EFFECT OF VARIOUS CONCENTRATIONS OF INDUSTRIAL WASTEWATER OF THE GELATIN AND COLLOIDS FACTORY ON ALGAL POPULATIONS OF ISMAILIA CANAL WATER IN BATCH CULTURES

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Abstract

The addition of different concentrations of industrial wastewater of the gelatin and colloids factory to batch cultures of some algal populations of Ismailia Canal water, grown under optimum laboratory conditions, resulted generally in remarkable alterations in the species composition, total algal counts and percentage composition of the main algal taxa of these populations. Such effects were reflected in the disappearance of some species and the decease or increase in cell counts of other species. The total algal count was increased at low and moderate concentrations (10%, 20% and 40%) but was decreased at high concentrations (60% and 80%).

Species number was decreased in all treated cultures relevant to that of the control. Such drop was progressively increased with further rise in the concentration of the industrial waste.

Within all concentrations of the industrial waste of Gelatin and colloids factory the recorded species exhibited variable degrees of tolerance. Generally, out of all species, 34 species were tolerant whereas 12 species were moderately sensitive, on the other hand, 26 species were highly sensitive.

Key words: Algal populations, Gelatin Factory, Ismailia Canal, pollution.

Introduction:

The industrial effluents discharged into the Ismailia Canal near Abboud bridge by the gelatin and colloids factory caused many complicated problems to the Ismailia Canal water at this area. Qualitative chemical analysis of the effluents experimented with revealed that it is composed mainly of carbonate, bicarbonate, phosphate and Calcium.

Sarma and Garg (1985) studied the effect of carbonate and bicarbonate on growth and sporulation of two blue green algae *Anabaena torulosa* and *Nostoc calcicola*. They found that, the latter alga exhibited faster growth rate following carbonates and bicarbonates addition as evidenced by the specific growth constants and generation time.

In a study dealing with the relation of available inorganic phosphate in water with phytoplankton abundance, Saha (1991) found that the phytoplankton count in Hazaribag Lake, Hazaribag (India) ranged between 487 and 1711 indiv. l^{-1}, while phosphate ranged between 0.18 and 1.23 mgl^{-1}. The correlation between changes in phosphate concentration and phytoplankton abundance revealed an inverse relationship. The discharges of the sewage treatment plants to Severn Sound, Georgian Bay (Canada) likely contributed to the increased total phosphorus levels and consequently the higher phytoplankton densities of the near shore waters (Gemza, 1995).

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Shaji and Patel (1994) investigating the phytoplankton ecology of a polluted pond at Anand (India) during October 1986 to September 1988, reported that, the variables like alkalinity, calcium and phosphate had profound impact on the algal flora.

The present investigation was carried out to study the effect of different concentrations of industrial wastewater of the gelatin and colloids factory on the diversity, species composition, succession and percentage composition of some algal populations of unpolluted Ismailia Canal water, grown in culture media.

Materials and Methods:

Subsurface water samples were collected from the main stream from the Ismailia Canal at El-Mazallat region (unpolluted) during August 1999. The collected water samples were filtered through zooplankton net to separate phytoplankton from any contaminated zooplankton (Pringsheim, 1946).

Regular daily samples of the wastewater effluents discharged from gelatin and colloids factory near Abboud bridge (Cairo) were collected during several periods and kept in refrigerator. Thereafter samples were mixed, shaked well ready to be chemically analysed. Qualitative chemical analysis of the effluents experimented-with revealed that it is composed mainly of carbonate, bicarbonate, phosphate and calcium, with average pH 9.3.

Five concentrations of the industrial wastewater of gelatin and colloids factory (10, 20, 40, 60 and 80%) were prepared from wastewater with Bold's Basal Medium V/V (Bischoff and Bold, 1963). Control samples containing only sterile Bold's Basal Medium without wastewater were also prepared.

50 ml of unpolluted (control) water samples collected from Ismailia Canal were introduced into 250 ml Erlenmayer flasks containing 50 ml sterile nutrient medium treated with one of the above concentrations of the industrial wastewater and into flasks containing only sterile nutrient medium without wastewater (control). Three replicates of each concentration and control were prepared.

