C H A P T E R - 6

C O N T E N T S

T A B U L A R   S T A T E M E N T S

(APPENDIX)

CAHPTER - VI

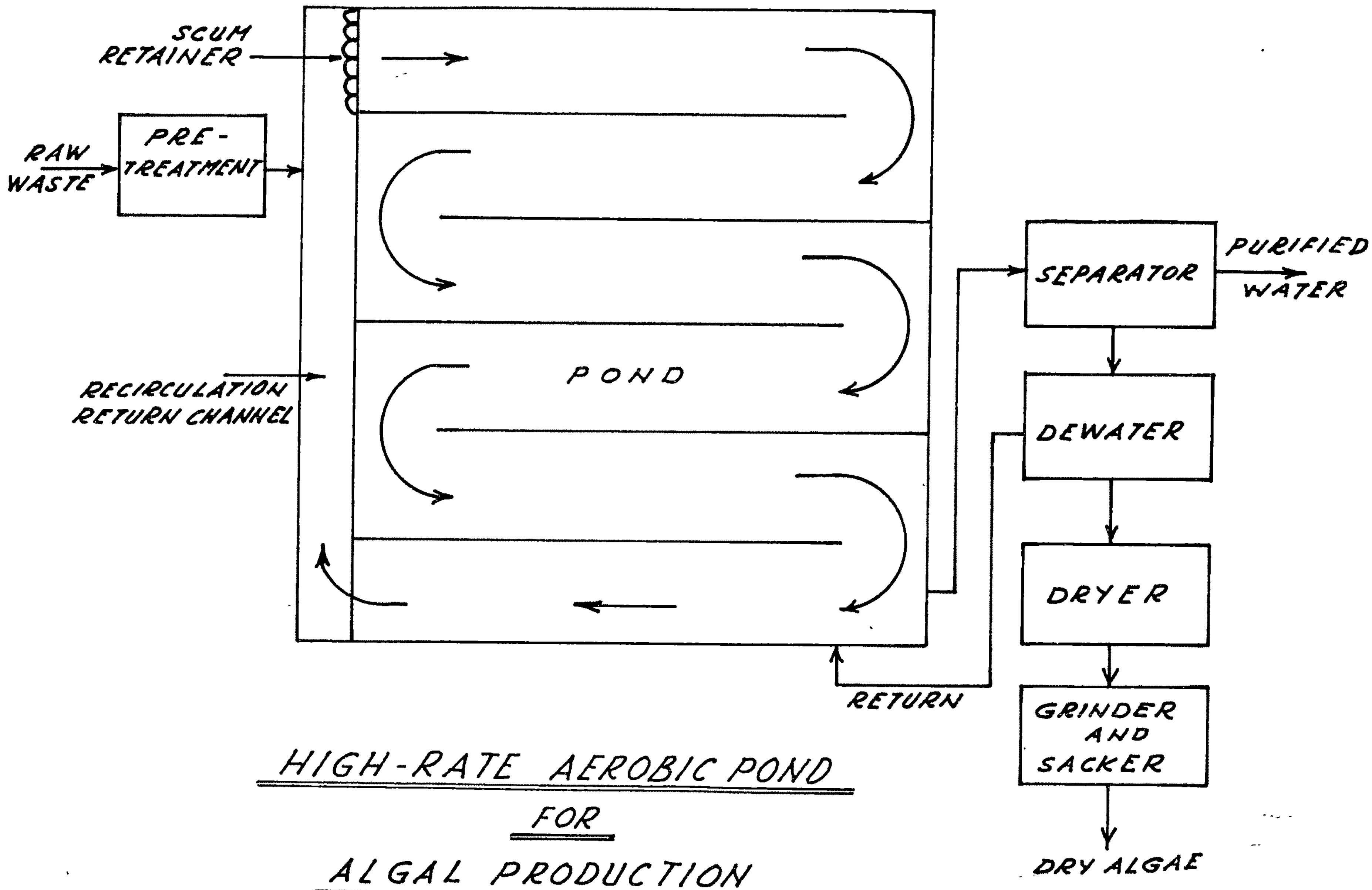
Economic Importance of Using High-rate aerobic Oxidation Ponds:

Man, the son of Adam and king of the Universe since the dawn of civilization, has been depending almost entirely on photosynthesis for his food, fuel and fibre. In his greed for power he has been exploiting the fossil fuels at such a fantastic rate that he is now forced to meet his energy needs by resorting to other souces of energy such as nuclear fission and through development of practical method for fixing the almost inexhaustible supply of solar energy. But there are many practical problems to be solved before he can use fully nuclear fission. High capital costs, highly developed technology, a highly trained scientific personnel and the problem of atomic waste disposal are some of them. So, the only safe and economical process left for man for consideration is the fixation of solar energy through the primordial process of photosynthesis (Oswald and Golucke, 1960).

