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PHYTO-FILTRATION OF TOXIC HEAVY METAL FROM SEWAGE WATER BY GROWING *TRIGONELLA FOENUM-GRAECUM* SEEDLINGS HYDROPONICALLY

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ABSTRACT:

Use of sewage water for irrigation purposes has emerged an important way to utilize its nutrients and removal of toxic heavy metals by growing tolerant plant species. In the present study, *Trigonella foenum-graecum* seedlings were grown hydroponically using sewage to know whether it can be used to phyto filtrate toxic heavy metal cadmium from sewage and also impact of sewage water on growth and biochemical parameters of *Trigonella foenum-graecum* seedling. The study result indicated decrease in concentration of Cadmium in sewage water after growing *Trigonella foenum-graecum* hydroponically. Insignificant increase was observed in root and shoot length, chlorophyll a, chlorophyll b, total chlorophyll and protein content in *Trigonella foenum-graecum* as compared to control. Present study concludes that *Trigonella foenum-graecum* can be grown hydroponically to phytofiltrate cadmium from sewage without affecting its growth adversely.

KEY WORD: *Cadmium, Chlorophyll content, Protein content, Root length, Shoots length.*

INTRODUCTION:

Hydroponics is a subset of hydro culture and is a method of growing plants using mineral nutrient solutions, in water, without soil. The phytofiltration involves the plant roots for removal of metals from aqueous wastes. It is defined as the use of plants, both terrestrial and aquatic; to absorb,

concentrate, and precipitate contaminants from polluted aqueous sources with low contaminant concentration in their roots.

A lot of works have been done on hydroponics and its role in phytofiltration of water. The present study was carried out to find the effect of sewage of Indore city on growth and biochemical parameters of *Trigonella foenum-graecum* seedling grown hydroponically and its role in phytofiltration.

MATERIALS AND METHODS:

Sewage Sample

For the present study, Sewage water was collected from the Chhavani and near vaishnavdevi temple, Indore city, M.P. India. Table A and B shows the physio- chemical analysis results of Sewage waste water.

Experimental Set-Up

Seeds of fenugreek (*Trigonella foenum-graecum)* sterilized with 0.1% w/v aqueous solution of mercuric chloride for 5 minutes to remove the microbes, followed with repeated washings by using sterilized double distilled water. Seeds were then grown in petriplate until root emerged out after which they were transferred to pots containing sewage water and grown for 25 days. Seedlings grown hydroponically in Hoagland media served as control.

Seedling Length (cm)

The root length and shoot length of the germinated seeds were measured from each experimental set. The shoot length was measured from the base of the primary leaf to the base of the hypocotyls and the mean shoot length was expressed in centimeter. Root length was measured from the tip of the primary root to the base of hypocotyls and mean root length was expressed in centimeter. By adding the root length and shoot length, seedling length was calculated and expressed in centimeter.

Chlorophyll Estimation

Chlorophyll was extracted using 80% acetone and estimated according to method of Sadasivam and Manickam (1992).

Protein Estimation

Estimation of protein was done by Lowry's (1951) method using Folin Ciocalteu reagent.

RESULTS AND DISCUSSION:

In present study root length of *Trigonella foenum-graecum* plant was increased in sewage as compared to control. Present study result is supported by findings of Sawaf (2005) who reported that *Sorghum durra* and *Sorghum dochna* showed increased root length when irrigated with sewage water.

In present study shoot length of plant increased as compared to control which is in accordance with results of Kaushik *et al* (2005) that wheat plants irrigated with treated and untreated textile effluent showed increment in shoot length as compared to the plants irrigated by distilled water.

Total length of *Trigonella foenum-graecum* plant was increased in sewage sample as compared to control, the result of present study is against to the findings of Dass (2012) who reported that length of plant of both wheat and rice decreased when treated with 75% and 100% of sewage.