All Flasks (treated and control) were incubated at 28C° under continuous illumination (4000 Lux) for a period of 7 days. The algal populations were counted at the beginning of the experiment in 50 ml control water of Ismailia Canal (start inoculum) according to the Sedgwick-Rafter method as recommended by the American Public Health Association (1985). Also, the total algal count in each flask for all treatments and control were determined at the end of the experimental period. Lugol's solution with acetic acid (Willen, 1962) was used for preservation of samples to complete counting.

Algal taxa were identified according to the systems proposed by Riley (1967); Nygaard (1976), Palmer (1980), Bourrely (1981) and Prsecott (1982). Any filamentous or massed colonial forms were counted as one cell.

Results and Discussion

The use of algal assay to determine and predict the effects of wastewater effluents holds considerable promise. In many cases these assays seem to be sensitive than the standard chemical and physical analysis (Hutchinson and Stokes, 1975; Shabana, 1989 and Kautsky, 1992).

The results presented in Tables 1, 2 and Fig. 1 indicate that the administration of the industrial waste of gelatin and colloids factory at various concentrations to the culture of Ismailia Canal algal populations caused marked alterations in the total algal counts, absolute counts of the main algal groups, percentage composition, species composition, degree of sensitivity and tolerance of algal species as compared with culture of the corresponding control.

The total algal counts and the number of species significantly varied between the cultures treated with the industrial waste of the gelatin and colloids factory at concentrations of 10%, 20% and 40% added to Ismailia Canal population cultures, resulted in a pronounced increase in the total algal counts. However, the maximum average (33137 x 10 cells ml^{-1}) was recorded at the concentration of 20% of the industrial waste, which accounted for an increase of 97.67% compared to control. On the other hand, the values of total algal count were decreased at high concentrations (60% and 80%) showing its lowest value (9105 x 10 cells ml^{1-}) at the concentration of 80% (the highest concentration), which accounted for a decrease of 45.68% compared to control. Such significant elevation in the total algal counts associated with the supplementation of the industrial waste at concentrations of 10, 20 and 40% may be due to favourable high nutrients contained in this waste. Smoot *et al.* (1998), reported that nutrient enrichment can result in measurable increase in algal growth. Also, Khatri (1987) found that poor population of phytoplankton in Idukki Reservoir of Kerala (India) was attributed to the poor concentration of nutrients. On the other hand, Pena *et al.* (1990), reported that the highest primary productivity was found in the nutrient-rich waters. Similar findings were obtained by other investigators (Lively *et al* .1983; Raman and Prakash, 1989 and Paerl and Turcker, 1995). They pointed out that high algal standing crops were recorded in the waters characterized by high concentrations of inorganic nutrients attributed to industrial waste discharges or nutrient enrichment.

It is worthy to mention that the decrease in the total algal count that was recorded at the high concentrations (60% and 80%) could be attributed to the unfavourable increase of nutrients at these concentrations of the industrial waste. Thus, the algal populations exhibited inverse response to the industrial waste at these concentrations. In this connection Eloranta and kettunen (1979), studying the effect of industrial wastewater of cellulose factory on phytoplankton found that the phytoplankton of the areas near the factory (highly affected) were inhibited in total count.

The results of this investigation revealed also that the industrial wastewater of gelatin and colloids factory at various concentrations caused marked disturbances in the average absolute counts of the algal groups and species (Table 2 and Fig. 1). The average absolute counts of both Cyanophyta and Chlorophyta were remarkably increased at the low and moderate concentrations (10, 20 and 40%) of the industrial wastewater. The values of the average absolute counts of Cyanophyta were gradually increased as the industrial waste increase to reach their maximum value (7997X 10 cells ml^{-1}) at the concentration of 40% (the moderate concentration) which accounted for an increase of 47.38% compared to control. However, the maximum value of the absolute counts of Chlorophyta (24272 X 10 cells ml^{-1}) was recorded in the cultures treated with the industrial waste at concentration of 20% which accounted for an increase of 139.25% compared to control. On the other hand, the average absolute counts of both Cyanophyta and Chlorophyta were gradually decreased at the high concentrations (60% and 80%) contributing their lowest values (3013 X 10 cells ml^{-1} and 5799 X 10 cells ml^{-1}), respectively at the highest concentration (80%) which accounted for a decrease of 44.47% and 42.84% compared to control, respectively.

