, sewage, solid wastes, use of more food, fertilizers, chemicals and human population are the major key factors for environmental pollution in this universe[4]. Activated sludge process, the dispersed-growth reactor is an aeration tank or basin containing suspensions of the wastewater and microorganisms, the mixed liquor. The contents of the aeration tank are mixed vigorously by aeration devices which also supply oxygen to the biological suspensions. Aeration devices commonly used include submerged diffusers that release compressed air and mechanical surface aerators that introduce air by agitating the liquid surface. The sloughed material is separated from the liquid in a secondary clarifier and discharged to sludge processing. Clarified liquid from the secondary clarifier is the secondary effluent and a portion is often recycled to the bio filter to improve hydraulic distribution of the wastewater over the filter.

The high concentration of dyes were more toxic to seed germinations as compared with lower concentration and the effluent treatment in plant leads to inhibition of germination, decreased chlorophyll synthesis and growth [5].

There is stress induced peroxidase activity in horse radish which grows in contaminated soil containing heavy metals. The mitotic index had fallen corresponding to increasing dosage of effluent and photo catalytically treated effluent leads to increased sugar, protein percentage and chlorophyll content in onion [6].

The experiment to study the effect of different concentration of textile effluent was conducted and found that there is no inhibitory effect of seed germination at low concentration and also reported that seeds germinated in undiluted effluents did not survive for longer period and observed that 10% concentration of effluent treated plant showed inhibition of growth. So, they advised that more dilution is required for utilization of effluent in beneficial way. The impact of coal washery impact on oryza sativum was studied and found that at high concentration of CWE (10 and 100%) there is marked decrease in seed germination [7].

The water samples mixed with textile industry effluent affect the germination of rice when compared to the other crops. The effect of consolidated tails on geminating seeds was analyses and found that there is inhibitory effect on germination of several plant species. There is no effect of treated effluent on soil but there is higher accumulation of metals in plant parts.

The germination was affected at 100% treatment and normally the germination is not inhibited by textile mill effluent. Soaking of seeds in waste water resulted in early germination [8].

## MATERIALS AND METHODS

### Collection of effluent sample

The effluent sample was collected from dye unit, cement factory, machinery waste effluent between 9 and 10 am. The effluent was collected in 5 liter plastic cans and analyses the effluent by following methods [9]

**Experimental setup**

The experimental set up are:-

Group I – Control.

Group II – 10, 20, 30, 40, 50, 100 percentages of dilutions.

Group III – Treated Effluent.

**Seed selection**

Chickpea (*Cicer arietinum L.*) commonly known as Bengal gram or gram, is an ancient pulse crop, occupying an important place in the pulse cultivation and ranking 3rd amongst the global farming. It is a valuable crop having high energy density, superior amino acid profile and high protein content. The chickpea is rich in protein, calcium, phosphorous and other minerals with oxalic acid in safe limits.

**Collection of seeds and Preparation of sample**

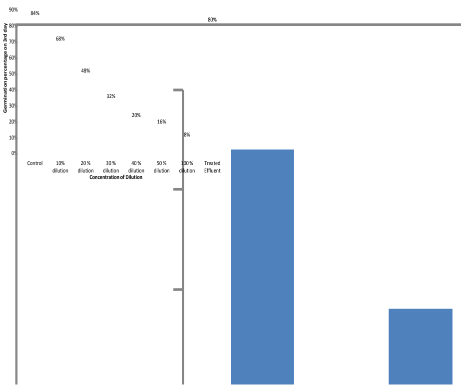
The seeds of *Cicer arientum* were obtained from Tamilnadu Agricultural University, Coimbatore and the seeds were treated with different concentration of (10%, 20%, 30%, 40%, 50%, and 100%) and pure tap water as control to compare the effect of industrial effluents for 3 days. And also maintained seeds are soaked in treated effluent. It is grind well with a mortar and pestle to form a paste which is used in the biochemical analysis.