In present study Chlorophyll content was increased in *Trigonella foenum-graecum* plant grown with sewage. The result of present study were against the result of study by Khan *et al* (2011) who suggested that higher concentration of waste water are inhibitory to synthesis of Chlorophyll molecules particularly Chlorophyll a.

The result of present study was also against the study of Liu *et al* (2002) who reported decrease in chlorophyll level in wheat plant when irrigated with sewage. Akhlar *et al* (2012) showed that 100% waste water enhanced the chlorophyll content. Increase in chlorophyll content in *Trigonella foenum-graecum* may be due to higher nutrient uptake from the sewage water.

In present study protein content in *Trigonella foenum-graecum* plant got increased in sewage samples as compared to control. Result of present study were supported with the findings of Aki *et al* (2009) who showed that total protein content increased in *lycopersicon esculentum mill, Capsicum annum l.* when treated with 45.4% and 25% waste water respectively as compared to control. Increase in Protein content may be due to presence of excessive organic material which can be used as source of nitrogen.

CONCLUSION:

From the present study it was concluded that *Trigonella foenum-graecum* seedling can be grown hydroponically without adversely affecting its growth. Present study also concludes that *Trigonella foenum-graecum* can be used to phytofiltrate cadmium from sewage.

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REFERENCES:

Akhtar N., Imam A, Khan N.A. 2012. “Effect of city waste water on characteristics of wheat with varying doses of nitrogen, phosphorus, and potassium”. *Recent Research in Science and technology*, 4(5): 18-29.

Dash A.K. 2012. “Impact of domestic waste water on seed germination and physiological parameters of rice and wheat’. *International Journal of Research and Reviews in Applied Sciences*, 12(2): 280-286.

Kaushik P., Garg V.K., Singh B. 2005. "Effect of textile effluent on growth performance of wheat cultivars". *Biores. Technol.* 96: 1189-1193.

Khan, M.G., Danlel, G., Konjit, M., Thomas, A., Eyasu, S.S., Awoke, G. 2011. "Impact of textile waste water on seed germination and some physiological parameters in pea (*Pisum sativum* L.), Lentil (*Lens esculentum* L.) And gram (*Cicer arietinum* L.)". *Asian Journal of Plant Science*, 10, 269-273.

Mugundhan M., Soundaria R., Maheshwari M., Santhakumari P. and Gopal. 2011. "Hydroponics- a novel alternative for geoponic cultivation of medicinal plants and food crops". *International Journal of Pharma and Bio Sciences*, 2(2): 286-296.

Lowry, O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J. 1951.J.Biol.Chem., 193, 265.

Pathrol M., Bafna A., Maheshwari R., Rangwala T., Batham A.R. 2015. "Impact of different dilutions of sewage water on seed germination characteristics and carbohydrate content of seedlings of *Vigna unguiculata". International Journal of Agriculture Innovations and Research*, 4(2): 2319-1473.

Sadasivam S., Manickam A., 1992: Biochemical Methods for Agricultural Sciences. Wiley Eastern Limited, New Delhi, India.11-12.

Swarf N. 2005: "Response of *Sorghum spp*. To sewage waste water irrigation". *International Journal of Agriculture & Biology*, 07(6): 869-874.

Table (A): Sewage analysis before growing plant hydroponically

Parameter	Normal Range	Sewage – 1	Sewage – 2
Total hardness (mg/l)	10-1000	312	196
Calcium (mg/l)	5-200	120	92
Magnesium (mg/l)	5-100	192	104
Chloride (mg/l)	5-1000	137.95	129.95
Sulphate (mg/l)	1-40	95.935	97.90
B.O.D (mg/l)	1-2000	3.2	3.5
C.O.D (mg/l)	5-1000	106.48	135.52
Cadmium (ppm)	0	0.005	0.004
Lead (ppm)	0	ND	ND

* ND- not detected.

