

STUDY OF PHYSICO-CHEMICAL AND BIOLOGICAL PROPERTIES OF GANGA WATER AT MISHERPUR(HARIDWAR) AND ITS IMPACT ON *CUCURBITA MAXIMA*

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Abstract : An experiment was conducted at Misherpur (Haridwar) during June 2010 . The water samples were collected from Misherpur (Haridwar) The parameter adopted for knowing the pollution load of samples were Colour , Odor, Temperature , D.O (Dissolve Oxygen) , B.O.D (Biochemical Oxygen Demand) , C.O.D (Chemical Oxygen Demand) , Ph , Nitrate , Nitrite ,T.D.S (Total Dissolve Solids) , T.S.S (Total Suspended Solids) , Amm Nitrogen , Total Nitrogen , Alkalinity , Hardness , Chloride , R-Cl (Residual Chlorene) , Turbidity , Metal , Tc (Total Coleform), Fc (Fecal Coleform) , Abundance of fungi and presence of Phyto-planktons. The *Cucurbita maxima* was selected for observing the effect of polluted water. The seven concentrations (0% ,10% ,20% ,40%, 60%, 80% 100%) were used to see their effect on germination and growth of plant .In the result 80% concentration was found more beneficial for plant growth and germination.

Keywords : *Cucurbita maxima*, Ganga water, Seed germination, Seedling growth

INTRODUCTION

The Ganga is most sacred river of the world. The people of India rely on Ganga for most life functions. Today over 29 cites and 70 town and thousands of village extended along the bank of Ganga. Nearly all their sewage which is nearly 1.3 billion liter per day goes directly into the river. Over the past century city population along the Ganga has grown at the tremendous rate while west control infrastructure has relatively unchanged. The ecosystem of river Ganga is one of the rich aquatic ecosystem in world Time to time many workers focked their study on it (Gaur Anupama etal., 2009 , Khana D.R., 2009 Gaur, A etal.,2010) . The present study has been conducted at Haridwar city. Haridwar is located in the foothills of shivalika (Himalya) . The river Ganga enters in Haridwar after flowing for 253 km fromits source at Gaumukha at the edge of Gangoteri glacier, enters into Indo- Gangatic plain of North India for first time in Haridwar. The position of Haridwar is 29⁰ 28'Nlatitude and 78⁰13' E longitude on the globe.The water quality of river Ganga is very good at Haridwar in the comparison of othe site of Indo- Gangatic plain , but at some place the pollution load in Ganga is very high and the site from where we collected samples was one of highly polluted site of Haridwar . It is only 1.5 km away from S.T.P plant of city. Plant receives much more domestic effluent then its capacity due to this region a big amount of treated and untreated effluent has been relished in to the stream of river Ganga named Nill Dhara . The domestic effluent is the main

polluting agent of aquatic environment across the world (Sing A.k etel.,1985 Dubey Sujata etal.,2010) . The domestic effluent alsoaffects the various life function of plants at particular amount as reported by Bishnoi etal.,(1999) Qusim M.S etal., (2000) and Gupta Suman etal., (2003). Gupta Rudhera etal., (2005) and many others focused their study on the effect of various pollutants on plants. In.the present study *Cucurbita maxima* was selected to observe the effect of pollution on plant . *Cucurbita maxima* is most growing crop in Ganga basin and it is also the most edible crop of India, so that is the main region of selection of it as research plant . The seven test solution (0% ,10% ,20% ,40%, 60%, 80% 100%) were prepared by diluting the polluted water including blank for knowing the effect of polluted water on plant . The distilled water was used as controller and blank solution

The first step of study was done in Petri dishes, where we observe the effects of pollution on seeds germination . In the second step the plants were cultivated in plastic begs for a month. In this step the effects were observe on growth of plants.

MATERIAL AND METHOD

(a) Collection of Sample: - Water samples were collected from Misherpur (Haridwar) during 5th of June2005 Monday 8.40 am. The water samples were collected in six B.O.D Bottles , 6 M.P.N Bottles and plastic cans. The samples were analyzed at the level of different parameters according to A.P.H.A 21th edition.