It can be conclude that, the industrial wastewater of the gelatin and colloids factory, which is characterized by its alkaline pH may be favourable to the growth of Cyanophycean members. The absolute counts of this group were remarkably increased at the low and moderate concentrations of this industrial waste as compared with the control. However, Vance (1965), reported that high loads of inorganic and organic matters are considered as an inducement for excessive growth of Cyanophyta. Rahaman (1984), Pointed out that the Cyanophyta was the tolerant group among phytoplankton to sugar and distillery industrial wastewaters.

Also, it is worthy to notice that the industrial wastewater of the gelatin and colloids factory was favourable for the growth of Chlorophyta. The industrial waste at the low and moderate concentrations (10, 20 and 40%) increased the absolute counts of this group as compared with the control. These observations are consistent with those obtained by Venkateswarlu (1984), who reported that the green algae survived well and grew better in the diluted effluents of some industrial wastes.

It is worthy to mention that the total count of Bacillariophycean members increased at the low concentrations (10% and 20%) of the industrial waste. The average total counts showed gradual drop as the concentration of the industrial waste increased to reach the minimum value (256X10 cells ml^{-1}) at the highest concentration (80%) which accounted for a decrease of 74.70% compared to control. Thus, the industrial wastewater of gelatin and colloids factory at the moderate and high concentrations (40, 60 and 80%) inhibited the growth of Bacillariophycean members. These observations are in harmony with those obtained by Lange – Bertalot and Lorback (1979), who reported that the wastewater of the chemicals industries near Ludwigshafen (Germany) was responsible for a growth inhibition of diatoms of the River Rhine.

Similarly, the total counts of Dinophyceae slightly increased at the low concentrations (10% and 20%) of the industrial waste. Above these concentrations, the total algal counts were gradually decreased as compared with the control (Tables 1 and 2). The same observations were recorded for the Euglenophycean members. In this connection Hargreaves and Whitton (1976), pointed out that the pollution of streams due to industrial run off can induce flourishment of numerous flagellates. Also, Rana (1997) on his study on the biological effects of the wastes of Sugar factory (India) reported that the polluted samples contained dense populations of *Euglena* and other Euglenoids.

The results presented in Tables (1 and 2) also show that the numbers of species recorded during this investigation were decreased in all treated cultures relevant to that of the control. Such drop in species numbers was progressively increased with further rise in the concentrations of the industrial waste of gelatin and colloids factory. In accordance to this, Mitchell and Buzzel (1971) and Badr (1990) stated that high organic loads causes a great reduction in species numbers of algae in batch cultures.

From Table 1, It seemed probable that, out of all recorded species in all concentrations of the industrial waste of gelatin and colloids factory, 34 species considered to be tolerant to the impact of the effluent. These species were: *Chroococcus limneticum, Cylindrospermum stagnale, Gloeocapsa rupestris, Merismopedia tenussima, Phormidium autumnale* (Cyanophyta), *Ankistrodesmus falcatus, Botryococcus braunii, Chlamydomonas polypyrenoideum, Chlorella vulgaris, Coelastrum cambricum, Coelastrum microporum, Dictyosphaerium pulchellum, Monoraphidium contortum,* *Nyphrocytium ecdysiscepanum, Pediastrum simplex, Scenedesmus acuminatus, Scenedesmus arcuatus, Scendedesmus bijuga, Scenedesmus dimorphus, Scenedesmus opoliensis, Scendedesmus quadricauda, Sphaerocystis schroeteri* (Chlorophyta), *Cyclotella comta, Cyclotella meneghiniana, Cyclotella ocellata, Melosira granulata, Navicula cryptocephala, Navicula gastrum, Navicula pupula, Nitzschia acicularis, Synedra acus, Synedra ulna* (Bacillariophyta), *Euglena sanguinea* (Euglenophyta) and *Glenodinium palustre* (Dinophyceae). The data also show that 12 species were considered to be of moderate sensitivity to waste water of gelatin and colloids factory. These species were: *Microcystis incerta* (Cyanophyta); *Coelastrum reticulatum, Nephrocytium agardhianum, Nephrocytium obesum, Scenedesmus longus, Staurastrum tetracerum* (Chlorophyta); *Anomoeoneis sphaerophora, Coccneis diminuta, Fragilaria leptostauron, Gyrosigma scalproides, Nitzschia palea* and *Synedra tabulata* (Bacillariophyta). On the other hand 26 species were highly sensitive to the waste water of gelatin and colloids factory. These species were: *Coelosphaerium dubium; Coelosphaerium Kuetzingianum* (Cyanophyta); *Actinastrum hantzchii, Ankistrodesmus spiralis, Closterium acutum, kirchneriella lunaris; kirchneriella obesa; Mougeotia genuflex, Nephrocytium limneticum, Pediastrum boryanum, Pediastrum duplex; Pediastrum sculptatum, Pediastrum tetras; Selenastrum westii, Spirogyra aequinoctialis, Tetraedron mutica* (Chlorophyta); *Cocconeis pediculus; Cymatopleura solea; Diatoma vulgare; Gomphoneis herculeana; Gyrosigma distortum, Gyrosigma spencerii, Navicula cuspidata, Rhopalodia gibba, Synedra actinastroides* (Bacillariophyta) and *Peridinium cinctum* (Dinophyceae). These data led to the assumption that the tolerance and senitivity of algal organisms to the experimental industrial waste depend on the concentration of the waste, pH of cultures as well as the algal physiological activity. Such assumption is in confirmity with reports of some other investigators (Rana,1977; Eloranta and kettunen, 1979; Saad and Antoine,1983; Shabana, 1989; Badr, 1990 and Smoot *et al.*, 1998).

