EXPERIMENTAL RESULTS

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CHAPTER- IV

Experimental results of the main series of experiments with two algae Chlorella vulgaris and Euglena gracilis:

1. Physical conditions: The results are shown in Tables 1 and 2 Appendix.

Temperature of the liquid cultures:

In the case of Chlorella vulgaris culture, the temperature ranged between 28.0 and 28.5°C, and in Euglena gracilis culture, the temperature ranged from 28.0 to 28.1°C. and in the case of control-it ranged from 28 to 28.5°C.

Colour:

Chlorella Vulgaris: In the case of control, the colour of the liquid remained pink in all the 6 ways, while in Chlorella - treated raw sewage, the colour turned from pink to green during 6 days.

Euglena gracilis: In the case of control, the colour of the sewage remained brown during the 6 days. But in Euglena-treated raw-sewage, the colour change was from brown to green during 6 days. (The pinkish colour of raw sewage in the first case was due to admixture with wastes from a textile mill nearby.

pH

Chlorella vulgaris:

In the case of control the pH varied from 7.7 to 7.9 while in algae treated rawsewage, it varied from 7.8 to 10.2

Euglena gracilis:

Control was having a pH range of 7.4 to 8.0 while in algae-treated rawsewage, it varied from 7.4 to 9.3.

2. Chemical conditions:

The important results of chemical analysis are shown in Table-1 and Table-2 (Appendix) They are described briefly below:

Phenolphthalein alkalinity:

Chlorella vulgaris: Little increase was found in the case of control, but in algae-treated samples, from second day onwards it increased indicating that carbon-dioxide from bicarbonates were used for algal photosynthesis and as a result sparingly soluble carbonates were thrown, down which were responsible for phenol-phthalein alkalinity.

Euglena gracilis: In control, a little increase is recorded, but in algae treated rawsewage, the increase is high. The same reason may be applicable as shown above.

Ammonia-Nitrogen:

Chlorella-vulgaris:

There is no significant change in the case of control flask during six days, but in algae treated raw sewage, the decrease is about 90% on 6th day.

Euglena gracilis:

There is no significant change in control, but in algae treated rawsewage, the decrease is about 92% on 6th day. The reason is, algae utilise ammonia-nitrogen for the growth of cells.

Nitrite-nitrogen:

Chlorella vulgaris:

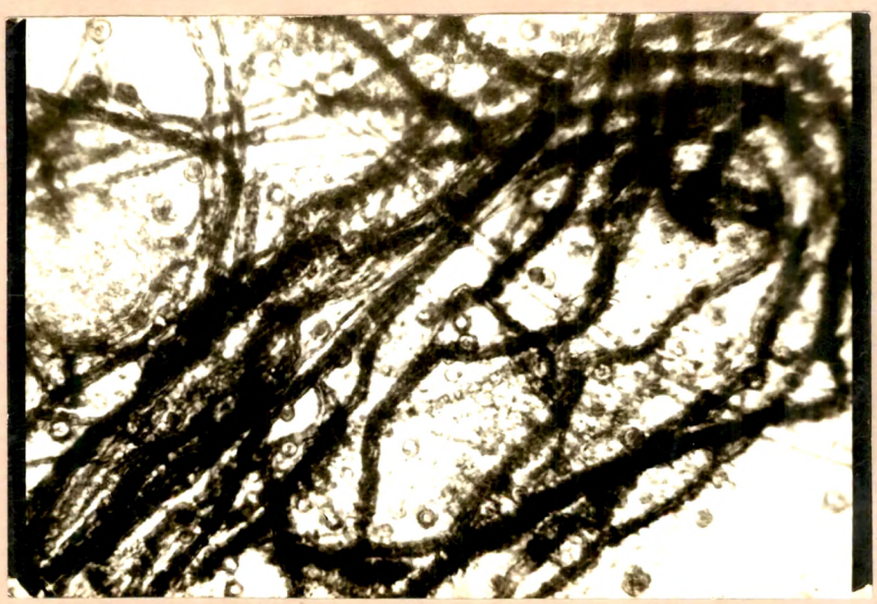
Very little amount of nitrite-nitrogen is present both in control as well as in algae treated rawsewage.

Euglena gracilis:

Negligible amount of nitrite-nitrogen is present both in control as well as in algae treated rawsewage.

Nitrate-nitrogen:

is absent both in control as well as in algae treated samples during six days in both the algae.



Dark brown filaments resembling
Leptothrix ochracea

Phosphates:

Chlorella vulgaris:

In the case of control the decrease is about 42%, while in algae treated raw sewage, the decrease is about 84% on 6th day.

Euglena gracilis:

In the control flask, the reduction is about 35%, but in algae treated sample, the reduction is about 76%. The reason is, algae utilise, phosphate for their growth.

BOD_5 at $20^{o}C$:

Chlorella vulgaris:

In control flask, the reduction in BOD_5 is about 80%, while in algae treated rawsewage, the reduction is about 90% on 6th day.

Euglena gracilis:

The control has reduction in BOD_5, about 50% while in algae treated sample, the reduction is about 90% on 6th day. The reason is during photosynthesis, algae releases oxygen, which is used up by bacteria to oxidise the organic matter.

COD

Chlorella vulgaris:

In the control falsk, the reduction of COD is 82% while in Chlorella treated rawsewage, the reduction is about 96% on 6th day.

Euglena gracilis:

In the control flask, the reduction is 50%, while in algae treated rawsewage, the reduction is about 88%.

3. BIOLOGICAL CONDITIONS USING CHLORELLA VULGARIS:

The biological changes notedon different detention periods are shown in tables from which the following observations are made:

(a) Dark brownish or light brownish filaments of leptothrix

Rotifer Lecane sp.
in the algal sample.

