CHAPTER - VI

NON-BIODEGRADABLE ORGANIC MATTER IN THE HIGH-RATE OXIDATION PONDS

Working of a high-rate pond:

The working of a high-rate oxidation pond has been furnished by Oswald, (1960) and it is quoted below:

"A high-rate pond must be shallow enough to permit the entry of light almost to the bottom of the pond and it must be mixed to maintain the deposited sludge in an aerobic condition. It must be lined to permit economical mixing to prevent undue turbidity and to control the growth of emergent vegetation".

"Mixing is accomplished through the use of high volume, low head pumps, which are automatically turned on periodically to create a flow velocity in the pond of about 1.5 ft. per second. This velocity supplies sufficient tractive force to suspend both deposited algae and deposited sludge, and to permit its contact with the oxygen rich supernatant at the pond. Experience has shown that a healthy aerobic sludge compared to activated sludge is maintained in the pond, provided mixing is carried out for about three hours per day. Following an initial accumulation the volume of aerobic sludge does

not increase but rather remains constant, indicating essentially that total oxidation is taking place. During mixing, the sludge is suspended throughout the pond volume, but within 15 minutes after mixing ceases, more than 80% of the sludge settles and is again deposited over the pond bottom so that sunlight entering the surface is not obscured. The algae do not adhere to the sludge nor do they become incorporated in it. Rather they remain suspended to continue their synthesis in sunlight unless an extremely high pH brings about auto-flocculation. From the data presented in Table-4, it is evident that high rate of entirely odour-free, BOD removal may be attained in high-rate ponds".

Oswald (1960) had further added: "Although reports which list the specific organisms involved in aerobic oxidation in stabilization ponds which are mainly contained in a yellow brown flocculent sludge (the substance created during bio-flocculation) differ but little from those found in activated sludge or in trickling filter slimes (22)".

From the foregoing reference it will be seen that Oswald has emphasized that in high-rate oxidation pond: (i) total bacterial oxidation is taking place, (ii) the volume of the sludge does not increase but rather remains

constant and that (iii) a healthy sludge comparable to activated sludge is maintained. The first two items are further explained below.

"Total Oxidation"

From the experiences in USA it is known that "total oxidation" of activated sludge cannot be achieved, as there is always a fraction which is inert and which cannot be broken further down by aeration. Kountz and Forney (1959) and Washington and Symons (1962) have estimated this inert fraction which they call as "non-biodegradable" and found it to be approximately 20% of the maximum mass of micro-organisms formed or 11 to 15% of the ultimate BOD_5 removed. Washington and Hetling (1965) found it to be about 10% of COD consumed. McWhorter and Heukelekian (1964) reported that inert organic matter to be of 12% of the initial COD.

According to Washington and Hetling the inert material corresponds to 10% of COD consumed. On this basis, an attempt has been made to calculate carbon dioxide, algal biomass and photosynthetic oxygen production in our three experiments, that can be produced from the non-biodegradable portion assuming that "total oxidation" in the literary sence is taking place. The results are shown in the subjoined tabular statement.

Detention period in days	10% CO_2 released (corresponding to inert mass)	Algae produced(corresponding to inert mass)	Algal biomass in total oxidation	% of Algae (inert) over algal biomass(Total)	Oxygen released (corresponding to inert mass)	Oxygen released in total oxidation	% of Oxygen released (inert) over O_2 released (Total)
Nostoc pyriformis (mg/l)							
2	31.7	17.7	206	8.6	28.3	329.6	8.6
4	34.6	19.2	212	9.1	30.7	339.2	9.1
6	38.5	21.4	218	9.8	34.2	348.8	9.8
Anabaena cylindrica (mg/l)							
2	24.2	13.5	199	6.8	21.6	318.4	6.8
4	28.3	15.7	201	7.8	25.1	321.6	7.8
6	31.3	17.4	205	8.5	27.8	328.0	8.5
Mixed Algae (mg/l)							
2	22.8	12.7	208	6.1	20.3	332.8	6.1
4	31.0	17.2	210	8.2	27.5	336.0	8.2
6	31.6	17.6	214	8.2	28.2	342.4	8.2

It will be seen from the subjoined tabular statement that the quantities of the several parameters calculated are really not significant if we take into consideration the fact that an allowance has been made in the estimation of the algal bio-mass on account of the presence of organic matter.

"Constant volume of sludge"

Secondly, from Oswald's statement about the occurrence of a "constant volume" of sludge", it would appear that the "constant volume" of aerobic sludge remaining in the high-rate pond may consist essentially of the inert matter and some active bacterial mass. Further work is necessary to examine the nature and the ratio of its biochemical constituents.