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COMPARATIVE STUDY OF BIOCHEMICAL PARAMETERS OF TRIGONELLA FOENUM-GRAECUM SEEDLINGS (METHI) GROWING HYDROPONICALLY AND IN SOIL BY USING SEWAGE WATER

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ABSTRACT

Environmental pollution in present scenario has become a matter of great concern. Emitted chemicals and solid wastes from different industries have increased amount of contaminants in air, water and soil to hazardous level. The present study was aimed to evaluate effect of polluted water sources on water and soil properties. Our study results showed increase in pH of soil on addition of polluted water. Electrical conductivity of soil was changed when treated with sewage water. It can be concluded from present study that when polluted water reaches fresh water and soil then it affects quality of soil adversely.

Keywords- *Sewage, Hydroponics, Phytofilteration, Hoagland media, Silica*

I. INTRODUCTION

At present environmental pollution has become a serious problem (Tiwari and Kazmi, 2013). Emitted effluents and solid wastes from various industries have increased the amount of contaminants in air, water and soil to hazardous level in many areas. Mining operation emits different heavy metals depending on the type of mining. For example, coalmines are sources of As, Cd, Fe, etc., which enrich the soil around the coalfield directly or indirectly. (Lacerda, 1997).Moreover, indiscriminate use of insecticides, herbicides, pesticides and some other chemicals used for plant protection and allied purposes have also led to their accumulation to damaging concentration in the organisms of the higher tropic level (Tiwari and Kazmi, 2013). Soil is the most important component of the environment, but it is one of the Earth's most undervalued, misused and abused resources (Gokulakrishnan and Balamurugan, 2010). Soil contamination has become a serious problem in all industrialized areas of the country. Soil is equally regarded as the ultimate sink for the pollutants discharge into the environment (Shokoohi*et al*., 2009).The present study aims at evaluating impact of different polluted water sources from Anuppur district, M.P. on soil quality.

II. MATERIALS AND METHODS

Sewage sample-

For the present study, Sewage water was collected from Chhawani and soil sample was collected from Govt. Holkar science college, Indore, M.P. India. Table A and B shows that Physio- chemical analysis of Sewage waste water and soil respectively.

Experimental setup

Seeds of Methi (*Trigonellafoenum-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 distilled water. Seeds were then grown in petriplate until root emerged out after which they were transferred to pots of hydroponic system and soil containing sewage water and grown for 25 days. Seedlings grown hydroponically in Hoagland media served as control.

Chlorophyll content

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

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Carbohydrate content
Carbohydrate was estimated according to method of J.E. Hedge (1962).

Protein content
Estimation of protein was done by Lowry's (1951) method using FolinCiocalteu reagent.

III. RESULT AND DISCUSSION

Chlorophyll content was increased significantly in *Trigonellafoenum-graecum* grown with sewage and silica added 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 to the study of Liu *et al* (2002) i.e. decreased chlorophyll level in wheat seedlings when irrigated with sewage.

The pigment (chlorophyll a, b and carotenoid) were increased in plants exposed at 25% and 50% concentration of waste water (100%) irrigation (Dhawan, 2009). In a study by Rehman*et al.*, (2009) the photosynthetic pigments such as chlorophyll a and b, and protein content were higher in the leaves of *Raphanussativus, Brassica campastris and Brassica napus* irrigated with treated textile effluent than those of supplied with untreated textile effluents.

Protein content in *Trigonellafoenum-graecum*was increased in all combinations of sample except soil sample as compared to control. The present study were supported to the findings of Cuneyt Aki *et al* (2009) who showed that total protein content increased in *lycopersiconesculentum mill, Capsicum annum l.* when treated with waste water 45.4% 25% respectively as compare to control. Increase in Protein content may be due to presence of excessive organic material which can be used as source of nitrogen.

Total Carbohydrate content of the seedlings of *Trigonellafoenum-graecum was* decreased in sewage and soil sample as compared to H.M. (control). The present study were against to the study of Bamniya*et al* (2010) who showed that total carbohydrate content is higher in waste water irrigated crops than control. This study supports to the study of Pathorol*et al* (2015) who showed that total carbohydrate content of the seedlings of *Vignaunguiculata* was decreased significantly at all levels of dilutions of sewage as compared to control.