Table (B): Sewage analysis after growing plant hydroponically

Parameter	*Normal Range*	*Sewage – 1*	*Sewage – 2*
Total hardness (mg/l)	10-1000	720	400
Calcium (mg/l)	5-200	330	230
Magnesium (mg/l)	5-100	390	170
Chloride (mg/l)	5-1000	249.92	199.93
Sulphate (mg/l)	1-40	131.54	68.22
B.O.D (mg/l)	1-2000	7.6	2
C.O.D (mg/l)	5-1000	51	60
Cadmium (ppm)	0	ND	ND
Lead (ppm)	0	ND	ND

* ND- not detected

Values are expressed as mean± SD, P-value was calculated to test significant difference.

S.No.	Parameters	Control	Sewage 1	Sewage 2
1	Root length (cm)	5.2 ± 1.47	5.83 ± 0.32^{NS}	6.83 ± 0.90 ^{NS}
2	Shoot length (cm)	7.56 ± 0.60	8.3 ± 1.06 ^{NS}	7.6 ± 0.20 ^{NS}
3	Total length (cm)	13.03 ± 3.13	15.43 ± 3.41 ^{NS}	13.1 ± 5.11 ^{NS}
4	Chlorophyll a	0.06 ± 0.012	0.08 ± 0.010 ^{NS}	0.076 ± 0.004 ^{NS}
5	Chlorophyll b	0.08 ± 0.011	0.100 ± 0.007 ^{NS}	0.083 ± 0.018 ^{NS}
6	Total chlorophyll(mg/g)	0.15 ± 0.012	0.18 ± 0.017 ^{NS}	0.16 ± 0.020 ^{NS}
7	Protein content(mg/g)	1.73± 0.017	3.55 ± 0.002 ^{NS}	6.15 ± 0.014*

Control-Hoagland media, sewage 1- Chhavani sewage, sewage 2- vaishno temple sewage

^{NS} p-value>0.05 is not significant, * p-value<0.05 is significant as compared to control