**Biochemical analysis**

The biochemical analysis which have carried out are Germination percentage was estimated by [10], Estimation of carbohydrate was determined by method,[11], Estimation of protein were measured using Folin-Ciocalteau regent as given by [12], Estimation of total free acids were measured by [13], Assay of amylase activity was assayed by Malik and sinh method, Assay of protease activity was assayed by Beevers method, Assay of catalase activity was assayed by [14] method, Assay of super oxide dismutase was determined by [15], Assay of glutathione reductase activity was determined by method of Beutler, Estimation of tocopherol was determined by Emmerie – Engel method, Determination of chlorophyll was estimated by, [16].

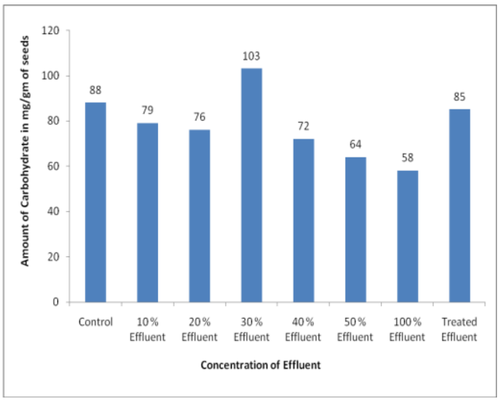
**RESULTS**

The germination percentages of treated effluent grown seeds are comparable with control plant. The germination percentage in raw effluent is concentration dependant decreasing with increasing effluent concentration. (Figure: 1).

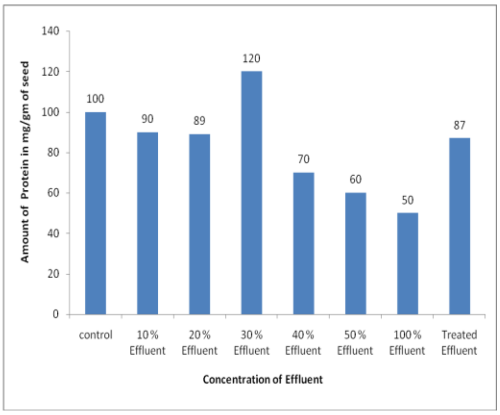


The lowest percentage of germination was noted in 100% effluent treated seeds. The higher concentration of effluent decrease enzyme dehydrogenase activity that is considered as one of the biochemical change which may have disrupted germination and seedling growth. [17].This might be due to the inhibition of enzyme activity [18]. The results also coincide with statement of [19].The germination index has been shown to be a very sensitive index of photo toxicity [20].

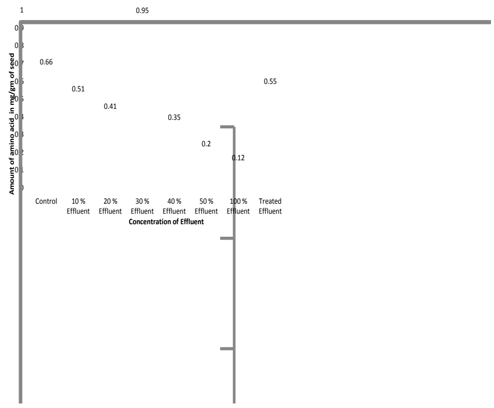
The content of carbohydrate was higher in 30% effluent treated seeds than in control and treated effluent. The increased level may be due to increased amylase activity and increased soluble sugars. (Figure: 2)