In the present study total carbohydrate content increased in S+Si which proved that Si agribooster increases the carbohydrate content.

Table: 1 Sewage analysis before and after growing plant hydroponically.

Parameter	Normal Range	Sewage analysis (before)	Sewage analysis (after)
Total hardness (mg/l)	10-1000	312	400
Calcium (mg/l)	5-200	120	230
Magnesium (mg/l)	5-100	192	170
Chloride (mg/l)	5-1000	137.95	199.93
Sulphate (mg/l)	1-40	95.935	68.22
B.O.D (mg/l)	1-2000	3.2	2
C.O.D (mg/l)	5-1000	106.48	60
Cadmium (ppm)	0	0.005	ND
Lead (ppm)	0	ND	ND

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Table: 2 Analysis of soil before growing Trigonellafoenumgraecum (Fenugreek)

S. NO	IDENTITY	(pH) (1:2)	(EC) (1:2) dSm^{-1}	Organic Carbon %	Available Nitrogen Kg/ha	Available Phosphorus Kg/ha	Available Potash Kg/ha
1	Soil Sample (Botany Department, Govt. Holkar Science College Indore	7.70	0.15	0.45	190	9.6	440
	Medium range for comparison	6.5-7.50	<0.80	0.50	250-400	>10	400

Table: 3 Analysis of soil after growingTrigonellafoenumgraecum (Fenugreek)

S. NO	IDENTITY (Soil Sample)	(pH) (1:2)	(EC) (1:2) dSm^{-1}	Organic Carbon %	Available Nitrogen Kg/ha	Available Phosphorus Kg/ha	Available Potash Kg/ha
1	Sewage T1	8.06	0.15	0.30	142	5.6	360
2	Sewage T2	8.04	0.15	0.33	156	5.6	400
	Medium range for comparison	6.5-7.50	<0.80	0.50	250-400	>10	400

Table: 4 Values are expressed as mean ± SD; p-value was calculated to test significant difference.

Parameters	**Control (Hoagland media) S1**	**Soil (irrigated with sewage water)S2**	**Hydroponic system (using sewage water)S3**	**Silica added sewage (In hydroponic system)S4**
Chlorophyll a	0.06 ± 0.01	0.09±0.0006*	0.08± 0.01*	0.10±0.008*
Chlorophyll b	0.08 ± 0.01	0.08 ± 0.004^{NS}	0.10±0.007*	0.13±0.18*
Total Chlorophyll	0.15± 0.01	0.17 ± 0.003^{NS}	0.18 ± 0.17^{NS}	0.24 ± 0.02^{NS}
Carbohydrate	370.2±61.0	292.2 ± 0.009^{NS}	292.8±53.2*	466.8±417.6*
Protein	1.73±0.76	1.70±0.14*	3.55±1.20*	5.06±0.89*

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

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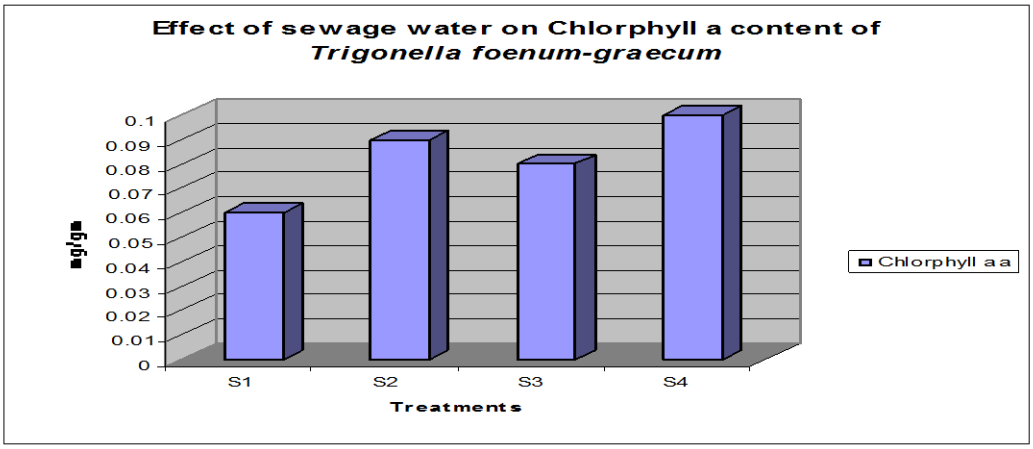