(b). Method Adopted for Study physicochemical and biological

Properties:-

Sr. No.	Test	Methods
1	Odour & Colour	Detected by naked eye and smelling (at site)
2	Temperature	Detected by digital thermometer
3	Ph	Detected by digital ph meter
4	D.O	Detected by titration with sodium thio-sulphate

5	B.O.D	Detected by titration method
6	C.O.D	Detected by open reflux method
7	T.D.S	Detected by evaporation (Dry weight)
8	T.S.S	Detected by evaporation (Dry weight)
9	Amm- N2	Detected by spectrophotometer (according A.P.H.A)
10	Electrical conductivity (E.C) –	Detected by digital E.C meter
11	Alkalinity	Detected by titration with H ₂ SO ₄
12	Hardness	Detected by titration with E.D.T.A
13	Chloride	Detected by titration with AgNO ₃
14	Total N2	Detected by T.K.N method
15	Nitrite	Detected by spectrophotometer (according A.P.H.A)
16	Nitrate	Detected by spectrophotometer (according A.P.H.A)
17	R-Cl	Detected by Ortho -Toluidine (at site)
18	Turbidity	Detected by digital turbidity meter
19	Metals	Detected by A.A.S
20	Tc, Fc -	Detected by Filter plating Technique
21	Phyto- plankton -	with the help of sedgwich rafter cell and wippel gride
22	Fungi -	Detected by using P.D.A media and preparing slide

(c) Germination experiment:-

Six test solutions (0%, 10%, 20%, 40%, 60%, 80%, 100%) prepared by diluting polluted water. The distilled water was used as controller. The germination test on *Cucurbita maxima* was conducted as per I.S.T.A (International rule of seedling testing annexure Annon .1985) method. According which healthy and undamaged seed of equal size were placed in sterilized Petri dish. The seed also covered by wetted tissue paper with different concentration polluted water. The measured amounts of test solutions were added in each Petri dish.

(d) Growth experiment:- The growth experiment was carried out in plastic bags during June 2009 Haridwar. Experiment setup consisted of 10 replicate beg per treatment and their were total seven treatments made by diluting samples with distilled water (0%, 10%, 20%, 40%, 60%, 80%, 100%) Plant growth and development were recorded through out the growing season through biweekly measurements. The leaf areas of third leaf of each plant were measure with the help of electronic leaf area meter at the end of one month.

RESULT AND DISCUSSION

Pollution Load and Water Quality of River

Because of high pollution load the Ganga water becomes brownish black in colour and the odour was also unpleasant. The temperature of water at this site was observed 19° C. This was 3°C more then other clean area of Haridwar.

The enhancement in water temperature was due to bio-chemical reactions which were operating in

water sample by microbes. The ph of water at the site was 7.8. It was also high, the main reason behind it that the domestic effluent contain big amount of detergent .The Electric Conductivity of sample was observed 553µhs.

It was high due to presence of big amount of free ions (presence of Co₂ increases Electric Conductivity). B.O.D (Bio-chemical oxygen demand) of sample was 19 Ppm. It is high due to presence of large number of micro-organism as they operate many bio-chemical reactions which require oxygen.

C.O.D (Chemical Oxygen Demand) was also high because the domestic effluents contain big amount of different chemical. D.O (Dissolve Oxygen) of sample was 4.3 Ppm. It is very low due to high pollution in Ganga water.

Alkalinity of sample was 302 Ppm. It is high due to presence of high concentration of detergent and alkaline salt in sewer water. Hardness of water sample was 250 Ppm Nitrate was 1.5 Ppm and Nitrite was 1 Ppm. T.D.S was 500 mg/L and T.S.S was 75 mg/L these value are very high due to high concentration of sludge and solavel material. R-Cl was not detected in sample. Chloride was found 16 Ppm in water sample. It was due to natural presence of NaCl in sewage water.

Turbidity of water was 250 Ppm because water sample contain big amount of sewage water, which has many soluble material in it.

