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Impact of Effluent of Carpet Industries Containing Municipal Sewage (Khamaria – Sant Ravidas Nagar Bhadohi, Uttar Pradesh, India) On Germination and Seedling Growth of Barley and Gram-with special reference to Waste water Treatment Method

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Abstract

In the carpet industry synthetic dyes and washing chemicals are used in huge quantity above the permit limit. On one hand these chemicals improve the quality of carpet and if do not manage properly and poured in the water reservoir have cumulative effect because of its non-degradable properties.Ghosia is a Town city of district sant Ravidas nagar Bhadohi. It is situated in between Kashi and Prayag.In this town several carpet industries and dye houses are found which are international fame. In this area carpet industries are used much water and released in polluted forms because the dye house emits several chemicals and dyes during the manufacturering and colorization of woolen and cotton yarns.

In present work the impact of the effluent of dye house of carpet industries was taken to study, situated in Ghosia Town (Sant Ravidas Nagar, Bhadohi) for this study two test plants wheat (Triticum aestivum–var-343) and Barley (Hordeum Vulgare Var-Jyoti) were taken. It was observed that the toxic effect of lead on growth and metabolism of germinating wheat and Barley. In this paper the seed germination and seedling growth the seed were selected for uniformity in size and weight. The surface of seed was sterilized with 0.1% aqueous solution of $HgCl_2$. Further it explores the possibility of the treatment of waste dyeing water with the help of various methods.

Key words: Carpet industry, synthetic dye, Cicer arietinum, municipal sewage, radical, Water treatment.

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Introduction

Rapid progress of industrialization has been of great advantage to mankind. However, environmental pollution has also been its by-product. It is well established that effluents are non degradable. When these pollutants become accumulated in animals through food chain, they become biomagnified in their cells. Some pollutants of industrial effluent are toxic and non-biodegradable. These pollutants damage protein molecules and inhibit several Bio-chemical enzymatic reactions.

The factory effluent is also rich source of heavy metals and has created a major crisis. This effluent in toxic level is deleterious on plant and animal system usually by damaging protein molecules and blocking enzymatic reactions.

In Khamaria town, District - Sant Ravidas Nagar (Bhadohi), there are several carpet industries of international fame. These industries use several chemicals and dyes during the manufacture of woollen and cotton yarn and carpets. Thus these industrial wastes contain several pollutants. Some of them are toxic for plants and animals. Effluents of these industrial wastes have polluted soil and water adjacent to dye house at Khamaria town.

These factory effluents are dropped out from factory without proper treatment to the river Ganga through a big Nala (Terhwa Nala). Some farmers use this polluted water for irrigation of their crops. Due to this practice, pollutants become accumulated in edible parts of plants. Through the food chain pollutants reach in human & cattle body & cause several diseases to consumers.

The municipal water of Khamaria is also a rich source of organic nutrients and toxic chemicals. This water has got twin effect on the plants *i. e.* enhanced growth due to organic nutrients and accumulation of toxic substances in the edible parts of the plants.

It is of interest to assess the impact of carpet industries effluents of Khamaria on Barley *(Hordeum vulgare)* and Gram *(Cicer arietinum)* plants, because these belong to energy food and body building food respectively. Poor farmers who have not irrigation facilities, usually grow barley for energy food, and also cultivate without irrigation.

Besides, the above crops do not require excessive use of fertilizer. Due to the above factors poor farmers grow the above crops.

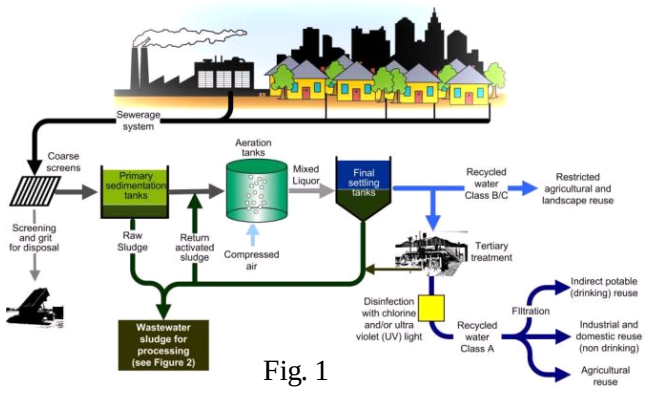

Fig. 1

In Khamaria some farmers use polluted water *i.e.* Dye house effluents and municipal sewage for irrigation of their above indicated crops. The municipal sewage mainly contains urban commercial and domestic wastes, industrial wastes, chemical fertilizers, biomedical wastes and pesticides. Since these waters contain toxic elements and there occurs up-take of toxic substance by the above indicated plants. So the toxic elements reach the plants and become accumulated into the edible parts of the plants. From these plants through food chain the toxic elements reach in our body system and damage protein specially by blocking the enzymatic reactions.