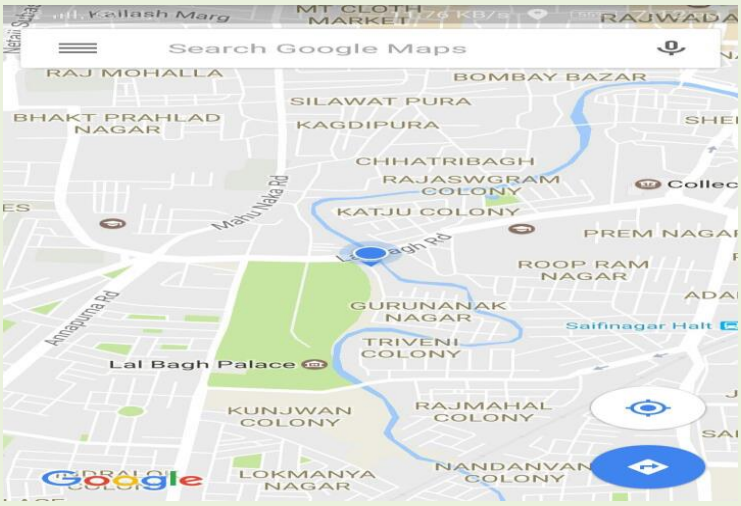

Fig.1 Map showing location of nallah near vaishnavdevi temple, Indore

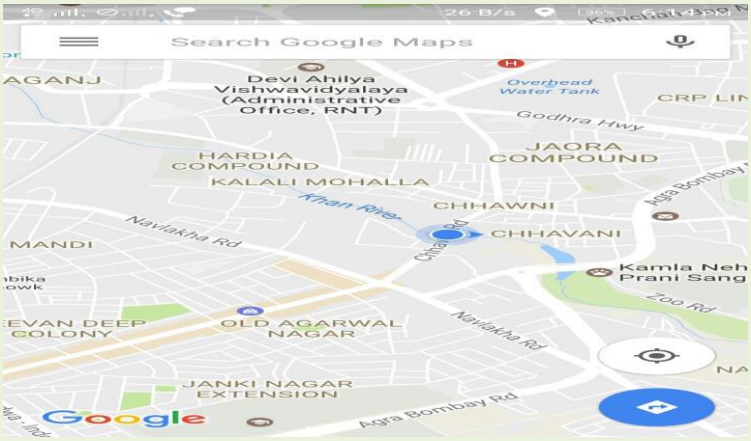

Fig.2 Map showing location of nallah near chhavani, Indore

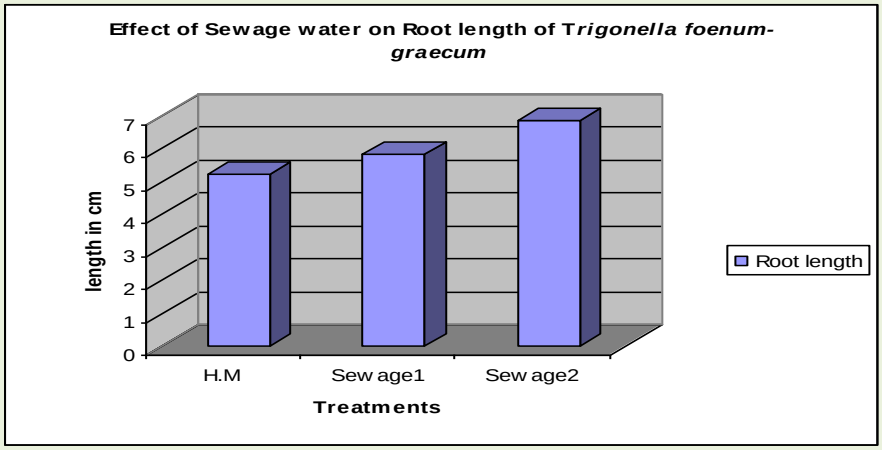

Fig 3: Effect of Sewage water on Root length (cm) of *Trigonella foenum-graecum*

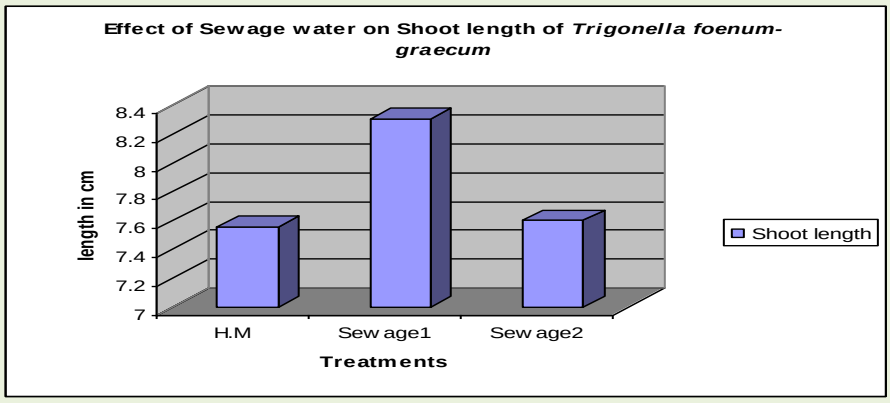

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Fig 4: Effect of Sewage water on Shoot length (cm) of *Trigonella foenum-graecum*