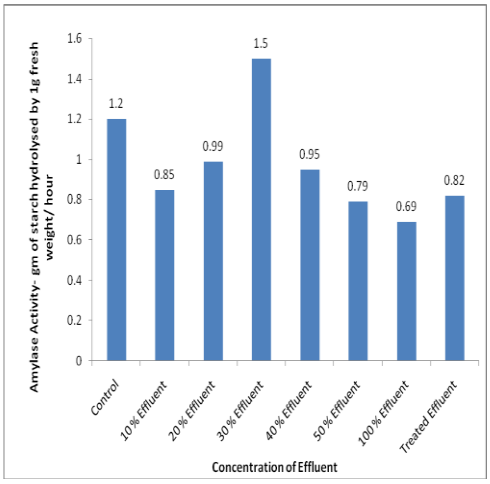

Increased concentration of protein was seen in 30% effluent treated seeds than in control as well as treated effluent. The result coincides with [21]. The increase in protein concentration may be due to enhanced activity of nitrite reducates and increased nitrogen utilizing efficiency. (Figure: 3)




The amount of total free amino acid was higher in 30% effluent treated seeds than control same as in treated effluent. The increase in amino acids is due to increased protease activity in the germinating seeds. The results coincide with [22]. (Figure: 4)

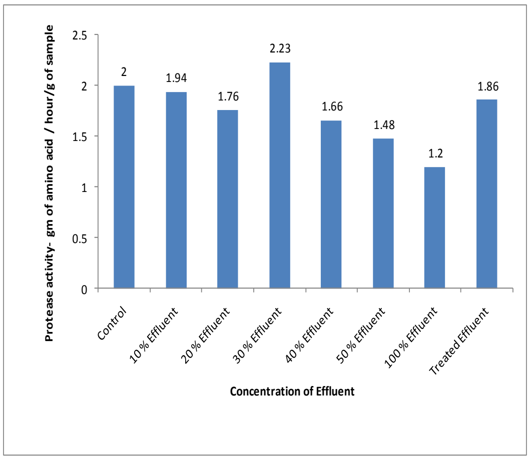


Increased activity of amylase was observed in 30% effluent treated seeds than in control same as in treated effluent coincide with [23]. This increased amylase activity is due to increased chloride concentration [24]. The effluent contains high concentration of chloride which increases the activity of amylase in the germinating seeds. (Figure: 5)

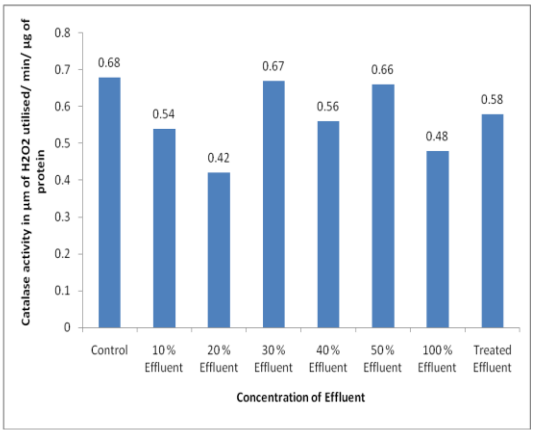



Increased activity of protease was observed in 30% effluent treated seeds than control as well as treated effluent as par with [25]. The increase in protease activity may be due to increased salt stress. (Figure: 6)

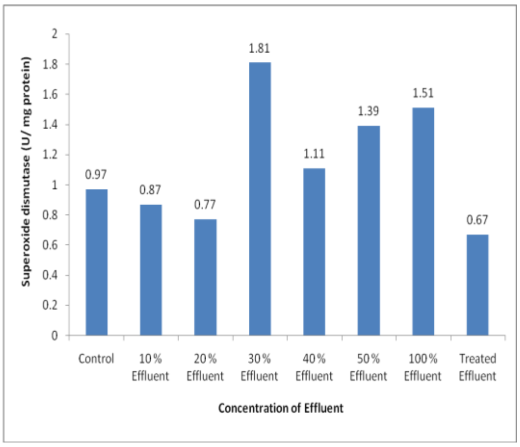
Increased activity of catalase was observed in 30% effluent treated seeds than control as well as treated effluent. The results indicate an