Total coliform, and fecal coliform was 2.6×10^6 and 1.2×10^6 as these bacteria found in fecal matters of human being. K, Na, Mn, Fe, Zn, were found in sample but Hg, Pb, Cd, Cr were not detected in sample.

Table 1: Physico -chemical Properties

Sr	Parameters	Value
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1	Colour	Brownish black
2	Odour	Unpleasant
3	PH	7.8
4	B.O.D	19
5	C.O.D	57
6	D.O	4.3
7	T.D.S	500 mg/L
8	T.S.S	75 mg/L
9	Total N2	14 Ppm
10	Amm N2	39.45 Ppm
11	Alkalinity	300 Ppm
12	Nitrate	1.5 Ppm
13	Nitrite	1 Ppm
14	R-Cl	N-D
15	Chloride	16
17	Hardness	250 Ppm
18	Turbidity	250 Ppm
19	E.C	553 µhs
20	K	4.065 Ppm
21	Hg	B.D.L
22	Na	4.759 Ppm
23	Pb	N-D
24	Mn	.365 Ppm
25	Cd	N-D
26	Cr	N-D
27	Fe	.64759 Ppm
28	Zn	8.433Ppm

Biological properties

The micro organism are living catalysts which operates vast number of chemical reaction in water. The knowledge of relationship between organism and ecological factors can be used as an Indicator of pollution level of water as Panday G. N *et al.*, (1980) had revealed the role of micro flora in the assessment of pollution level of river Ganga. In the sample the 28 species of phytoplankton was found. The membre of class Chlorophyceae were found in highest number percentage in the samples of river water then other class of algae. Which was 43.3% of total number of plankton, it was followed by the member of Bacillariophyceae 38.8 % , Cynophyceae 9.7%. The member of class Euglenophyceae was found in lowest number in the samples 8.2 % of total number phytoplankton detected in the samples. A number of workers have reported many algal species as indicator of water pollution (Bilgrami K.S *et al.*, 1985, Sikander .M 1987, Khana D.R *et al.*, 2009) . In the current study the occurrence of Occillatoria , Navicula and Euglena were indicating the higher degree of organic pollution. Which has been reported by Gadag *et al.*, (2005).

The fungi is the main component of aquatic ecosystem , It is naturally found in river water and domestic effluent Bilgrami K. S *et al.*, (1991). Curtis B.L.C (1920) gave a description on sewage fungi and its effect. The fungi is also considered as the bio indicator of pollution as the presence or absence of some species represent the different kind of pollution

in the water fungi also show more tolerance from high concentration of pollutants reported by Blaudez *et al.*, (2000). Fungi cause many Sevier disease in plants and animals. The fungal genera Achlya, Saprolegnia, Isoachlya Aphanomyces , Dictyus , Pythium , Mucor, Ascobolus, Olpidopsis, Phoma , Fusarium are the one of them they effect the health of plant by causing different disease in the different part of life cycle.

Coliform bacteria are a commonly used bacterial indicator of water pollution, although not an actual cause of disease. Other microorganisms sometimes found in surface waters which have caused human health problems include: (Tyagi, Sing A.K *et al.*, 1985)

High levels of pathogens may result from inadequately treated sewage discharges. This can be caused by a sewage plant designed with less than secondary treatment (more typical in less-developed countries). In developed countries, older cities with aging infrastructure may have leaky sewage collection systems (pipes, pumps, valves), which can cause sanitary sewer overflows. Some cities also have combined sewers, which may discharge untreated sewage during rain storms.

Pathogen discharges may also be caused by poorly managed livestock operations. The water samples contain a big number of T.C and F.C which exposed heavy pollution load on the river water at this site.

