Effect of water Soluble Substances of Licorice (Glycyrrhiza glabra L.) on the Growth of Algae and some water properties of the Refinary unit of Babylon University Campus

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Abstract

Phsico-chemical properties of water and phytoplankton population in three types of water (Hilla river water, drinking water of refinary unit and distilled water) were studied during Augest, 1993. All three types of water except the controls were treated with a water soluble substances of Licorice root. No marked differences between the treatments were found in pH, electrical conductivity, alkalinity, water hardness and Ca^{+2} or Mg^{+2} contents.

Concerning the phytoplankton data, diatoms were dominant algae besides green and blue green algae and the water soluble substances of licorice root reduced severely the growth of algae in all types of treated water.

Key words

Glycyrrhiza glabra L., Phytoplankton and glycyrrhizin.

Introduction

Cyanophyat are photoautotrophic organisms that live in fresh or salt water, swamps, pools and wet soils (Bell and woodcock,1983).Also chlorophyta are photoautotrophic eukaryotic organisms that live in aquatic environment, mainly fresh water. Meanwhile bacillariophyta are familiar algae that are having aquatic and terrestrial habit (Bell and Woodcock ,1983).

It is possible that some toxic compounds are produced in the drinking water during the metabolic processes of algae and cause some side effects on human health (Walther,1989). On the other hand licorice plant is a perennial herb and it is roots produce a colorless saponin glucoside called glycyrrhizin (Al-Rawi and Chakravarty, 1988). Goodwin and Mercer (1986) showed that alkaloids supress some physiolgical processes in plants and probably these substances might have an inhibitory effect on the algae metabolism which finally retards the growth. It is evident that algae were found in drinking water of the refinary unit (personal observation).

The objective of this investigation is to study the effect of water soluble substances from licorice plant root on the growth of algae and some characteristics of the drinking water of the refinary unit of Babylon university campus .

Material and Methods

The study was conducted during August, 1993. Three types of water were investigated. Unrefined river water, drinking water from the water refinary unit of Babylon university campus and distilled water were used as a medium for algal growth . Three samples (each of 20 g.) of Licorice root fine dry powder were solubilized in 200 ml of distilled water then filtered. Each filterate (around 140 ml) was diluted to 2000 ml with the concerned type of water and kept in 2 liters conical flask until used for incubation and analysis. Besides, two liters of each type of water without Licroice root soluble by-product were put in flasks and tested as a control. All six flasks were incubated in a controlled growth chamber at a temperature of 25±1C° and relative humidity of 60-70% and light intensity of 64-66 lux for five days.

All data measurments were done intially and for four successive 24 hours intervals except for the last analysis which was carried out after 48 hours. The recorded data included pH which measured by pH meter (model philips) and electrical conductivity which determined by conductivity meter (Jenway model 4010) which used as an indicator of salinity. Also alkalinity, total water hardness, calcium and magnesium contents were estimated by titration according to Lind (1979).

For phytoplankton investigation, sub-samples of 250 ml of each treatment were filtered through millipores filter (Sartorius type 0.45 micron of pore size) and used for total count of phytoplankton as described by Hinton and Maulood (1980).

Results and Discussion

(Table 1) indicates that Licorice root soluble substances reduced the pH of all tested water as compared with the three types of untreated water during the incubation periods. It is possible that some soluble substances might contain some organic acid which lowered the pH of the water. On the other hand there is no marked differences in the pH of incubation periods except after 72 hr where the pH raises probaly due to the formation of some alkaloids. It is evident from table 2 that electrical conductivity (E.C.) values were ranged between 2.8-0 (microsemins/cm) without pronounced variations among the treatments except for distilled water were the lowest values were recorded.

(Table 3) shows that there were slight differences in alkalinity of water between all treatments except for distilled water where lower values were obtained. However water soluble substances of Licrorice root slightly increased the alkalinity as compared with the untreated water. The trend of alkalinity was similar to that of electrical conductivity . Moreover, (Table 4) points that Licorice root soluble substances markedly decreased the total water hardness as compared with the initial

values through the whole incubation period, or with the untreated water especially after 48 hr in all trials. It is probable that some soluble substances might neutralize the effect of $CaCO_3$ which causes the hardness of water. However there is no differences because water is free of dissolved salts, although treated dist. Water after 120 hr showed reasonable value of water hardness probably due some experimental error.

Table 1 . Effect of water soluble substances of Licorice root and type of water on pH values .
sub. = soluble substances .

Time of incubation , hours	River water		Drinking water		Dist. water	
	without sub.	with sub.	without sub.	with sub.	without sub.	with sub.
0	7.80	7.80	8.20	8.20	7.02	7.02
24	7.92	5.10	8.00	5.20	7.20	4.70
48	8.40	5.60	8.20	5.50	7.20	5.20
72	7.80	6.02	7.94	6.04	7.10	5.80
120	8.1	7.80	8.20	8.10	7.10	6.70

Table 2 . Effect of water soluble substances of Licorice root and type of water on the electrical conductivity (EC , microSemins/cm) .
sub. = soluble substances .