The present study was undertaken to evaluate the effect of carpet industry effluent on seed germination and seedling growth. Based on dose response curve obtained from studies three sites of carpet industry effluent are selected. One selected effluent was promotory and others were inhibitory. Impact of these effluents of three sites on growth and yield of some crop plants *i. e. Hordeum vulgare* cvs and *Cicer arietinum* cvs are under taken.

Benerji and Kumar[1] studied that the use of polluted water (Containing municipal and industrial effluent) for irrigation led to growth promotion of Carrot root (*Doucus carota* cv. P.K.) and Potato tuber (*Solanum tuberosum* cv. 2708) grown in field receiving such irrigation showed higher amount of total N, protein N, Soluble N and total P. It was also reported that there was low amount of reducing sugar in Potato tuber and Carrot root.

Quenche *et. al.*[4] have observed that when heavy metal is added to soil, decreased to leaf that dry weight of Corn, Soya been, Gram and Wheat have been found with metals increasing concentration in soil or nutrient solution.

Linmann *et. al.*[5] reported Cadmium up-take by wheat from sewage sludge used as plant nutrient sources.

Mishra P. And Ambasht[8] studied the impact of effluent of carpet industries (Bhadohi) on seed germination of *Triticum acstivam* cv. R.R. 21. It was reported that effluent containing Chromium (Cr) was inhibitory for seed germination of test plants.

Mukharji and Ganguli[9] shows that the treatment of Rice seed with HgCl, (10^{-2} m) for 24 hours led to seedling growth.

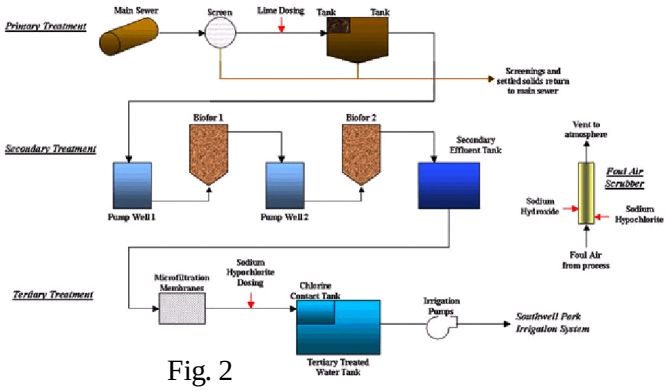

Fig. 2

Material and Methods

To study the impact of carpet industries effluent containing municipal sewage on growth of *Hordeum vulgare* and *Cicer arietinum*, municipal sewage containing carpet industries effluent were collected from Khamaria town. To study the above polluted water on germination and growth of test plants, seeds were selected for their uniformity criteria being size and shape. Selected seeds were sterilized with 0.1% $HgCl_2$, solution and thoroughly washed with distilled water. Two set of experiments were performed. In one set selected sterilized and thoroughly washed seed of test plants (*Hordeum vulgare* and *Cicer arietinum)* was imbibed in distilled water for 12 hours. In second set of experiments seeds were imbibed for their full imbibitions period in municipal sewage containing carpet industries effluents.

Imbibed seeds were transferred on moistened filter paper in Petri plates. For first set of experiment (Control set) filter paper was moistened by polluted water containing municipal sewage and carpet industries effluents.

Result

The results will be carried on *Hordeum vulgare* in polluted water set (municipal sewage containing carpet industries effluent) the radical growth was enhanced 110% of control and coleoptile growth was enhanced 112% of control set.

In case of *Cicer arietinum* in polluted water set, the radicle growth was enhanced 112% of the control set and epicotyl growth was 109% from the control set.