Table 1 : Effect of various concentrations of the Industrial Waste water of the Gelatine and Colloids Factory on standing stock of the algae existing in control water sample of Ismailiya Canal using batch culture assay for a period of 7 days.

Algal groups and species	Start inoculum	Control	Concentrations (%)									
			10%		20%		40%		60%		80%	
			Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease
Cyanophyta-:												
1- *Anabaena circinalis* Rabenhorst	1	2	5	+150.00	1	-50.00	-		-		-	
2- *Chroococcus limneticus* Lemm.	1	2	5	+150.00	12	+500.00	4	+100.00	2	0.00	1	-50.00
3- *Chroococcus turgidus* (Kütz.) Naegeli	1	4	6	+50.00	10	+150.00	3	-25.00	1	-75.00	-	
4- *Coelosphaerium dubium* Grunow	1	2	-		-		-		-		-	
5- *Coelosphaerium kuetzingianum* Naegeli	1	12	-		-		-		-		-	
6- *Cylindrospermum stagnale* (Kütz.) Bornet	6	512	659	+28.71	731	+42.77	790	+54.30	332	-35.16	190	-62.89
7- *Gloeocapsa rupestris* Kütz.	2	48	55	+14.58	80	+66.67	60	+25.00	25	-47.92	10	-79.17
8- *Meresmopedia tenuissima* Lemm.	36	136	140	+2.94	65	-52.21	20	-85.29	15	-88.97	12	-91.18
9- *Microcystis aeruginosa* Kütz.	5	36	10	-72.22	8	-77.78	5	-86.11	2	-94.44	-	
10- *Microcystis incerta* Lemm.	6	16	10	-37.50	7	-56.25	5	-68.75	-		-	
11- *Oscillatoria tenuis* C.A.Agardh	2	40	10	-75.00	5	-87.50	-		-		-	
12- *Phormidium autumnale* (C.A.Ag.) Gomont	14	4616	5961	+29.14	6629	+43.61	7110	+54.03	4920	+6.59	2800	-39.34
Chlorophyta-:												
1- *Actinastrum hantzschii* Lagerheim	1	2	-		-		-		-		-	
2- *Ankistrodesmus falcatus* (Corda) Ralfs	3	36	165	+358.33	100	+177.78	30	-16.67	10	-72.22	8	-77.78
3- *Ankistrodesmus spiralis* (Turner) Lemm.	1	2	-		-		-		-		-	
4- *Botryococcus braunii* Kütz.	8	36	75	+108.33	60	+66.67	40	+11.11	20	-44.44	13	-63.89
5- *Chlamydomonas polypyrenoideum* Prescott	3	24	45	+87.50	20	-16.67	15	-37.50	5	-79.17	2	-91.67
6- *Chlorella vulgaris* Beyerinck	693	7452	15648	+109.98	17000	+128.13	11250	+50.97	7300	-2.04	4500	-39.61
7- *Closterium acutum* Bréb.	1	2	-		-		-		-		-	
8- *Coelastrum cambricum* Archer	2	56	80	+42.86	60	+7.14	30	-46.43	25	-55.36	20	-64.29
9- *Coelastrum microporum* Naegeli	1	36	55	+52.78	40	+11.11	20	-44.44	15	-58.33	10	-72.22

