



Evaluation of Algae from the Effluent of Dandot Cement Company, Dandot, Pakistan

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ABSTRACT: Twenty genera and fifty species of algae have been reported from the effluent water of Dandot Cement Company. They include thirteen genera and thirty five species from Chlorophyceae; three genera and six species from Cyanophyceae and four genera and nine species from Bacillariophyceae. Camera Lucida drawings of all the species are being provided. The present investigation suggest that the effluent have inhibited the growth of algae particularly the members of class Cyanophyceae and Bacillariophyceae. pH range 7.0 to 7.6 is the best for sustenance of aquatic life. Here the pH of the pond is 7.5 seems to be normal for aquatic vegetation. However the Chemical Oxygen Demand (COD) which is 10 time higher than that recommended by Pakistan National Environmental Quality Standard (PNEQS), could be one of the reasons to check the growth of algal vegetation in the pond. @JASEM

It is universal fact that industrial growth is of paramount importance for the economic development of a country. But at the same time we forget about, how much damage is caused due to this development to our environment. Almost all industries in Pakistan are discharging their waste emission in to the surrounding without a sense of responsibility. Probably that may be one of the reasons that United Nations terms Pakistan as "Pollutes Paradise" (Mahmood, 2001). Two types of pollutions arise from industries i.e. gaseous and effluents. Gaseous pollution occurs due to the combustion of coal, smelting of ores and other industrial processes. The biggest contributor to water pollution is the industrial wastes. These wastes can be produced from textile, chemicals, petrol, pulp and paper industries and tanneries. According to Mahmood (2001) the effluents coming from the sugar mills have significantly inhibited the growth of the algal vegetation and the inhibitory effect depend upon the concentration of different pollutants in the effluent. Ali *et al.* (1977) observed that effluent water coming from various industrial areas have checked the growth of algae and invertebrates. The present

investigation is to see the effect of effluents which is rich in fossil food and oil contamination on the algal growth found in the waste water coming from Dandot Cement Company Limited, Dandot, District Jhelum.

MATERIALS AND METHODS

Algal samples were collected from the pond full of effluent water of Dandot Cement Company Ltd. Dandot, District Jhelum from September 2001 to March 2002. The samples were collected by hand picking, squeezing and scrapping the aquatic vegetation and were brought to the laboratory. The bottles were numbered accordingly. The preserved algal specimens were identified one by one under the microscope and original diagrams were drawn with the help of Camera lucida. The identification of the specimens was done with the help of work by Prescott (1951), Tiffany and Britton (1952), Desikachary (1952) and Whitford & Schumacher (1973). The effluent water samples of the company were chemically analysed at the PCSIR laboratories, Lahore.

Table 1 : Chemical analysis of Effluent samples collected during the years 2001-2002

	Sample 1	Sample 2	Sample 3	Mean
Colour	Colourless	Colourless	Colourless	--
Odor	Odorless	Odorless	Odorless	--
Total Dissolved Solids(ppm)	772.00	769.25	770.00	770.42
Iron (ppm)	0.00	1.50	1.00	0.83
Manganese (ppm)	0.00	1.00	1.40	0.80
Copper (ppm)	0.00	2.00	1.50	1.17
Zinc (ppm)	0.00	2.50	1.50	1.33
Total Hardiness as CaCl ₂ (ppm)	350.00	360.00	345.00	361.67
Calcium (ppm)	88.00	85.00	83.00	85.33
Magnesium (ppm)	31.59	30.00	32.00	31.20
Sulphate (ppm)	73.40	37.00	72.50	60.97
Nitrates (ppm)	4.00	4.50	3.98	4.16
Carbonates (ppm)	0.00	0.00	0.00	0.00
Bicarbonates (ppm)	300.00	292.01	302.09	298.03
pH	7.50	7.52	7.48	7.50