The growth of test plant is increased by the municipal sewage water was containing carpet industries effluent irrigation. This process is responsible for heavy metal accumulation in edible parts of plants which is hazardous.

Discussions

According to this observation the seed germination was promotory in Municipal sewage containing carpet industries effluents in *Hordeum vulgare* in comparison of *Cicer arietinum*. In case of seedling growth there was the maximum promotion was recorded in *Hordeum vulgare*.

My Observation of promontory of seed germination under the influence of carpet industries effluent is comparable with earlier investigations on factory effluents treatment viz. Agarwal S. And Kumar A.[2], Singh M. And Singh D.[7] and Chaney R.L.[10]. Seedling growth in our finding indicate that it is promotory in polluted water in comparison to control set (Distilled water).

Need of Waste Water Treatment :

Waste Water is defined as water which carries wastes from homes, industries, businesses or any other sources. It is usually a mixture of water and dissolved or suspended solids. Since water is becoming a scarce commodity, hence it is imperative to evolve technologies which treat them efficiently so that they can be reused. Treatment is also necessary because it helps in the reduction of physical, physiological, radioactive, biological and chemical pollutants.

Types of Waste Water Treatment Plants :

Depending on the nature of the Waste Water to be treated, Waste Water can be classified as:

Sewage Treatment Plants
Sludge Treatment Plant
Industrial Waste Water Treatment
Agricultural Waste Water Treatment Plant
Radioactive Waste Water Treatment Plant
Recycling Waste Water Treatment Plant

Effluent Treatment Method :

Effluent treatment method consists of following process-Coagulation, Flocculation, Sedimentation, Filtration, Chlorination, Softening. For the best results these process should be followed in sequence. The water so treated can be used again for any industrial or other process. In some effluent plants however, sedimentation/settling units are used for primary as well as for the secondary treatment of solid liquid separation. These solids are present in colloidal forms which are removed primary sedimentation/ setting tanks of clarifier.

Wastewater Treatment Methods :
Wastewater is treated in following stages:

Pre-Treatment :

Pre-Treatment is a process which involves the passing of the effluent through the screen chambers to remove large floating solid particles which are settled in the primary sedimentation tanks. In this process apart from pre-chlorination, heavy suspended impurities are also removed.

Water Treatment Plant

Primary Treatment

Primary treatment includes chlorination, sedimentation and sludge digestion. Sludge digestion takes place in a sludge digester in which the organic or inorganic wastes and solids removed from sedimentation are subjected to anaerobic fermentation. Since inorganic suspended solids hinder the performance of the biological oxidation of organic matter hence their removal is necessary. Removal of organic suspended solids present in the effluents reduces the aeration tank volume requirement which provides a primary clarification system prior to aerobic biological treatment process.

Secondary Treatment :

In a secondary treatment process bio solids are separated from the water. Here soluble organic matter is biologically oxidized in the presence or the absence of oxygen. The process mainly removes dissolved organic matter and reduces biological oxygen demand. Whole process takes place in a secondary treatment system. A good secondary system has surface overflow rate of 16-80 meter cube/ meter square of the clarification area per day.

Tertiary Treatment :

Tertiary treatment is primarily used to recycle water for industrial reuse. It may be also use if the effluent from a secondary treatment plant is not satisfactory. The process used in tertiary treatment system is filtration, demineralization and the reverse osmosis process.

Integrated Wastewater Treatment Plant in a Beach Area

Stages of Sewage Treatment :

Sewage treatment is accomplished in three stages which are as follows:

PrimaryTreatment :

In a primary treatment wastewater is relieved from the contaminants like coarse sands, pebbles, organic and inorganic wastes, fatty substances etc. The waste water consists of large objects like rags, cans, tin etc which are removed by screen. This is necessary because the presence of these objects can harm the sensitive parts of the plant. Followed by the screen there is a grit chamber that are used for removing sand and other heavy inorganic. The materials so collected in the grit chamber are collected and bagged for disposal.

The liquid being freed from grit is passed to through the fixed or rotating screens in order to get rid of floating and larger materials. Some plants use sedimentation stage in which the sewage is passed through large tanks which are called as primary clarifiers or primary sedimentation tanks. In these tanks floating materials are removed and homogeneous liquid is ready for the biological treatment whereas, the sludge is separated for the separate treatment. Primary tanks consist of scrapers that drive the sludge towards a hopper in the base of the tank. From here the sludge is pumped out for treatment.