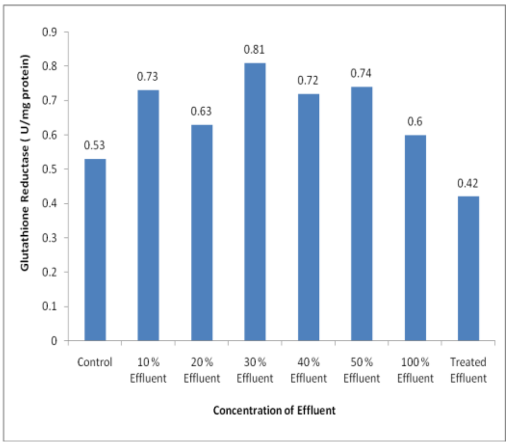

enhanced activity of catalase as detoxifying enzyme and the induction of mechanism of tolerance [26]. (Figure: 7)



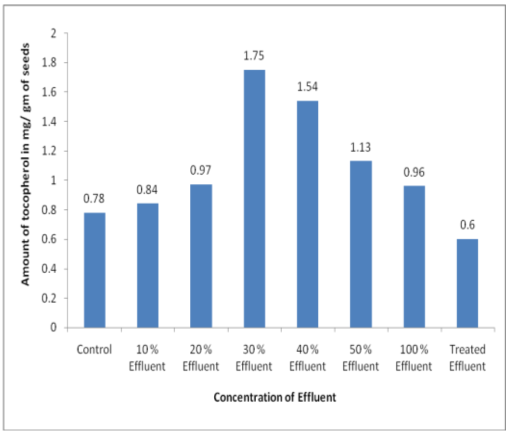

Increased activity of superoxide dismutase was observed in 30% effluent treated seeds than control and treated effluent. The result indicates the response of increased level of organic free radicals and related hydrogen peroxide increase induced by environmental pollution [27]. (Figure: 8)



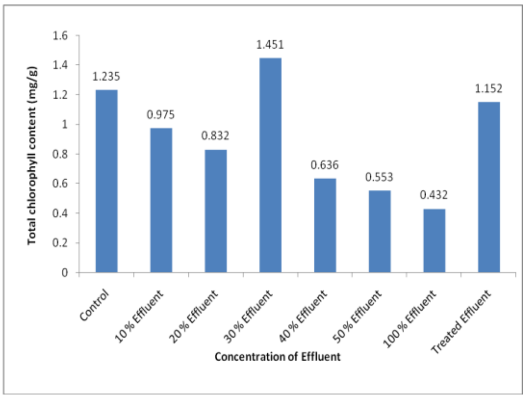

Increased activity of glutathione reductase was seen I 30% effluent treated seeds than control as well as treated effluent. The increase in activities of GR in polluted samples may be due to survival tactic of plants and induction of tolerance against the stress [28]. (Figure: 9)




The amount of tocopherol was higher in 30% effluent treated seeds than control and treated effluent. The result indicates an accumulation of non-enzymatic antioxidant, tocopherol might be due to stress related induction of tolerance mechanism [29] gave similar increase of tocopherol content in effluent treated seeds. (Figure: 10)




Increased concentration of chlorophyll contents was seen in 30% of plants grown on different types of effluents than control as well as treated effluent. Enhancement in Chlorophylls content may be due to high nutrient uptake, synthesis and translocation probably facilitated by optimum availability of iron and magnesium and also due to reduction in phenol content in the treated effluent. Similar results were obtained by [30] using distillery waste water. (Figure: 11)




## DISCUSSION

Industrial effluent rich in organic matter and plant nutrients are finding agricultural use as cheaper way of disposal. The evolution of toxicity of these wastes by biological testing is therefore extremely important for screening the suitability of waste for land application. For environmental testing, bioassays provide an integrated picture of overall toxicity of an effluent, reacting in a predictable way to various types of environmental contaminants.