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RESULT AND DISCUSSION

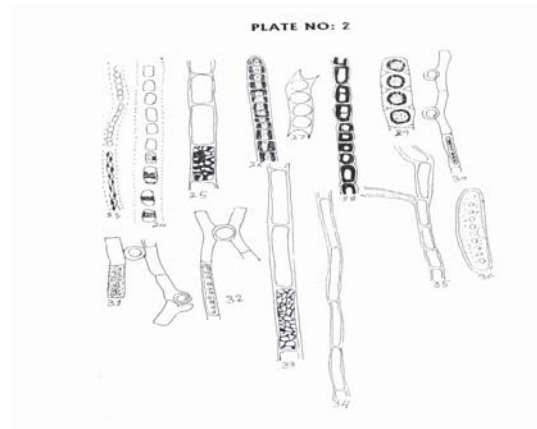
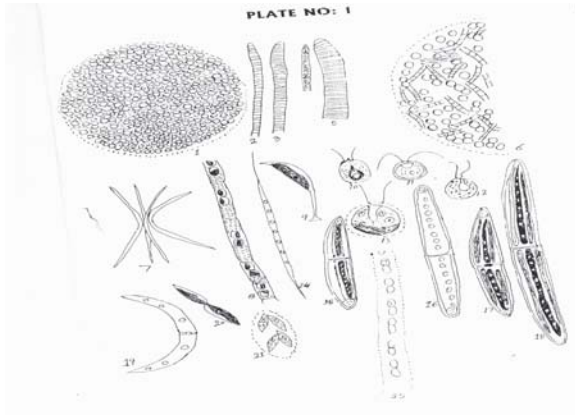
The effluent coming from various factories directly effect the growth of the marine flora. The inhibitory effects depend upon the concentration of different pollutants occurring in the effluents (Nisar, 1999; Mahmood, 2001). The present findings suggest that the effluent of Dandot Cement Company have inhibited the growth of algae, particularly the members of class Cyanophyceae and Bacillariophyceae. The members of the class Chlorophyceae were found to be tolerant to some extent. The pH, total hardness, calcium and magnesium, sulphates, chlorides, nitrates, carbonates and bicarbonates were analysed at PCSIR laboratories, Lahore. The pH of the sample was 7.5 (Table 1). During this study total 20 genera with 50 species were studied. They include 13 genera and 35 species from Chlorophyceae; 4 genera and 9 species from Bacillariophyceae and 3 genera and 6 species from Cyanophyceae (Table 2, Plate 1-3). The Chlorophyceae consists of *Closterium* and *Microspora* with five species each; *Chlamydomonas* and *Spirogyra* with four species each; *Geminella*, *Mougotia* and *Rhizoclonium* with three species each; *Elakatothrix* with two species. The rest of the genera i.e. *Ankistrodesmus*, *Binuclearia*, *Characium*, *Closteriopsis*, *Roya* and *Zygnemopsis* with one species per genera. Bacillariophyceae was the next larger class with 9 species belonging to 4 genera. *Frustala* and *Gomphonema* were with three species whereas *Cocconeis* with two species and *Navicula* with only one species.

The Cyanophyceae was the least represented class having 6 species from three genera. *Oscillatoria* being found the dominant genus with four species. *Microcystis* was with two species while *Phormidium* have only one species.

The percentage presence of Chlorophyceae in the effluent water was 70%, followed by the Bacillariophyceae occupying the intermediate position with 18%, while the least value approximately 12% was observed by Cyanophyceae. Thus mostly frequently occurring class was Chlorophyceae and the least one was Cyanophyceae pH range 7.0 to 7.6 is best for the sustenance of aquatic life. It shows that the pH of the pond of effluent water which is 7.5 is normal for the aquatic vegetation.