Secondary Treatment :

Secondary treatment method uses aerobic biological processes to degrade the biological content of the sewage like human waste, food waste, soaps and detergent and dye waste. In this method bacteria and protozoa convert the biodegradable soluble organic contaminants into flock.

In Secondary treatment systems two methods viz. fixed film and suspended growth are used. In these methods sewage passes over the surface of the biomass which grows on the media. Of these two systems fixed film system is preferred as it can easily cope with drastic changes in the amount of biological material and can provide higher removal rates for organic material and suspended solids than suspended growth systems.

For strong organic loads sometimes roughing filters used. These filters usually consist of tall, circular filters which are filled with open synthetic filter media where sewage is applied at a relatively high rate. These filters are fabricated to for high hydraulic loading and a high flow-through of air.

Secondary Sewage Treatment Process :

Activated sludge plants are also used in secondary treatment that use dissolved oxygen to promote the growth of biological flock which aids in the removal of the organic material. It is also capable of trapping particulate material and can, convert ammonia to nitrite and nitrate ultimately to nitrogen gas. If plant is receiving more variable loads then trickling filter beds can be used.

In secondary treatment Biological Aerated Filter (BAF) is also used which consist of reactor filled with a filter media. The media supports highly active Biomass that is attached

to it and filters suspended solids. Carbon is reduced and ammonia is converted in aerobic mode. In the final stage of secondary treatment biological floc is settled and material is filtered. The sewage water so produced after this treatment contains very low levels of organic material and suspended matter. When the sewage is passed through rotating biological contractors (RBCs) the microorganism which covered the surface of the RBCs reduce the BOD and further remove suspended matter from the waste water[3].

Tertiary treatment :

Wastewater is given tertiary treatment to further enhance its quality before they are discharged in the environment. The popular methods that are used in this stage are filtration, lagooning, removal of chemicals like nitrogen and phosphorus etc. Different treatment processes are required to remove nitrogen and phosphorus. Nitrogen is removed through the biological oxidation of nitrogen from ammonia to nitrate, followed by denitrification, the reduction of nitrate to nitrogen gas which is removed to the atmosphere. Phosphorus on the other hand can be removed by using two processes that is by the use of specific bacteria, called polyphosphate that accumulate large quantities of phosphorus within their cells they are removed from the water ans are used as fertilizer. Chemical precipitation can also be used to remove phosphorus. Wastewater is sometimes further disinfected by using chlorine, ozone gas and ultraviolet light. Effluent is any substance that creates pollution, such as municipal sewage or industrial liquid waste that flows out of a treatment plant, septic system, pipe, etc. Effluent can be the outflow from a sewage treatment facility or the wastewater discharge from industrial facilities. Effluents are being produced in large amounts from a number of industries, and it is posing a serious threat to our environment. Handling of such type of effluents is quite necessary to prevent our environment from being further threatened by such dangers[11].

Effluent Treatment Plant :

The effluent treatment plant may follow any of these processes available today, such as conventional method, modern technology. Here we will concentrate on the conventional method used for the effluent treatment plant. The conventional method consists of three main stages, which includes:

- Primary Treatment
- Secondary Treatment
- Tertiary Treatment

Primary Treatment :

The primary treatment process consists of three processes including, physical treatment, chemical treatment, and biological treatment. The physical treatment includes the separation of solid and semi-solid materials from the effluent. This phase use equipment, such as grit chamber and bar screen. After the physical processing is over, the effluent is treated chemical, which includes the processes like coagulation and flocculation. After the removal of solid materials and chemical treatment, the effluent is passed through a biological treatment process.

Secondary Treatment :

The secondary treatment includes the

following processes in the entire treatment including, Activated Sludge Process, Aerobic/ Anaerobic Digestion, Sequence Batch Reactor, Tricking Filter, Oxidation Pond. These two are the major ones.

Activated Sludge Process: This process uses dissolved oxygen to promote the growth of biological floc which helps in removing the organic material. It can convert ammonia to nitrite and nitrate and ultimately to nitrogen gas. This process is also capable of trapping particulate material.