Fig 1: Effect of Sewage water on chlorophyll a (mg/gm) of *Trigonellafoenum-graecum*

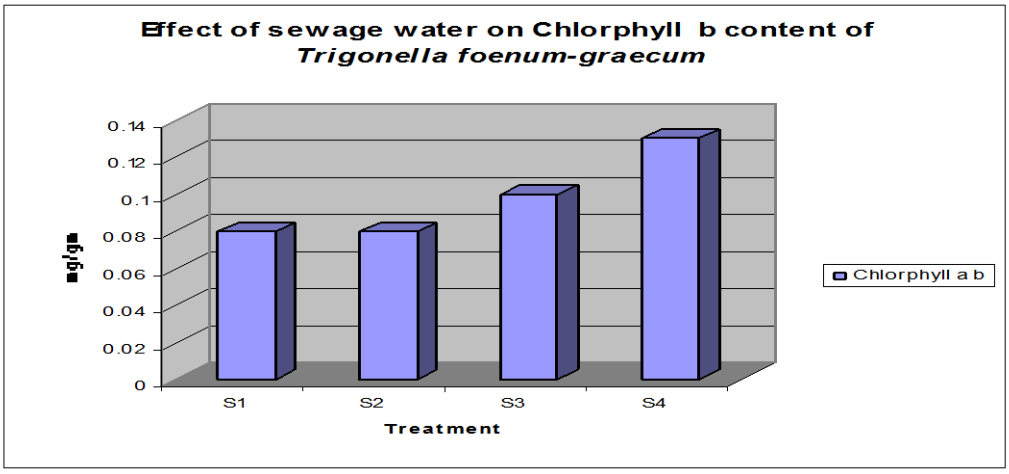

Fig 2: Effect of Sewage water on chlorophyll b (mg/gm) of Trigonellafoenum-graecum

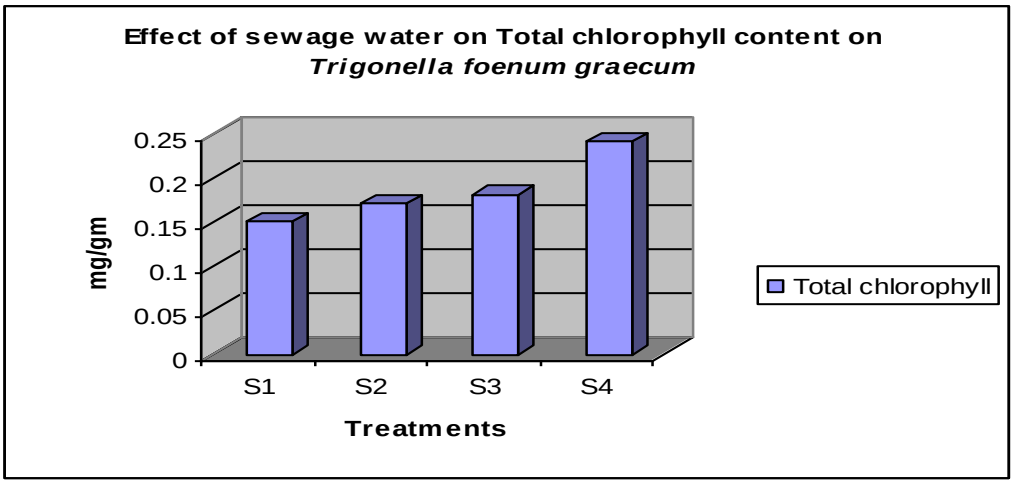

Fig 3: Effect of Sewage water on Total chlorophyll (mg/gm) of Trigonellafoenum-graecum