Table 1 : Continued

Algal groups and species	Start inoculum	Control	Concentrations (%)									
			10%		20%		40%		60%		80%	
			Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease
10- *Coelastrum reticulatum* (Dang.) Senn.	4	8	10	+25.00	22	+175.00	5	-37.50	-		-	
11- *Dictyospaerium pulchellum* Wood	12	388	250	-35.57	230	-40.72	110	-71.65	70	-81.96	49	-87.37
12- *Kirchneriella luaris* (Kirch.) Moebius	1	12	-		-		-		-		-	
13- *K. obesa* (W.West) Schmidle	1	2	-		-		-		-		-	
14- *K. subsolitaria* G.S.West	1	2	5	+150.0	1	-50.00	-		-		-	
15- *Monoraphidium contortum* Komarkova	9	20	255	+1175.0	1640	+8100.0	1245	+6125.0	265	+1225.0	53	+165.00
16- *Mougeotia genuflex* (Dillw) C.A. Agardh	1	2	-		-		-		-		-	
17- *Nephrocytium agardhianum* Naegli	2	48	30	-37.50	10	-79.17	5	-89.58	-		-	
18- *N. ecdysiscepanum* W. West	1	28	45	+60.71	35	+25.00	20	-28.57	10	-64.29	4	-85.71
19- *N. limneticm* G.M.Smith	1	2	-		-		-		-		-	
20- *N. obesum* West & West	1	4	10	5	5	+25	1	-75.00	-		-	
21- *Pediastrum boryanum* (Turp.) Meneghini	2	12	-		-		-		-		-	
22- *P. dublex* Meyen	1	4	-		-		-		-		-	
23- *P. sculptātum* G.M.Smith	1	8	-		-		-		-		-	
24- *P. simplex* (Meyen) Lemm.	13	64	85	+32.81	35	-45.30	25	-60.94	20	-68.75	16	-75.00
25- *P. tetras* (Ehrenb.) Ralfs	1	8	-				-		-		-	
26- *Scenedesmus acuminatus* (Lag.) Chodat	2	16	30	+87.50	65	+306.25	55	+243.75	30	+87.50	13	-18.75
27- *S. arcuatus* Lemm.	1	5	8	+60.00	10	+100.00	14	+180.00	5	0.00	1	-80.00
28- *S. bijuga* (Turp.) Lagerheim	3	112	180	+60.71	455	+306.25	385	+243.75	153	+36.61	61	-45.54
29- *S. dimorphus* (Turp.) Kütz.	2	92	100	+8.70	165	+79.35	110	+19.57	100	+8.70	80	-13.04
30- *S. longus* Meyen	1	28	20	-28.57	8	-71.43	5	-82.14	-		-	
31- *S. opoliensis* P. Richter	1	10	60	+500.0	55	+450.0	30	+200.0	15	+50.00	7	-30.00
32- *Scenedesmus quasricauda* (Turp.) Bréb.	7	1576	1650	+4.70	4180	+165.23	3425	+117.32	1905	+20.88	952	-39.59
33- *Selenastrum westii* G.M.Smith	1	2	-		-		-		-		-	