The inhibition of plant growth and crop production by toxic pollutants is a global agricultural problem. Plants adapt to pollution stress by different mechanisms, including changes in morphological and developmental stresses as well as physiological and biochemical processes. *Cicer arientum* were treated with industrial effluent for 3 days in 10%, 20%, 30%, 40%, 50%, 100%, pure tap water as control and treated effluent to compare the effect of industrial effluent on seeds. Germination percentage was high in the control and it decreases beyond 30% dilution. At 100% effluent treatment the seed germination was completely inhibited.

The amount of carbohydrate, protein and total free amino acids were comparable with control, their amounts were increased in the 30% effluent treated seeds. Most of the enzymes were stimulated and their activity was found to be enhanced in the 30% effluent treated seeds.

The effluent directly released from the industry affect the germination of seeds and completely destroys the agriculture. In order to prevent this effluent was diluted to different concentration and seeds were allowed to grown germination was observed in seeds cultivated in low concentration of effluent. The concentration of macro molecules such as carbohydrates, protein was also increased. The enzyme activity of amylase, protease and catalase in effluent treated seeds were also comparable with that of seeds germinated in tap water. The concentration of some other important compounds was increased in the effluent treated seeds.

The industrial effluent can be used for irrigation purpose by the farmers on the basis of the fact that the effluents may serve as a potential source of fertilizer for agricultural use and prevent the wastewater from being a environmental hazard. Use of wastewater in agricultural irrigation is becoming a common and ever increasing practice because of two reasons. Firstly, wastewater represents an extra source of water available for irrigation. Secondly, recycling of the nutrients through the crops and biological degradation of remaining organic matter

