CHAPTER - VI

BACTERIAL FLORA IN HIGH-RATE OXIDATION POND

The main object of aerobic biological waste treatment is the removal of organic substrates from the waste water. This is achieved by two important metabolic processes taking place in the ecosystem. They are: (i) complete oxidation of a part of the organic substrates resulting in the formation of CO_2, H_2O and energy; and (ii) biosynthesis and growth accompanying the decomposition of the remaining organic substrates, and newly formed cells are a major end product of this intermediate metabolism. It is an account of the latter process that the activated sludge process maintains and even increases itself (Symons and Mckinney, 1958). So, a very striking feature of microbial metabolism in waste treatment systems generally is the relatively enormous, amount of new bacterial cells which are normally produced during the oxidation of organic substrates.

One should therefore expect to find a heavy accumulation of bacterial sludge in the high-rate aerobic pond system also. But Oswald (1960, p. 384) has

stated that a healthy sludge comparable to activated sludge is maintained in the pond and that, following an initial accumulation of the volume of aerobic sludge does not increase but rather remains "constant" indicating that "total oxidation" is taking place. The use of the phrase "total oxidation" by Oswald is not correct one in this context. According to his own statement, a certain amount of sludge is always maintained. This shows that all the organic matter is not totally burnt but certain residue is left behind. What this residue consists of is not known. In our batch culture experiments with the Scenedesmus obliqus, there was no large accumulation of sludge as in the classical activated sludge process but only comparatively little brownish deposits were seen intermixed with algae when viewed under a microscope. Also, the formation of a "constant" volume of bacterial sludge in Oswald's pilot and field ponds and very little sludge in our laboratory experiments is possible only if the system is operated on endogenous metabolism.

From the experience in U.S.A. it is known that "total oxidation" of sludge cannot be achieved since there is always a fraction which is inert and which

cannot be broken down by aeration. Kountz and Forney (1959), and Washington and Symons (1962) found that the non-degradable portion remaining to be about 20% of the maximum mass of micro-organisms found or 11 to 15% of the ultimate BOD_5 removed. McWhorter and Heukelekian (1964) reported the inert matter to be 12% of the initial COD, and Washington and Hetting (1965) to be about 10% of the COD consumed. So, the "constant volume" of sludge reported by Oswald (1960, p.384) in the high-rate aerobic pond may consist essentially of inert matter and bacterial sludge. Further work is, therefore, necessary to determine the nature and ratio of the biochemical constituents of the "constant volume" reported in high-rate aerobic ponds.

It would therefore, seem that the high-rate aerobic oxidation pond system is operated on endogenous metabolism and therefore, one would expect to find entirely different types of organisms during its assimilation and endogenous phases. In fact, Jasewicz and Porges (1956) and Porges (1960) have made a complete survey of the bacteria in action in a dairy waste activated sludge. They found the presence of Pseudomonas and Achromobacteriaceae when the sludge was in its

endogenous phase and the presence of Bacillus in its assimilation phase. In our own case significant difference in composition of the bacterial flora in the two phases is found, as shown in Table-8 (Appendix). also Table 7 ?