Table 1 : Continued

Algal groups and species	Start inoculum	Control	Concentrations (%)									
			10%		20%		40%		60%		80%	
			Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease
34- *Spaerocystis schroeteri* Chodat	1	28	30	+7.14	55	+96.43	35	+25.00	20	-28.57	10	-64.29
35- *Spirogyra aequinoctialis* G.S.West	1	2	-		-		-		-		-	
36- *Staurastrum paradoxum* Meyen	2	8	20	+150.00	15	+87.50	5	-37.50	1	-87.50	-	
37- *Staurastrum tetracerum* Ralfs	4	4	7	+75.00	5	+25.00	1	-75.00	-		-	
38- *S. uniseriatum* Nygaard	1	2	8	+300.00	1	-50.00	-		-		-	
39- *Tetraedron mutica*	1	2	-		-		-		-		-	
Bacillariophyta:-												
1. *Anomoeoneis sphaerophora* O.Mull	1	4	5	+25.00	6	+50.00	1	-75.00	-		-	
2. *Cocconeis diminuta*	1	2	3	+50.00	4	+100.00	2	-0.00	-		-	
3. *C. pediculus* Ehrenb.	1	2	-		-		-		-		-	
4. *C. placentula* Ehrenb.	1	2	3	+50.00	5	+150.00	4	+100.00	2	0.00	-	
5. *Cytlotella comta* Ehrenb.	4	45	155	+244.44	20	-55.56	10	-77.78	5	-88.89	3	-93.33
6. *C. meneghaniana* Kütz.	14	35	85	+142.86	40	+14.29	30	-14.29	20	-42.86	10	-71.43
7. *C. ocellata* Pant	60	380	900	+136.84	300	-21.05	190	-50.00	115	-69.74	70	-81.58
8. *Cymatopleura solea* (Bréb.) W.Smith	1	4	-		-		-		-		-	
9. *Cymbella tumida* (Bréb.) V.H.	1	2	3	+50.00	1	-50.00						
10. *C. turgida* (Greg.) CL.	1	2	2	0.00	-		-		-		-	
11. *Diatoma hiemale*	1	6	8	+33.33	10	+66.67	5	-16.67	2	-66.67	-	
12. *D. vulgare*	1	2	-		-		-		-		-	
13. *Epithemia turgida* (Ehrenb.) Kütz.	1	2	5	+150.00	4	+100.00	3	+50.00	1	-50.00	-	
14. *Fragilaria leptostauron*	2	3	10	+233.33	5	+66.67	1	-66.67	-		-	
15. *Gomphoneis herculeana*	1	2	-		-		-		-		-	
16. *Gomphonema olivaceum* Kütz.	1	2	4	+100.00	10	+400.00	3	+50.00	1	-50.00	-	
17. *Gyrosigma distortum* (W.Smith) CL.	1	2	-		-		-		-		-	

Table 1 : Continued

Algal groups and species	Start inoculum	Control	Concentrations (%)									
			10%		20%		40%		60%		80%	
			Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease	Absolute count	% of increase or decrease
18. *G. scalproides* (RABH) CL.	1	2	3	+50.00	5	+150.00	1	-50.00	-		-	
19. *Gyrosigma spenceni* (QUCK) GRIFF. & HENRF	1	2	-		-		-		-		-	
20. *Melosira granulata* Ralfs	67	152	375	+146.71	260	+71.05	105	-30.92	50	-67.11	30	-80.26
21. *M. varians* Agardh	2	4	10	+150.00	7	+75.00	5	+25.00	2	-50.00	-	-80.26
22. *Navicula cryptocephala* Kütz.	1	4	8	+100.00	6	+50.00	5	+25.00	2	-50.00	1	-75.00
23. *N. cuspidata* Kütz.	1	2	-		-		-		-			
24. *N. gastrum* (Ehrenb.) Kütz.	2	3	6	+100.00	5	+66.67	5	+66.67	3	0.00	2	-33.33
25. *N. pupula* Kütz.	2	4	5	+25.00	20	+400.00	25	+525.00	5	+25.00	2	-50.00
26. *Nitzschia acicularis* Smith	4	8	10	+25.00	15	-87.50	9	+12.50	5	-37.50	3	-62.50
27. *N. palea* (Kütz.) W.Smith	8	52	15	-71.15	10	-80.77	5	-90.38	-		-	
28. *Rhopalodia gibba* (Ehrenb.) O.Müll.	1	2	-		-		-		-		-	
29. *Synedra actinastroides*	1	4	-		-		-		-		-	
30. *S. acus* Kütz.	3	28	35	+25.00	45	+60.71	10	-64.29	5	-82.14	3	-89.29
31. *A. tabulata* (Agardh) Kütz.	1	24	15	-37.50	10	-58.33	5	-79.17	-		-	-
32. *S. ulna* (Nitz.) Ehrenb.	152	224	235	+4.91	325	+45.09	265	+18.30	198	-11.61	132	-41.07
Euglenophyta												
1. *Euglena sanguinea* Ehrenb.	2	130	325	+150.00	150	+15.38	85	-34.62	50	-61.54	25	-80.77
2. *Phacus asymmetrica* Prescott	1	2	3	+50.00	4	+100.00	5	+150.00	2	0.00	-	
Dinophyceae												
1. *Glenodinium palustre* (Lemm.) Schiller	1	45	55	+22.22	50	+11.00	30	-33.33	15	-66.67	8	-82.22
2. *Perdinium cinctum* (Muell.) Ehrenbe.	1	4	-		-		-		-		-	
No of species	87	87	61	-29.89	60	-31.03	55	-36.78	41	-52.87	34	-60.92
Total No. of organisms	1214	16764	28015	+67.11	33137	+97.67	25667	+53.11	15749	-6.05	9106	-45.68

N.B: Filamentous and colonial organisms were counted as one organism. Total count x 10 = organisms / ml.