Aerobic/Anaerobic Digestion: Aerobic biological processes are used to decompose the biological content of the sewage like food waste, soaps, detergent and human waste. Bacteria and protozoa are introduced to convert the biodegradable soluble organic contaminants into floc.

Tertiary Treatment :

Tertiary treatment of wastewater is essential to further enhance its quality. Some popular methods used in this stage are filtration, lagooning, removal of chemicals like nitrogen and phosphorus etc. Various treatment processes are used to remove nitrogen and phosphorus. The ammonia present in the wastewater is changed to nitrite and it is followed by denitrification. Phosphorus can be removed by using specific bacteria, called polyphosphate that collects large quantities of phosphorus within their cells. They are removed from the water and are used as fertilizer.

Waste Water Treatment Recycling

Conclusion

Above diagram has been prepared based on the interpretation of the secondary data sources. It is refered from the observational result and analysis that there are different types of sewage and water treatment method which are useful for recycling of dyeing water. Different treatment of wastewater is essential to further enhance its quality. After the various filtration process water can be use for different purposes and will be beneficial for the environment.

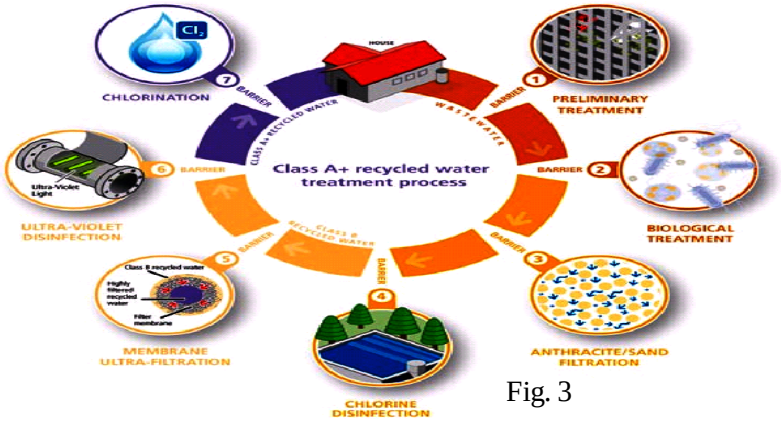

Fig. 3

These observations are comparable with the earlier investigations like Cochran A. A. and Lawrence, C.G.[3], Singh Anoop, Agarwal S.B. and Rai J.N.P.[6], Pandey R.K. and Singh D.[11]

Effect of carpet industries effluent contain municipal sewage on seed germination and seedling Growth in dark grown seedling of Hordeum vulare cv. Pragati.

Parameter Organ	Days after radicle emergence					
	Site of Carpet Industries Effluent (C.I.E.) with municipal sewage					
	3		5		7	
	Control	Polluted water	Control	Polluted water	Control	Polluted water
Germination	90%	92%	-	-	-	-
Length (cm) Radicle	4.40	4.95	8.95	9.80	14.10	14.90
Coleoptile	3.20	3.70	8.30	8.90	16.20	17.10
Fresh weight (mg) Radicle	14.20	14.80	19.80	21.10	22.80	23.20
Coleoptile	51.00	52.20	68.80	70.20	94.60	96.50

Effect of carpet industries effluent contain municipal sewage on seed germination and seedling

Parameter Organ	Days after radicle emergence					
	Site of Carpet Industries Effluent (C.I.E.) with municipal sewage					
	3		5		7	
	Control	Polluted water	Control	Polluted water	Control	Polluted water
Germination	90%	96%	-	-	-	-
Length (cm) Radicle	3.90	4.40	5.90	6.80	9.30	10.20
Epicotyl	2.10	2.30	4.40	4.80	7.90	8.50
Fresh weight (mg) Radicle	58.30	62.90	90.40	98.80	141.20	152.50
Epicotyl	46.80	48.30	102.60	107.90	152.80	168.80

Growth in dark grown seedling of Cicer arietinum cv. P.G.110.