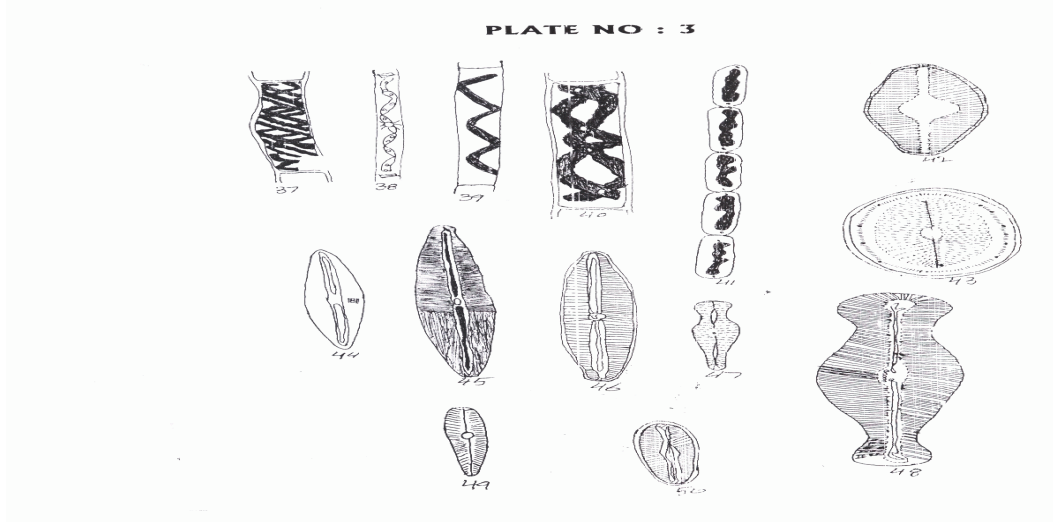
Table 2: List of algal species found in the effluent water of Dandot Cement Company Limited Dandot, District Jhelum, Pakistan.

Text Page	Fig. No.	Species
15	1	<i>Microcystis aeruginosa</i> x 750
17	2	<i>Oscillatoria calcuttensis</i> x 550
17	3	<i>O. natans</i> x 715
17	4	<i>O. princeps</i> x 650
16	5	<i>O. tenius</i> x 750
18	6	<i>Phormidium mucicola</i> x 750
22	7	<i>Ankistrodesmus falcatus</i> x 500
22	8	<i>Binuclearia tartan</i> x 440
23	9	<i>Characium rostratum</i> x 750
24	10	<i>Chlamydomonas cienkowskii</i> x 750
24	11	<i>C. globosa</i> x 1000
24	12	<i>C. polypyrenoidum</i> x 1000
25	13	<i>C. sphaenicola</i> x 1000
25	14	<i>Closteriopsis longissima</i> x 600
26	15	<i>Closterium acerosum</i> x 165
27	16	<i>C. didymotocum</i> x 165
27	17	<i>C. lanceolatum</i> x 165
27	18	<i>C. turgidium</i> x 165
28	19	<i>C. venus</i> x 650
28	20	<i>Elakatothrix glutinosa</i> x 1000
29	21	<i>E. viridis</i> x 440
30	22	<i>Geminella interrupta</i> x 500
30	23	<i>Geminella minor</i> x 440
30	24	<i>G. mutabilis</i> x 440
31	25	<i>Microspora floccose</i> x 750
32	26	<i>M. quadrata</i> x 550
32	27	<i>M. stagnorum</i> x 1125
32	28	<i>M. tumidula</i> x 1125
33	29	<i>M. willeana</i> x 1000
35	30	<i>Mougotia calcarea</i> x 300
35	31	<i>M. scalaris</i> x 225
35	32	<i>M. sphaerocarpa</i> x 300
36	33	<i>Rhizoclonium crassipilum</i> x 150
37	34	<i>R. heiroglyphicum</i> x 125
37	35	<i>R. hookerii</i> x 125
38	36	<i>Roya obtusa</i> x 125
39	37	<i>Spirogyra aequinoctialis</i> x 375
39	38	<i>S. narcissiana</i> x 225
40	39	<i>S. porangabae</i> x 310
40	40	<i>S. subsala</i> x 500
41	41	<i>Zygnemopsis desmidioides</i> x 590
44	42	<i>Cocconeis flexella</i> x 100
44	43	<i>C. placentula</i> x 1000
45	44	<i>Frustala rhoboides</i> x 1000
46	45	<i>F. vulgaris</i> x 1000
45	46	<i>F. viridula</i> x 1000
46	47	<i>Gomphonema contstrictum</i> x 1000
47	48	<i>G. geminatum</i> x 750
47	49	<i>G. olivaceum</i> x 1000
48	50	<i>Navicula bacillum</i> x 1000



Chemical oxygen demand (COD) determines the organic compounds which are susceptible to oxidations and depletion in oxygen in the surrounding water. The Pakistan National Environmental Quality Standard (NEQ) for effluent

is 150 mg O₂/l. As 10 times dilution is necessary in the water body, therefore 15mg O₂/l is required for the existence of aquatic life. The above COD value in the sample effluent water might could be one of the reasons which have checked the growth of algae.



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