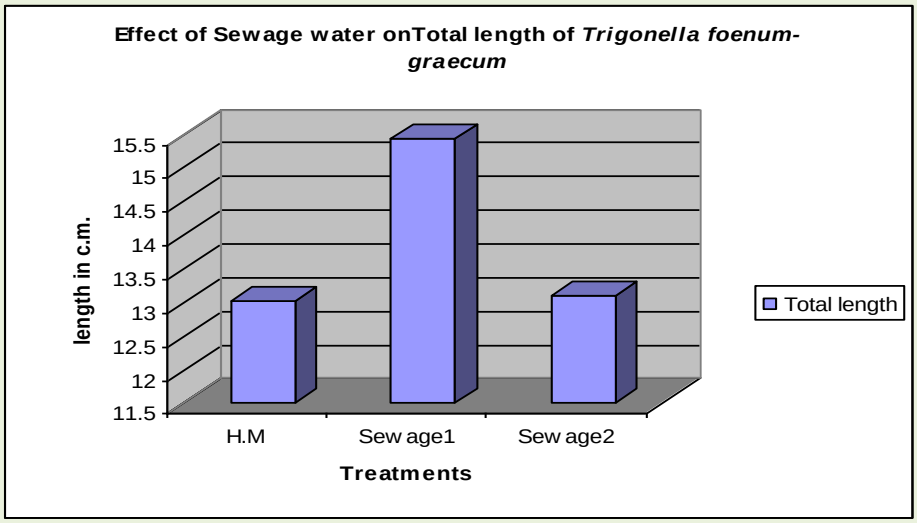

Fig 5: Effect of Sewage water on Total length (cm) of *Trigonella foenum-graecum*

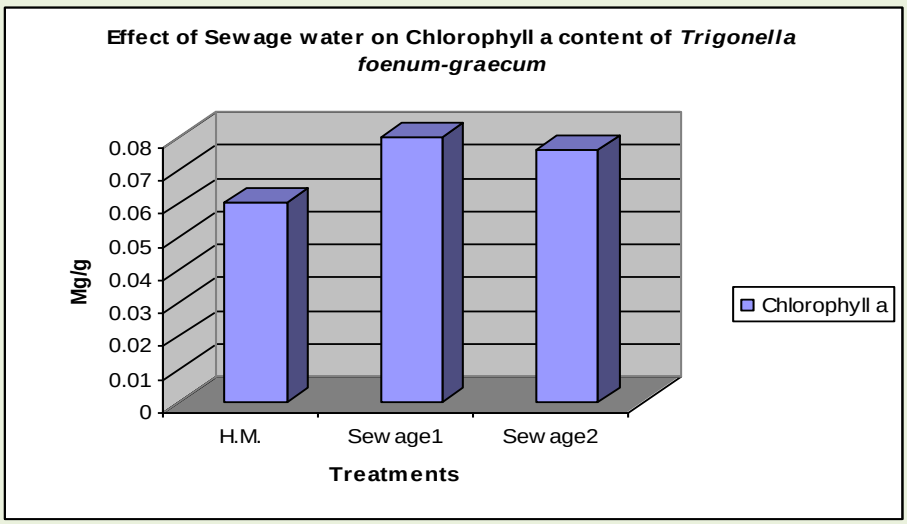

Fig 6: Effect of Sewage water on chlorophyll a (mg/g) of *Trigonella foenum-graecum*