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## REFERENCES

1. Murugesan M, Sangeetha S, Sugandhi G, Madhav V, Sheela Berchmans S, Sekar R, Sumathi R.J, Kumar, J., and Rao, P (2005). Torulopsis candida based sensor for the estimation of biochemical oxygen demand and its evaluation, Electro analysis, Vol: 8(7), PP.No: 698-701.
2. Christian,V., Shrivastava, R., Shukla, D., Modi, H.A and Vyas, B.R.M.(2005). Degradation of Xenobiotic compounds by lignin – degrading white – rot fungi; Enzymology and mechanism, involved, Indian Journal of Experimental Biology, Vol:43, PP.No: 301-312.
3. Adeyinka, J,S and Urum, K.C.N (2004). Effect of hydrogen peroxide on crude oil polluted soil, asian jouirnal of microbiology, Biotechnology and environmental science, Vol: 6(3), PP No: 345-348.
4. Sharma, R., Chandreshwar, L., Kulshreshtha, D., Prasad, F.M., Susan Verghese, p and Kumar, A(2004). Human exposure to trace elements, Indian journal of Environmental protection. Vol: 24(2), PP No: 125-128.
5. Hassan Moaward, Wafaa. M, Abd EI-Rahim, Dr. Khalafallah M. (1874). Evolution of biotoxicity dye using two bioassays Jour of Envi pollution Vol: 4(3), PP No: 256-260)
6. Cait Coyle J (2003). The effect of varying concentration of heavy metals on optimal peroxidase activity. J. Envi. Qual Vol: 12(4), PP No: 243-249.
7. Pandey A.K. and Pandey G. (2002). Impact of washery effluent on seed germination, seedling growth and chlorophyll content of oryza sativa. J. Indl. Plln contl, Vol: 2(18) PP No: 175-181.
8. Swastipanda and P.C. Mistra (1997) Effect of textile mill effluent on maize germination and growth J. of Envi and pollution, Vol: 4(3) PP No: 234-236.
9. APHA (1992). Standard Method for the Examination of water and wastewater ($19^{th}$ edition). American Public Health Association, Washington DC. Vol: 2(1) PP No: 454-459.
10. Sadasivam. S and Manickam. A (1996). In: Biochemical methods, new age international (p) limited, publishers India. Vol: 2(3) PP No: 107-110.
11. Hedge, J.E and Hofreiter, B.T. (1962). In: Carbohydrate chemistry 17 (Eds whistler R.L. and Be Miller, JN) Academic Press, New York. Vol: 2(4) PP No: 124-128.
12. Lowry, O.H; Rosebrough, N.J, Farr, A.L and Randall, K.J (1951) J Bio chem. Vol: 2(6) PP No: 193-265.
13. Moore S and Stein, W.H. (1948) In: methods in Enzymology (Eds. Colowick, S.P. and kailan, N.D.) Academic press, Newyork. Vol: 3(4) PP No: 68-75.
14. Sinha A.K. (1972). Colorimetric assay of catalase Anal. Biochem.Vol:4(7) PP No: 389-391.
15. Das, S.L. and Chany, G.B.B. (2000). A modified Spectrometric Assay of SOD using nitrite. Ind.J. Biochem. Biophys. Vol: 3(7) PP No: 201-204.
16. Witham, F.H., Blaydes, D.F. and Devlin, R.M. (1971). Experiments in plant physiology Van Nostrand, New York. Vol: 2(3) PP No: 245-248.
17. Nagajyoti, p.c, Dinakar; n, Prasadd. T.N.V.K.V, suresh.c and damodharan, journal of applied science research (2008).Heavy metal toxicity: Industrial effluent effect on groundnut (arachis hypogaea.) Seedling. Vol: 4(1) PP No: 110-121,
18. Agarwal S.K,T.Swarnlata and P.S Dubey,1996. Sources of water pollution in Biodiversity and Environment APH-Publishing corporation, New Delhi, Vol: 3(7) PP No: 180-182
19. Munns D.N., Hohenberg, J.S. Righetti T.L., Lacter D.J. (1981) Soil acidity tolerance of symbiotic and nitrogen fertility on soyabean Agronomy, Vol: 2(6) PP No: 70 – 73.
20. Tlquia,S.M., Tam,N.F.Y., and Hodgkiss,I.J.(1996).Effects of company an phytotoxicity of spent pcg – manure sawdust litter Environmental pollution, Vol: 9(3) PP No :249-256.
21. Chauham S.V.S and Kumar, Grown in tannery effluent, J.of Envi and Pollution, Vol: 4(3) PP No:234-237.
22. Das Gupta K and Basuchawdhria, P (1974). Effect of Mb on $N_2$ metabolism, Calcutta university, Vol: 4(5) PP No: 345-350.
23. Sang Wan S, Babbers and Varghese T.M. (1997). Effect of salinity on growth and soluble content J. Indian soc. Soil science, Vol: 3(9) PP No: 402-404.

24. Sheoran F (1980). Effect of industrial effluents on enzyme activity, J. Environ Qual, Vol: 9(3) PP No: 512-518.
25. Mala V (1991). Effect of dye industry effluent on enzyme activity in rice J. Envr Qual, Vol: 1(3) PP No: 357-360.
26. SimsJ.T and Bowel F.C (1980) The influence of organic waste water and inorganic nitrogen source on soil yield and elemental composition of ion, J. Environ Qual. Vol: 9(3) PP No: 512-518
27. Agarwal, S.K. (1998).Environmental Biotechnology. APH is publishing Corporation. Vol: 2(4)PP No :83-93.
28. Pakova,V., Hilscherova, K., Feldmannova, M., Balaha,L.(2006). Toxic effects and oxidative stress in higher plants exposed to polycyclic aromatic hydrocarbons and their N-hetrocyclic derivatives Environmental toxicology and chemistry, Pensacola, FL, USA, SEATEL, USA. Vol 2(5) PP No: 3238-3245
29. Noctoc. G (2006). Metabolic Signaling in defence and strees: the central roles of soluble redox couples. Plant cell and environ. Vol: 2(9) PP No: 409-425.
30. Srivastava. N and Sanhai. R (1987). Effects of distillery waste in the performance of Cicer arientum l. Environ. Pollut.Vol:4(3) PP No: 91-102.