(i) Production of power from solar energy by means of algae. (Oswald, 1962).

Oswald and his associates have shown the possibility of fixing radiant energy for large scale production of algal matter at very low cost. They have shown

FIG. 18



HIGH-RATE AEROBIC POND

FOR

ALGAL PRODUCTION

that algae could probably be produced for digestion at less than $ 0.01 per pound in open, shallow and sewage fertilized high-rate aerobic ponds. So, the economic feasibility of using algae for fixation of solar energy appears to be within the realms of practical politics. Their early studies have shown that, although the production of methane from algae grown on communities wastes may be technically and economically feasible, their later studies have indicated that some source of nutrient for the algae other than domestic sewage would have to be found to be enable the process to supply a significant fraction, if not all, of the power requirements of a community. This led to the concept of introducing digester residue influents into the algal culture, thereby recycling the fertility elements and thus increasing the energy fixing capacity of the ponds. Studies of the practicability of recycling digester residues were undertaken and it was found to be feasible on a laboratory scale (Oswald and Golucke, 1960). This is a promising method for producing electricity from solar energy, became available for evaluation.

(ii) Production of cheap algal protein (Oswald, 1962)

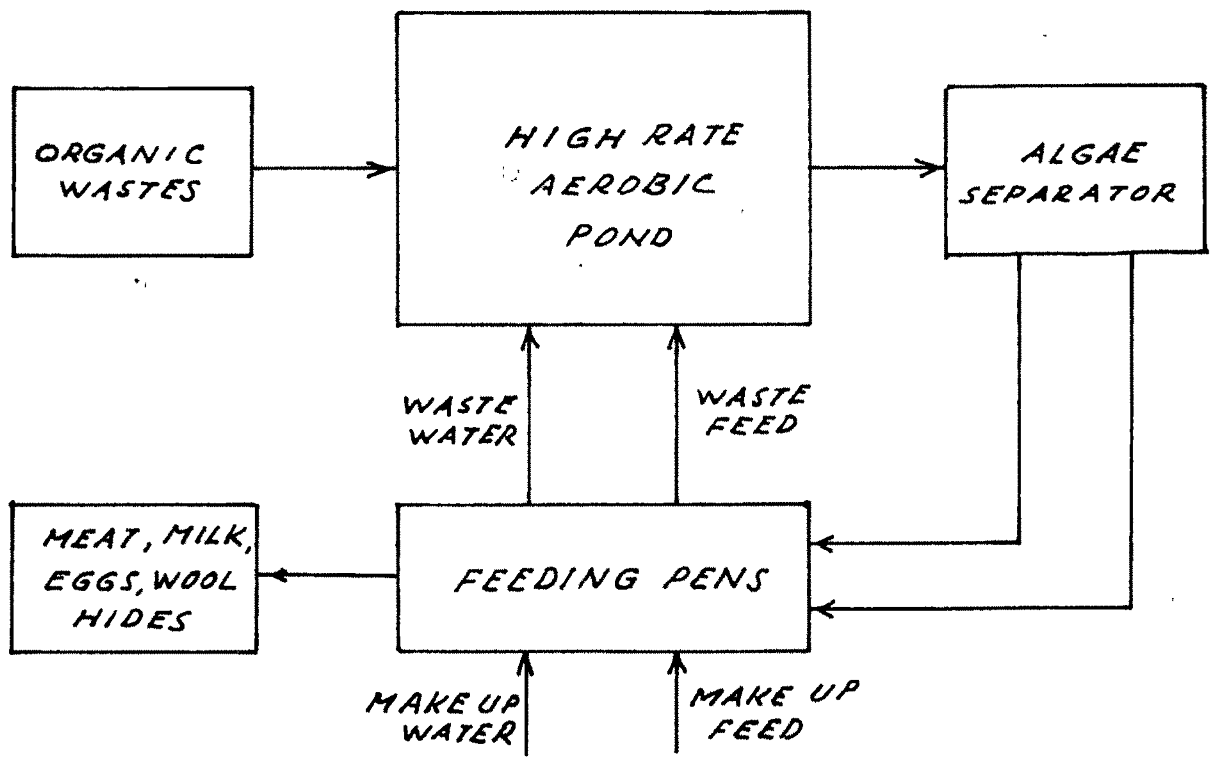
Large scale production of algae at the extremely low cost required to make economically feasible the production of power through algal digestion necessitates highly specialized pond design and operation criteria. The development of these criteria was accomplished in a series of studies at the University of California over a period of a decade. Information gained from the laboratory and pilot plant studies at the University, together with that from the numerous other excellent studies of algal cultivation in organic media carried out at other centres (Burlew 1953; Tamiya 1957) make it possible to define a number of clearly essential and fundamental operational criteria for the culture of algae in organic organic wastes.