Ochracea were seen in both the culture flasks in almost equal numbers.

(b) Organic debris intermixed with algal mass was seen when microscopically examined in the algae-treated flasks.

(c) Brownish flocculent precipitates were noted only in the control flasks at the bottom or suspended but not in the algae treated flasks.

(d) Paramecium candatum was more conspicuous in the control flasks than in the algae-treated flasks.

(e) Spathidium spathula was seen only in the control flasks.

(f) Aspidisca costata was seen more in numbers in the algae-treated flasks.

(g) Vorticella spp were seen in both the culture flasks in varying numbers.

(h) The rotifer lecane sp was characterised of algae-treated flasks. They showed brownish floceulent organic debris inside their stomachs and some of them contained green algal forms too.

(i) Algae were dominant only in the algae treated flasks.

4. BIOCHEMICAL CONDITIONS USING MICROCYSTIS AERUGINOSA:

a. Carbohydrates:

a_1. Free sugar: In the case of control the reduction in free sugar in 6 days is about 70%, while in the sewage treated with Microcystis aeruginosa, the reduction is about 86% on 6th day.

a_2. Total sugar: In the control flask the reduction in total sugar in 6 days is about 68% while in algae treated sample, the reduction is about 81%.

b. Protein: In the case of rawsewage about 55% of protein content is reduced in 6 days, while in the waste water treated with Microcystis, the reduction in the protein content is about 83%.

c. Amino-nitrogen: 51% reduction takes place in control flask during 6 days while in algae treated sample the reduction is about 81%.

D. Volatile acids (lower fatty acids): In the case of Rawsewage the reduction in volatile acids in 6 days is about 71% while that in algae treated sample is about 86.%

5. BACTERIOLOGICAL RESULTS:

Bacteriological Examination (Sanitary Aspect) in high-rate aerobic oxidation pond using chlorella vulgaris:

The decrease in bacteria or increase in the percentage reduction on different detention periods in the case of chloreela is shown below in table.

Detention periods in days.	Control	Rawsewage	Highrate	Algae treated
	Coliform MPN	Total colonies count	Coliform MPN	Total colonies count
0	9.18×10^7	17.6×10^9	16.09×10^7	$18.85.10^9$
2	$+17.99 \times 10^9$	$+41.6 \times 10^9$	$+11.84 \times 10^9$	$+34.42 \times 10^9$
4	90.8%	74.4%	99.95%	99.99%
6.	99.99%	99.97%	99.99%	99.99%

Control:

The coliform group of organisms show an increase in number by about 17.99×10^9 on 2ndday but it decreased on 4th day, showing a reduction of about 90.8%, and on the 6th day the reduction is 99.99%. But still these are 16x10 coliform type bacteria remains on 6th day.

16×10^4 Table VI

Total colonies count also increases on 2nd day by 41.6 x 10^9 but it decreases on 4th and 6th days of showing 74.4 and 99.99% reduction respectively. Still 48x10^5 residual bacteria are present on the 6th day.

High-rate(Algae treated):

Coliform group organisms also increase on second day by 11.84 x 10^9 but decrease on 4th and 6th day 99.95 and 99.99% respectively. 60 x 10^2 residual bacteria remain on 6th day.

Total colonies count increases on 2nd day by 34.42 x 10^9 while it decreases on 4th and 6th day by 99.99%. Still 27 x 10^4 bacteria remains in the medium on 6th day.

So, it will be seen that by using algae in the system, even on the 4th day 99.95% of coliform and 99.99% of total colonies count reduction is there compared to the control where on 4th day 90.8% and 74.4% of coliforms and total colonies count reduction respecti--vely takes place.

MICROORGANISMS IN HIGH RATE AEROBIC POND WITH CHLORELLA VULGARIS IN BARODA SEWAGE(TABLES 7 TO 10 APPENDIX)

1. The bacteria found in High-rate oxidation pond grown on domestic sewage belong predominantly to Gram negative, non-spore forming rods affecting sugars and tentatively determined as belonging to the genera which vary in dominance on the different detention periods. The dominant genera are recorded in table X from which it will be seen that the dominant genera on the 2nd day are Aeromonas, Bacillus, Comamonas, Havobacterium and Pseudomonas. On the 4th and 6th days, the predominant ganera are Achromobacter, Aerobacter, Proteus and Serratia. The genera which are found common mostly on 4th and 6th days are: Achromobacter and Proteus. Comamonas constitutes only a minor part of the predominant bacteria; and Proteus, Achromobacter, Serratia and pseudomonas are found to be

the main generia bacterial's constituents of high rate aerobic pond.

Most of the Gram nagative rodshaped strains do produce acid from glucose, though some like Alcaligenes and Comamonas do not.

The yellow coloured strains attacking glucose with acid production belong to the genera Psevdomonas Flavobacterium and Xanthomonas and colourless organisms attacking glucose with acid produ--ction, are Achromobacter, Bacillus Corynbacterium and Zooglea (Bergey' 1957) Acid and Gas in glucose produced by the colourless strains are: Aerobacter, Aeromonas E. coli, proteus and Zymomonas, and the coloured strain is serratia (Bergey 1957).

The strains which react oxidatively in Hugh and leifson's glucose medium are Achromobacter, flavobacterium psevdomonas, Serratia, Xanthomonas and Zooglea. Those which act fermentatively are: Aerobac--ter, Aeromonas, and E.Coli. And those which are neutral are: Alcali--genes and Bacillus and the strain which reacts alkaline in the glucose medium is Comamonas (skerman 1967, p 85)

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