Bilgrami K.S *et al.*, 1985 and Sikander. M 1987 studied the relation between microorganism and

ecosystem of river Ganga. The number of microbes level.
(Algae, Fungi, Bacteria) are increase with pollution

Table 2:

Sr	Name of phytoplankton	N.o of Units
1	Cynophyta-	
	a. Ocillatoria	4
	b. Anabaena	2
	c. Microcystis	3
	d. Coelosphaerium	2
	e. Phormidium	4
2	Chlorophyta –	
	a. Hydrodictyon	5
	b. Cladophora	3
	c. Spirogyra	8
	d. Stigeoclonium	9
	e. Chlamydomonas	5
	f. Oedogonium	3
	g. Pandoria	4
	h. Eudorina	3
	i. Pediastrum	2
	j. Synura	15
	k. Scenedesmus	3
	l. Chlorella	2
	m. Scenedesmus	8
3	Bacillario phyta –	
	a. Navicula	10
	b. Fragillaria	7
	c. Synedra	6
	d. Pinnularia	6
	e. Denticula	8
	f. Diatoma	7
	g. Melosira	11
	h. Nitzschia	5
4	Euglenophyceae	7
	a. Euglena	6
	b. Phacus	6
	Total Units	157

Table 3:

Sr	Name of Fungi	Present/ Absent
1	Achlya	+
2	Saprolegnia	+
3	Isoachlya	-
4	Aphanomyces	+
5	Dictyochus	-
6	Pythium	+
7	Mucor	+
8	Ascobolus	+
9	Olpidiopsis	-
10	Phoma	+
11	Fusarium	+

Population of T.C and F.C –

Table 4:

Sr	T.C	F.C
	2.6×10^6	1.2×10^6

Germination and Plant Growth : Initially the concentration of test solution. It shows maximum germination percentage was increasing with the growth on 80% concentration of test solution. But at

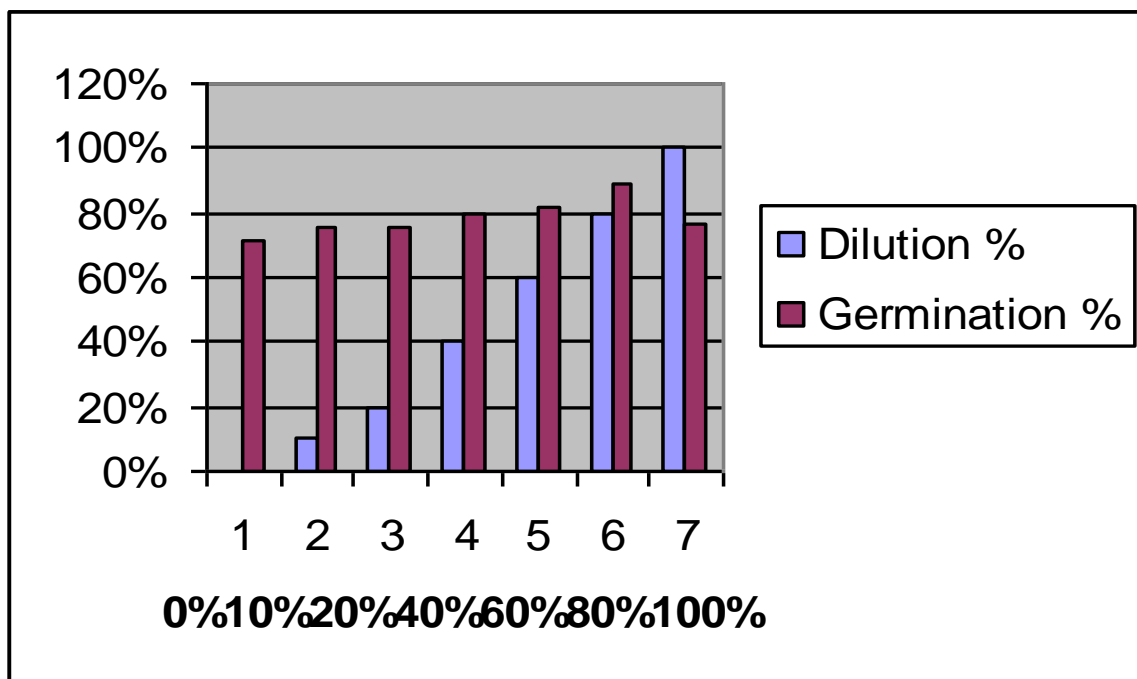
full strength of test solution the germination percentage suddenly got retire.