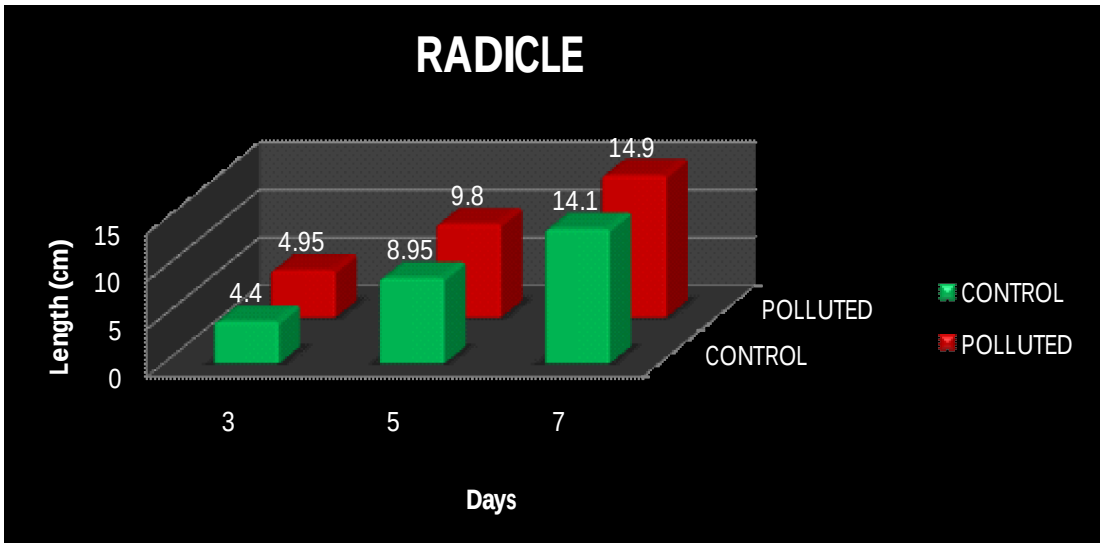

Fig. 4

Municipal sewage containing Carpet Industries Effluent vs. Length of Hordeum vulare cv. Pragati.