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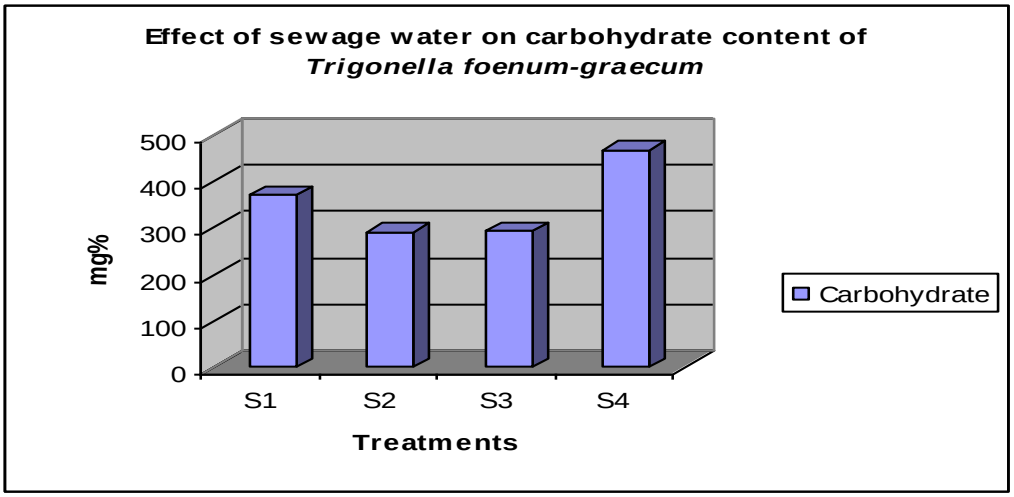

Fig 4: Effect of Sewage water on carbohydrate content (mg %) of Trigonellafoenum-graecum

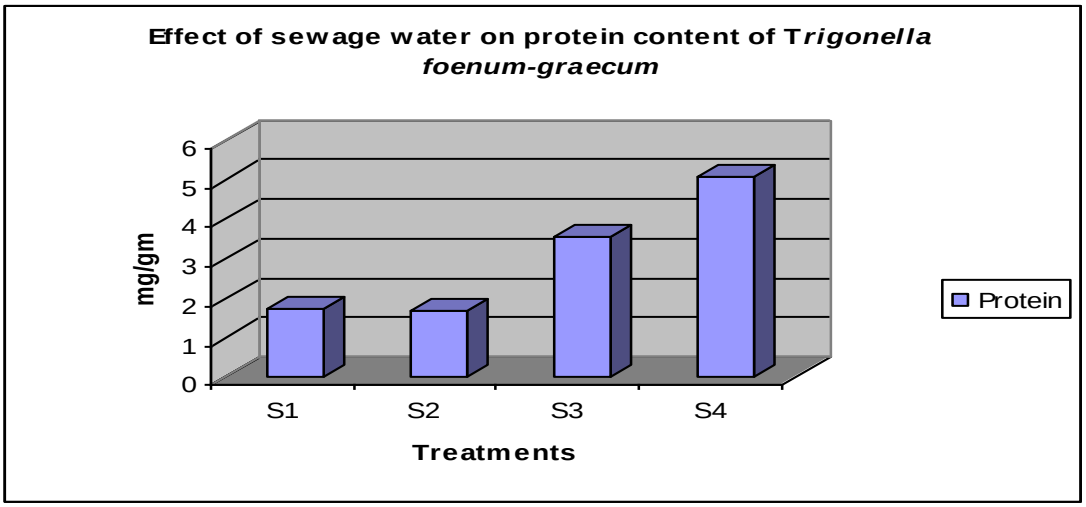

Fig 5: Effect of Sewage water on Protein content (mg/gm) of Trigonellafoenum-graecum

IV. CONCLUSION

The result of present study shows that different combination of sewage with silica along with soil has positive as well as negative impact on biochemical parameters of *Trigonellafoenum-graecum.* Chlorophyll content in *Trigonellafoenumgraecum* increases in both the sewage and Silica added sewage as compared to Hoagland media.

Total carbohydrate content decreases in *Trigonellafoenumgraecum* grown in sewage water and in soil as compared to Hoagland media, but it increases in Silica added sewage which is proves that silica enhances the carbohydrate biosynthesis of *Trigonellafoenumgraecum.* Protein content in *Trigonellafoenumgraecum* increases in the soil and Silica added sewage as compared to Hoagland media.

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