The growth of radicle and plumule significantly increase with the concentration till 80% and suddenly get degraded at 100%. The 2 week and 4 week mature plants root and shoots also followed this pattern. The leaf area (3ed leaf) of one month mature plants leaf was found maximum at 80% concentration as defining in table 5. This study revolved that the domestic effluent contains such of many substances which are very helpful in the growth and germination

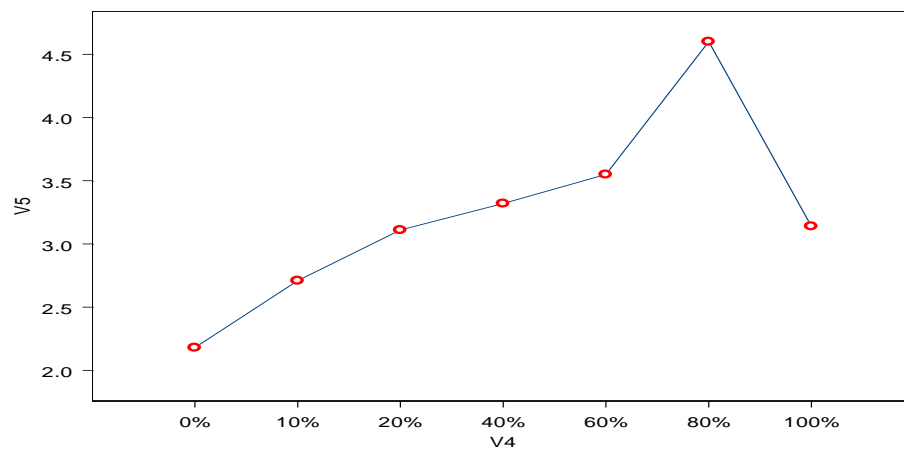
of plant at particular percentage, with these beneficial substances effluent also has many substances which work as growth inhibitor and also starts affecting the plant at high concentration as reported by Qusim M.S *et al.*, (2000). There 100 % was that concentration where all growth inhibitor (Microbes, Detergent and metal) show high per activation. In other hand 80% concentration of sample was found more beneficial than other concentration of samples.

Table 5 :

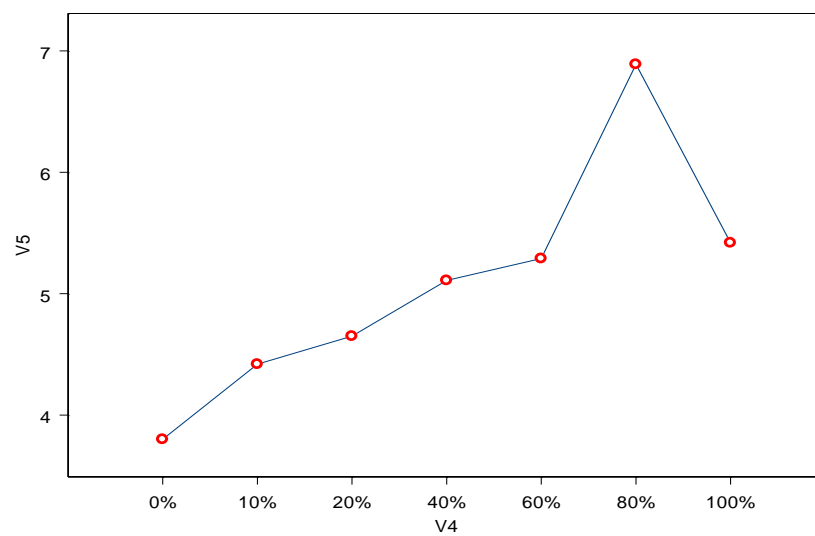
Concentration	Germination	1week Radicle Plumule		Shoot length 2 week 4 week		Root length 2 week 4 week		Leaf area of 3ed leaf
0%	71% ±0.2	2.18 ±0.01	3.80 ±0.04	11.64 ±0.02	45.65 ±0.8	3.42 ±0.2	4.50±0.3	324.3 ±3.0
10%	76% ±0.3	2.71 ±0.01	4.42 ±0.01	12.10 ±0.3	46.48 ±0.9	3.65 ±0.07	4.95±0.5	390.0 ±2.9
20%	76% ±0.3	3.11 ±0.1	4.65 ±0.3	12.35 ±0.4	48.15 ±0.6	4.13 ±0.3	5.30±0.2	440.5 ±2.9
40%	80% ±0.3	3.32 ±0.01	5.11 ±0.01	13.26 ±0.3	48.79 ±0.8	4.50 ±0.2	5.75±0.3	455.7 ±3.3
60%	82% ±0.2	3.55 ±0.01	5.29 ±0.01	13.75 ±0.3	49.25 ±1.0	4.90 ±0.3	6.32±0.3	503.2 ±4.0
80%	89% ±0.1	4.60 ±0.01	6.89 ±0.01	17.35 ±0.4	55.14 ±0.7	5.32 ±0.3	7.80±0.2	667.8 ±5.3
100%	77% ±0.3	3.41 ±0.1	5.42 ±0.01	14.22 ±0.5	50.21 ±0.6	5.13 ±0.3	6.28±0.3	536.4 ±5.7