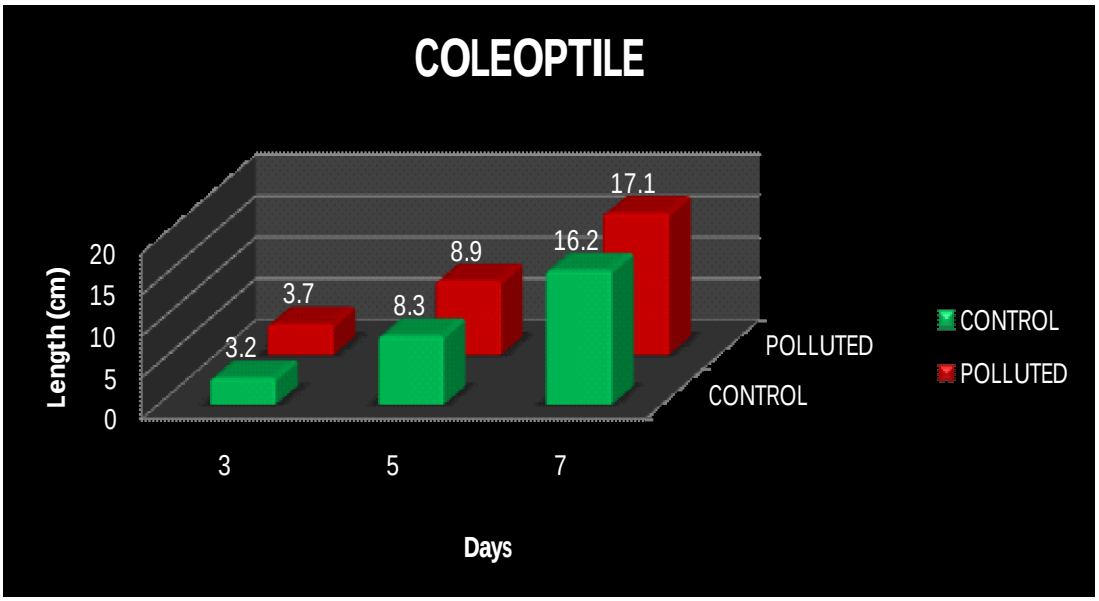

Fig. 4

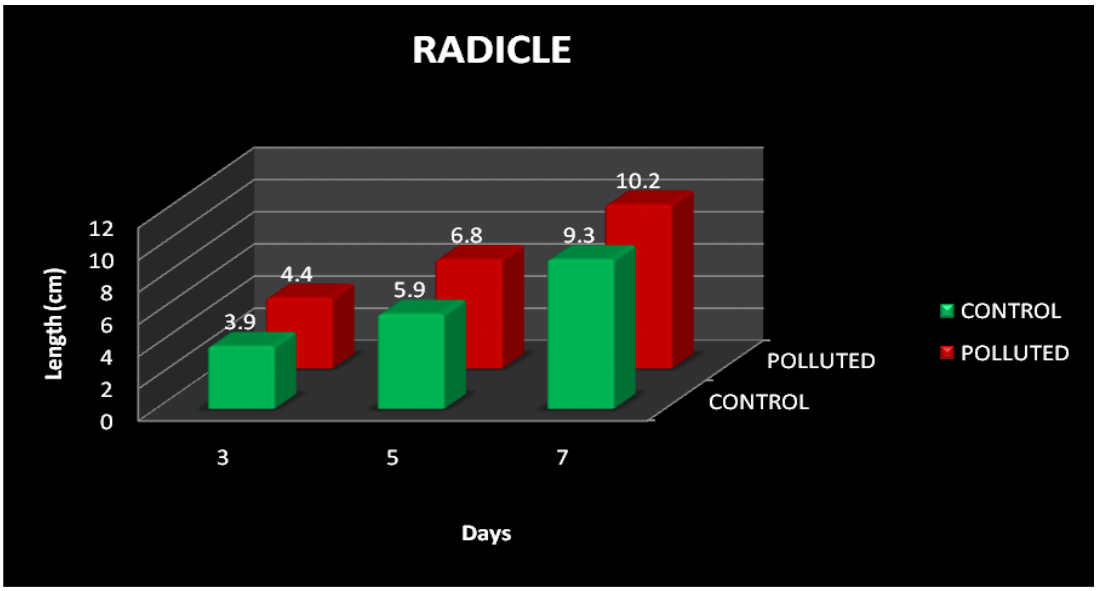

Fig. 5

Municipal sewage containing Carpet Industries Effluent vs. Length of Cicer arietinum cv. P.G.110.

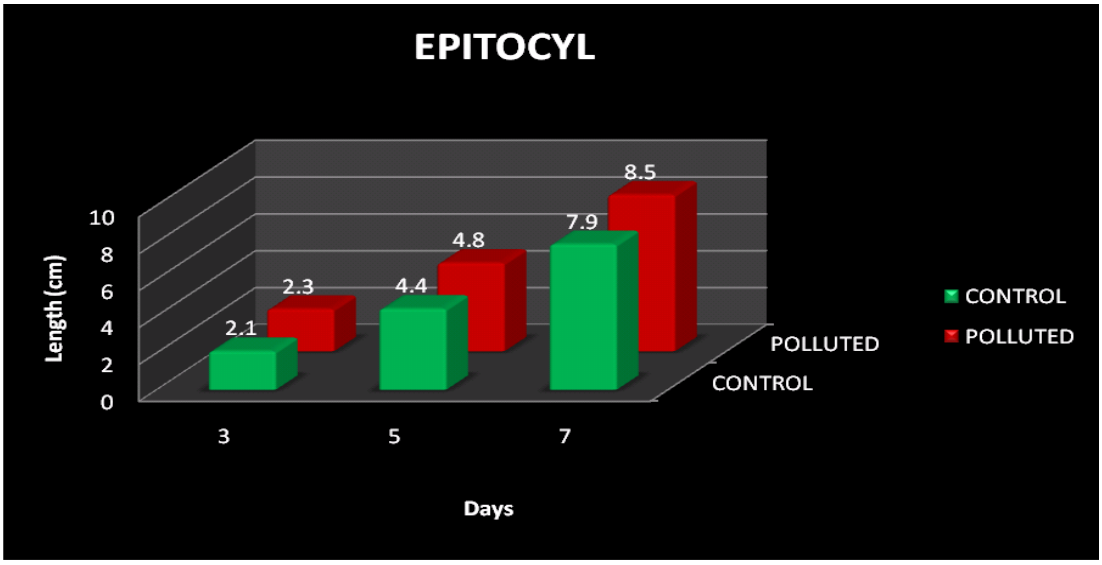

Fig. 6

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