(iii) Preventing eutrophication of receiving waters: (Oswald, 1962)

The older conventional methods of secondary treatment like the activated sludge and trickling filter processes produce effluents which produce uncontrolled multiplication of algae in receiving waters. But the effluents from high-rate aerobic oxidation ponds, having produced one crop of algae in the ponds, and their effluents thereby usually depleted of algal nutrients, will not produce a second crop of algae if admitted into receiving waters. The effluents from high-rate aerobic ponds

FIG. 19

ANIMAL PRODUCTS PRODUCTION COMPLEX USING HIGH-RATE OXIDATION PONDS AND CLOSED CYCLE CONVERSION OF ORGANIC WASTES



are more ideally suited for discharge into natural waters in which algal growth has frequently been a source of nuisance.

(iv) Helpful in softening hard waters: (Oswald, 1962).

For hard waters containing a significant amount of salts of calcium and magnesium which constitute the major elements of permanent hardness, the method of high-rate aerobic oxidation pond may be used to bring about a significant degree of softening. The increased pH resulting from various algal photosynthesis causes the precipitation of $Mg(OH)_2$ and complexes containing Ca, Am and PO_4 water softening is the result. About 50% of permanent hardness may be removed in this manner.

(v) For establishing industralised food production complexes:

Oswald (1962) has visualised new possibilities of establishing industralized food production complexes with unusual properties. He has shown one such hypothetical system schematically shown (vide Fig.19):

Organic wastes are diverted into shallow ponds in which algae are grown for harvest. Harvested algae, together with supplemental food, are fed to animals which in turn produce meat, milk, eggs, wools, hides and other products useful to man. All useful products are removed from the system and all wastes, such as urine, manure, wash water, meat trimmings and dressings are returned for biological conversion to algae and reuse in the cycle.

(vi) <u>Economics of Nitrogen utilization of high-rate aerobic oxidation ponds and in conventional agriculture</u>. (Oswald,1962).

In conventional agriculture 5 lbs of N are required to produce 1 lb. of eggs or meat and 4 lbs. are lost as waste. But in a controlled photosynthesis complex, 2 lbs. of newly introduced N are combined with 3 lbs. of reclaimed N from 5 lbs. of feed N. As in conventional agriculture, after feeding 1 lb of egg or meat 4 lbs. of waste are obtained. However, of these 4 lbs. of waste N 3 lbs. are converted back to feed, and only 1 lbs goes to waste. Thus in such a problem producing complex, 50% introduced into the cycle appears as useful products, whereas only 20% is converted into useful products in conventional agriculture. Similar cycles could be shown for milk, wool and other animal products. According to Oswald computations shows that 5 million acres of algal-animal cultures will meet the entire protein needs of the U.S.A., whereas 300 million acres are now required with conventional agriculture. The economics resulting from waste disposal and water retention by means of high-rate aerobic ponds would be the incidential benefits of such complexes.

(vii) Salvaging sea water for algal protein. (Oswald, 1962).

In coastal town sea water can be mixed with the town sewage or other organic wastes in high-rate aerobic oxidation ponds for producing dense crops of various types which can be harvested for algal protein. In this way nearly a third of the sum total of fresh water resources can be diverted to purposes other than protein production.

In brief researches to-date on **high-rate aerobic** oxidation ponds carried out by Oswald and his associates in the University of California go to show that it is technically feasible "to treat wastes, to reclaim water, to render water organic material suitable for use as an animal feed stuff, to obtain unprecendental yields of protein per acre of pond surface in either fresh or saline waters and to produce electrical power from Sunlight using organic wastes as a medium" (Oswald, 1962).