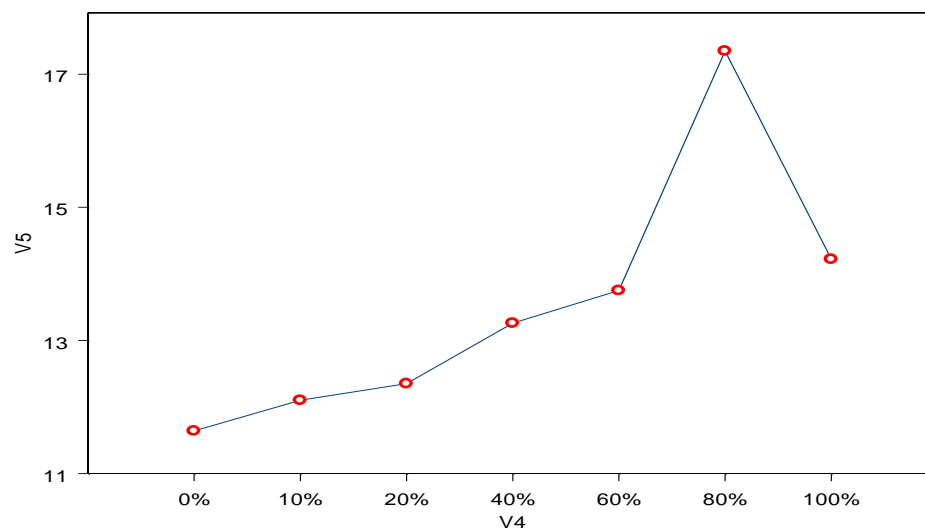
Graph of Germination



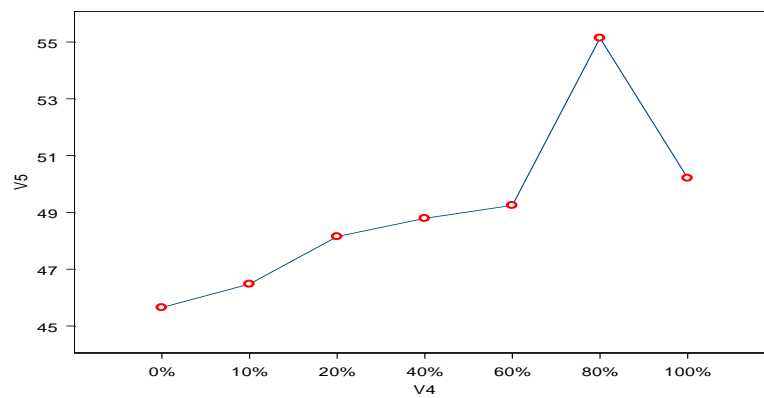
Graph of Radicle



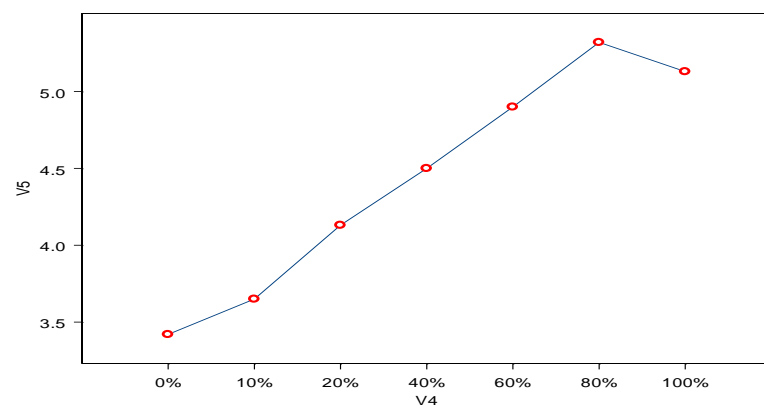
Graph of Plumule



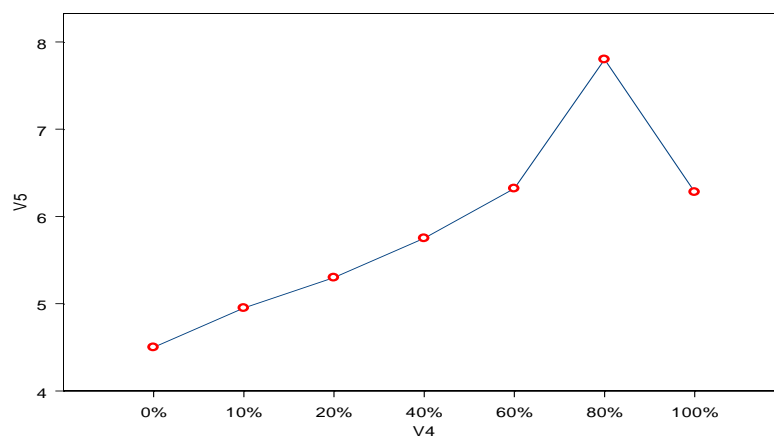
Graph of Shoot length(2week)



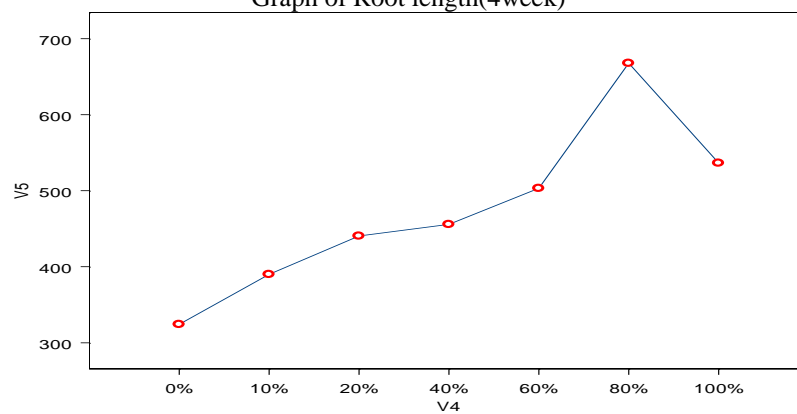
Graph of Shoot Length(4week)



Graph of Root length(2week)



Graph of Root length(4week)



Graph of Leaf Area(4week)

CONCLUSION

The water of river Ganga at this site received a big amount of domestic effluent as described before so the quality of water samples was very poor as the colour of samples was brownish black. The result of this study demonstrates the germination was significantly low at full strength treatment than 80% concentration. The root length, shoot length of 2 weeks and 4 weeks mature plants also follow above pattern of growth. The leaf area (3rd leaf) of plants which was treated with 80% concentration test solution was maximum. In the conclusion we can say the dilute concentration (80%) was found more beneficial than full strength

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