Table 2 : Effect of various concentrations of the Industrial Waste water of the Gelatine and Colloids Factory on standing sample of Ismailiya Canal water algae along with percentage compositopms of the main groups, after 7 days growth period.

Algalgroups and species	Start inoculum	Concentrations (%)					
		10%	20%	40%	60%	60%	80%
Total count	1214	16764	18015	33137	25667	15749	9105
% of increase or decrease			+67.11	+97.67	+53.11	-6.05	-45.68
No. of species	87	87	61	60	55	43	34
% of decrease			-29.89	-31.03	-36.78	-50.57	-60.92
Cyanophyta							
Absolute count	76	5426	6861	7548	7997	5297	3013
% of total	6.26	32.37	24.49	22.78	31.16	33.63	33.09
% of increase or decrease			+26.45	+39.11	+47.38	-2.38	-44.47
No. of species	12	12	10	10	8	7	5
% of total	13.79	13.79	16.39	16.39	14.55	16.28	14.71
% of decrease			-16.67	-16.67	-33.33	-41.67	-58.33
Chlorophyta							
Absolute count	793	10145	18871	24272	16861	9969	5799
% of total	65.32	60.52	67.36	73.25	65.69	63.30	63.68
% of increase or decrease			+86.01	+139.25	+66.20	-1.73	-42.84
No. of species	39	39	25	25	23	18	17
% of total	44.83	44.83	40.98	41.67	41.82	41.86	50.00
% of decrease			-35.90	-35.90	-41.03	-53.85	56.41

Table 2 : Continued

Algalgroups and species	Start inoculum	Concentrations (%)					
		10%	20%	40%	60%	60%	80%
Bacillariophyta							
Absolute count	340	1012	1900	1113	689	416	256
% of total28.01	28.01	6.04	6.78	3.36	2.68	2.64	2.81
% of increase or decrease			+87.75	+9.98	-31.92	-58.89	-74.70
No. of species	32	32	23	22	21	15	10
% of total	36.78	36.78	37.70	36.67	38.18	34.88	29.41
% of decrease			-28.13	-31.25	-34.38	-53.13	-68.75
Euglenophyta							
Absolute count	3	132	328	154	90	52	30
% of total	0.25	0.79	1.17	0.46	0.35	0.33	0.33
% of increase or decrease			+148.48	+16.67	-31.82	-60.61	-77.27
No. of species	2	2	2	2	2	2	1
% of total	2.30	2.30	3.28	3.33	3.64	4.65	2.94
% of decrease			0.00	0.00	0.00	0.00	0.00
Dinophyceae							
Absolute count	2	49	55	50	30	15	8
% of total	0.16	0.29	0.20	0.15	0.12	0.10	0.09
% of increase or decrease			+12.24	+2.04	-38.78	-69.39	-83.67
No. of species	2	2	1	1	1	1	1
% of total	2.30	2.30	1.64	1.67	1.82	2.33	2.94
% of decrease			-50.00	-50.00	-50.00	-50.00	-50.00