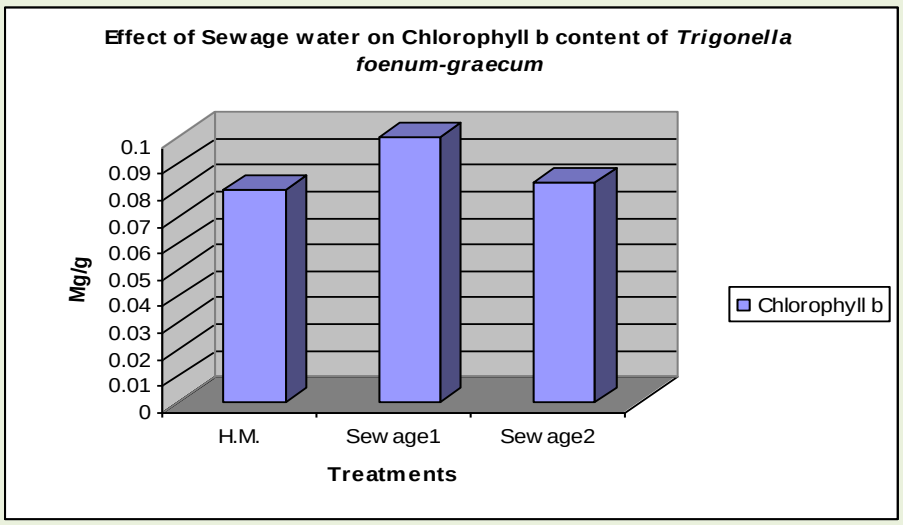

Fig 7: Effect of Sewage water on chlorophyll b (mg/g) of *Trigonella foenum-graecum*

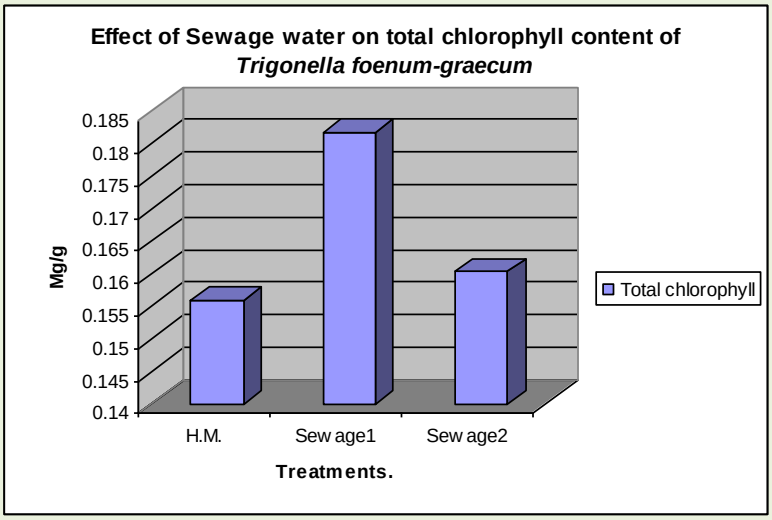

Fig 8: Effect of Sewage water on Total chlorophyll (mg/g) of *Trigonella foenum-graecum*

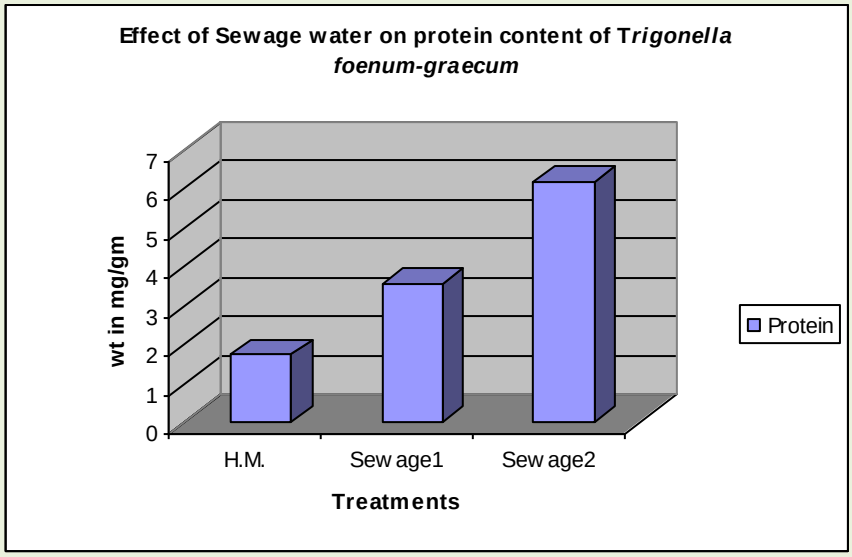

Fig 9: Effect of Sewage water on Protein content (mg/g) of *Trigonella foenum-graecum*