Time of incubation , hours	River water		Drinking water		Dist. water	
	without sub.	with sub.	without sub.	with sub.	without sub.	with sub.
0	2.80	2.80	1.60	1.60	0	0
24	2.80	1.70	2.70	1.10	0	0.50
48	1.30	1.60	1.40	1.60	0	0.20
72	1.20	1.50	1.60	1.40	0	0.20
120	1.40	1.50	1.10	1.60	0	0.20

Table 3 . Effect of water soluble substances of Licorice root and type of water on the alkalinity (mg of $CaCo_3$/liter) of water .
sub. = soluble substances .

Time of incubation , hours	River water		Drinking water		Dist. water	
	without sub.	with sub.	without sub.	with sub.	without sub.	with sub.
0	90	90	80	80	2	2
24	82	92	88	76	8	20
48	84	104	102	102	4	14
72	82	104	84	102	4	20
120	80	90	89	92	4	10

Table 4 . Effect of water soluble substances of Licorice root and type of water on the total water hardness (mg of $CaCo_3$/liter) of water .
sub. = soluble substances .

Time of incubation , hours	River water		Drinking water		Dist. water	
	without sub.	with sub.	without sub.	with sub.	without sub.	with sub.
0	78.00	78.00	62.72	62.72	0	0
24	78.00	70.56	62.72	79.20	0	0
48	78.00	47.04	78.40	39.20	0	0
72	31.36	54.88	47.04	39.20	0	0
120	15.68	54.88	23.52	47.04	0	23.52

There were clear variation between treatments in the valaues of calcium content (Table 5) except for distilled water. The data of distilled water here were similar to that mentioned in hardness of water . It is apparent from table 6 that water soluble substances of Licorice root had a diminished effect on magnessium content in the drinking water especially after 48 hr and beyond . However the effect on distilled water was simillar to that found in hardness or calcium content .

(Table 7) shows that water soluble substances of Licorice root severely lowered the number of algae in all three types of water . It is possible that some toxic compounds as a soluble by-product from Licorice root might depress the growth of algae . Simliar conclusion was reported by Bartall et. al. , 1986 . They mentioned that some phenolic , alkaliod and glycosides compounds might have a toxic effect on the algal photosynthetic efficanecy . Some alkaloids acts as a strong chelating

Table 5 . Effect of water soluble substances of Licorice root and type of water on the calcium content (mg of $CaCo_3$/liter) of water .
sub. = soluble substances .

Time of incubation , hours	River water		Drinking water		Dist. water	
	without sub.	with sub.	without sub.	with sub.	without sub.	with sub.
0	25.14	25.14	12.56	12.56	0	0
24	21.99	18.85	15.71	13.14	0	0
48	15.71	15.71	15.71	12.56	0	0
72	6.28	18.85	15.71	12.56	0	0
120	3.14	15.71	6.28	15.71	0	0

Table 6 . Effect of water soluble substances of Licorice root and type of water on the magnesium content (mg of Mg^{+2}/liter)
sub. = soluble substances .

Time of incubation , hours	River water		Drinking water		Dist. water	
	without sub.	with sub.	without sub.	with sub.	without sub.	with sub.
0	3.79	3.79	7.62	7.62	0	0
24	5.69	5.70	5.70	7.62	0	0
48	9.42	1.89	9.51	1.90	0	0
72	3.80	1.89	1.89	1.90	0	0
120	1.90	3.80	1.90	1.89	0	0

Table 7 . Effect of water soluble substances of Licorice root and type of water on the total number of algae per liter of the water .
D = diatoms . B.G. = blue green algae . G= green algae
sub. = soluble substances .

Time of incubation , hours	River water		Drinking water		Dist. water	
	without sub.	with sub.	without sub.	with sub.	without sub.	with sub.
0	D . : 248 B.G.:9 G.: 24 281	D . : 248 B.G.:9 G.: 24 281	D . : 102 B.G.:0 G.: 5 107	D. : 102 B.G.:0 G.: 5 107	0	0
24	D . : 99 B.G. : 2 G. : 60 161	D . :14 B.G.:0 G.: 0 14	D . : 71 B.G.:3 G.: 0 74	D . : 6 B.G.:0 G.: 0 6	0	0
48	D. : 74 B.G. :8 G.: 90 172	D. : 13 B.G.:1 G.: 0 14	D. : 105 B.G.:2 G.: 0 107	D. : 2 B.G.:0 G.: 0 2	0	0
72	D : 33 B.G. :0 G.: 20 53	D :11 B.G.:0 G.: 6 17	D : 148 B.G.:5 G.: 9 162	D : 8 B.G.:0 G.: 0 8	0	0
120	D. : 135 B.G. :3 G.: 32 170	D. : 10 B.G.:0 G.: 1 11	D. :90 B.G.:0 G.: 3 93	D. : 2 B.G.:0 G.: 0 2	0	0

agents (Goodwin & Mercer 1986) which precipitate some nutrients and might prevent biosynthesis of some vitamins which are essential for phytoplankton (Rogers, 1973). Regarding the phytoplankton types of algae. diatoms were dominant followed by green algae and blue-green algae reduced the growth of algae and have little effect on the quality of drinking water which remained within the international limits of water quality (W.H.O., 1986). Also more researches are needed to indentify the soluble substances of Licorice root .

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