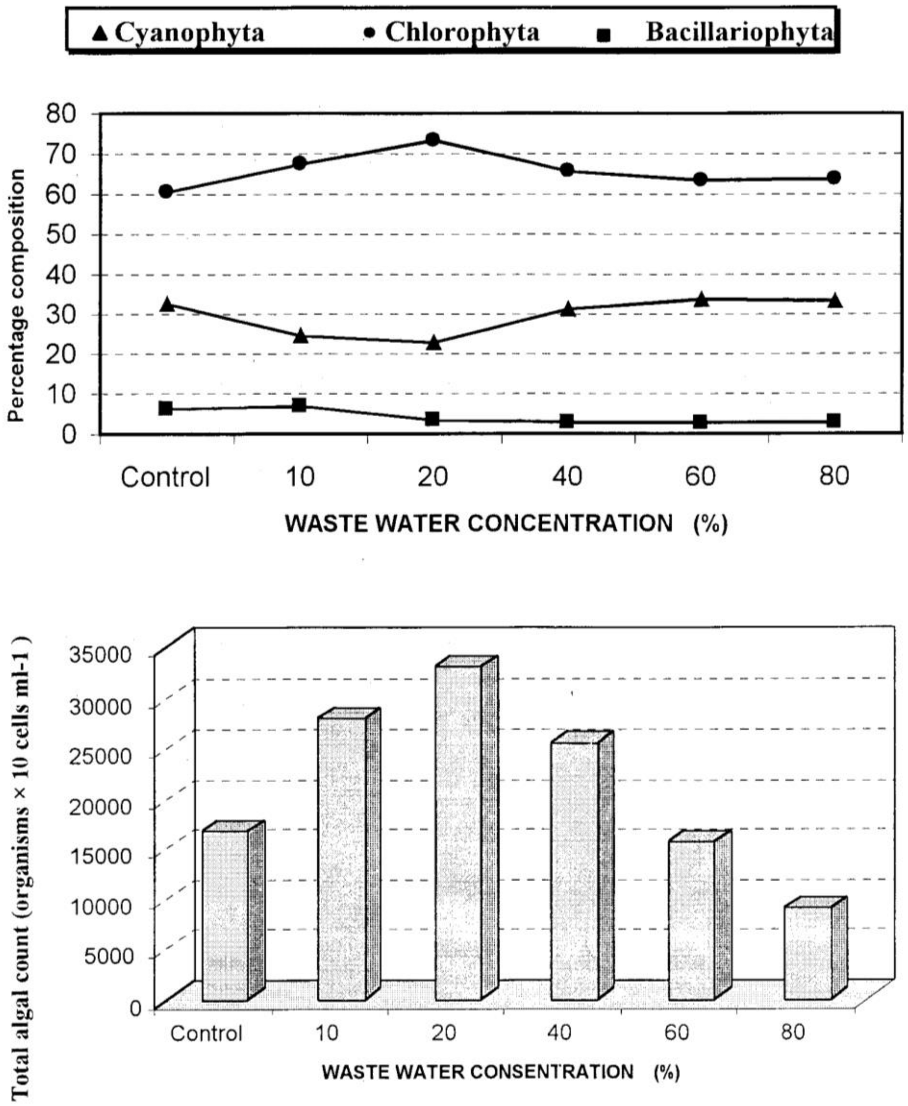

Fig. 1: Effect of various concentrations of the industrial waste water of the Gelatine and Colloids Factory on the average total agal counts and the percentage composition of the main algal groups of the Ismailiya Canal water in cultures after 7 days incubation period .

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الملخص العربى

" تاثير التركيزات المختلفة لمخلف مصنع الجيلاتين والغرويات على العشائر الطحلبية لمياه ترعة الاسماعيلية فى المزارع الساكنة"

أمين عرفان دويدار ، سعيد عبد القادر العطار ، ربيع عبد التواب شهاب

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- بإضافة التركيزات المختلفة للمخلف الصناعى لمصنع الجيلاتين والغرويات إلى مزارع مياه ترعة الإسماعيلية التى تضم بعض العشائر الطحلبية والتى تركت تنمو تحت أنسب الظروف المعملية. أدى إلى تغييرات جوهرية فى التركيب النوعى والتعداد الكلى فى النسب المئوية للمجاميع الرئيسية لهذه العشائر الطحلبية وقد إنعكس هذا التغيير فى إختفاء بعض الأنواع وزيادة أو نقص البعض الآخر.
- وقد أوضحت الدراسة زيادة التعداد الكلى للطحالب فى التركيزات المنخفضة والمتوسطة للمخلف الصناعى (١٠% ، ٢٠%، ٤٠%) بينما أنخفض التعداد فى التركيزات العالية (٦٠، ٨٠%).
- تراجعت أعداد الأنواع الطحلبية تحت تأثير جميع المعاملات وقد زاد الإنخفاض مع زيادة التركيزات.
- إختلفت درجة تحمل الطحالب لتأثير مخلف مصنع الجيلاتين والغرويات وقد تبين إن ٣٤ نوعا لها القدرة على تحمل ومقاومة تأثير المخلف بينما وجد أن عدد ١٢ نوعا تتصف بحساسية متوسطة للملوث كما سجل ٢٦ نوعا كانت شديدة الحساسية لتاثير المخلف الصناعى.