

## Chapter III

### EXPERIMENTAL INVESTIGATION

#### In - Plant Study

The processing line of soya - bean cake factory was studied, and the sources of wastes discharged were investigated. The volume of water used and waste discharged were determined.

#### Waste Water Sampling and Analysis

Composite samples were collected every hour during six hours operation at the same point and analyzed for COD, BOD<sub>5</sub>, total solid, settleable solid, suspended solid, ammonia nitrogen, organic nitrogen, phosphorus, and pH. The methods of analysis were conducted according to Standard Methods for the Examination of Water, Sewage, and Industrial Wastes.

Some characteristic was evaluated to unit emission rate

#### Analysis of Treatment Alternative

According to wastewater characteristics, the unit process is selected to study.

### Laboratory Evaluation

The study covered plain sedimentation as primary treatment process and activated sludge as secondary treatment process. Biological treatability study was necessary to determine whether or not the waste water was amenable to treatment with biological process.

Plain sedimentation Composite waste in the container was thoroughly mixed and transferred to 5, 1-litre beakers which were set up to contain samples for 0, 15, 30, 60 and 120 minutes settling time. After the specified time interval, the upper 250 ml in each beaker was decanted and analyzed for COD, BOD<sub>5</sub>, suspended solid, total solid, ammonia nitrogen, and organic nitrogen. The percentage removal of COD, BOD<sub>5</sub>, and suspended solid were determined to select the suitable detention time.

Biological treatability study The batch - fed unit used in this study is shown in Fig 1. The system should be started on a feed containing about 1,000 mg/l of COD. In the system, nutrient and oxygen must be sufficient for biological degradation and the pH must be near neutrality. The pH was raised by adding  $K_2HPO_4$ . The unit was seed with sewage. Acclimation procedure based on fill and draw was carried out by feeding 10 per cent of waste water on the first day and increasing 10 per cent of wastewater per day. The system

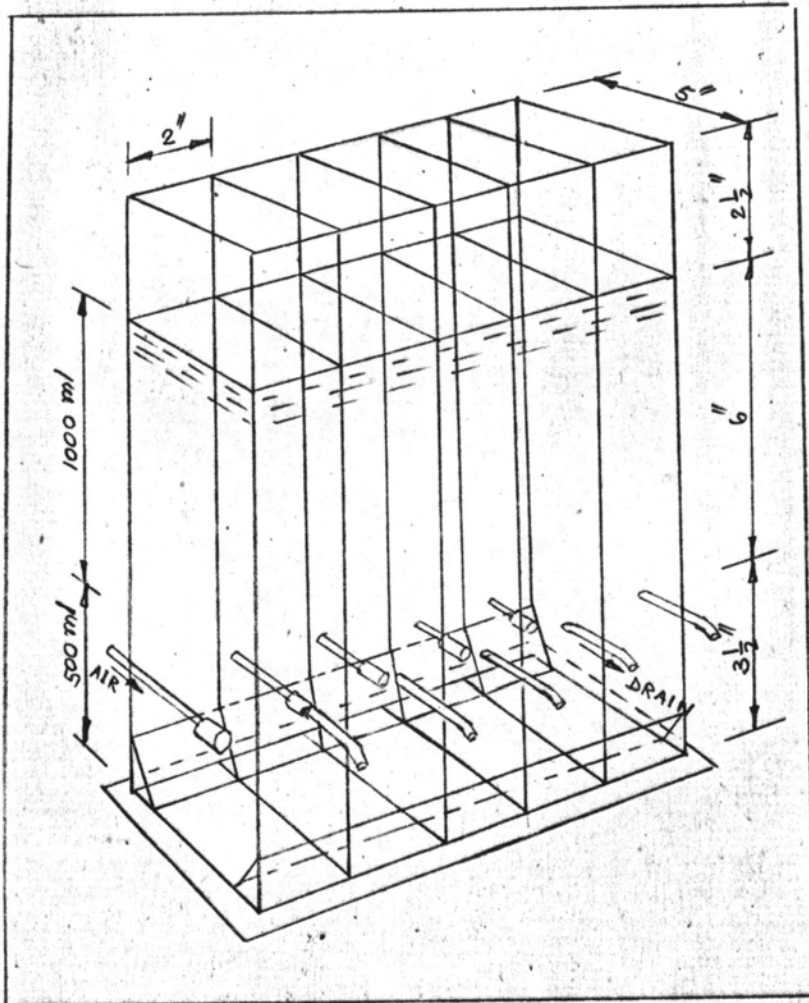


Fig.1 Batch-fed Activated Sludge Unit

should then be settled and refed daily until the MLSS has reached about 1500 to 2000 mg/l. When MLSS reached the desired level soya - bean cake waste water was poured into the unit. After 23 hr. aeration, air supply was stopped and mixed liquor was allowed to settle for 1 hr., clear supernatant was taken to determine for COD. The percentage of COD removal was determined to estimate the biological treatability of the waste.

Batch-fed activated sludge process study In the system, the MLSS was in the range of 1000 - 3000 mg/l, the nutrient and oxygen were over minimum requirements. The pH was raised by adding  $K_2HPO_4$ . The settled waste was analyzed for COD and pH before aeration. At 0, 30, and 60 min, 2, 3, 4, 6, 8, 10 and 23 hr. after aeration, samples were taken to analyze for suspended solid, volatile suspended solid and soluble COD. Some design parameters for activated sludge process were determined according to Eckenfelder's Mathematical Approach.

Continuous - fed activated sludge process study The continuous - fed unit used in this study is shown in Fig 2, The unit consisted of aeration and settling compartments separated by a baffle, an aeration tank volume of 2 liter and a settling chamber of 0.5 litre. Deflector between aeration

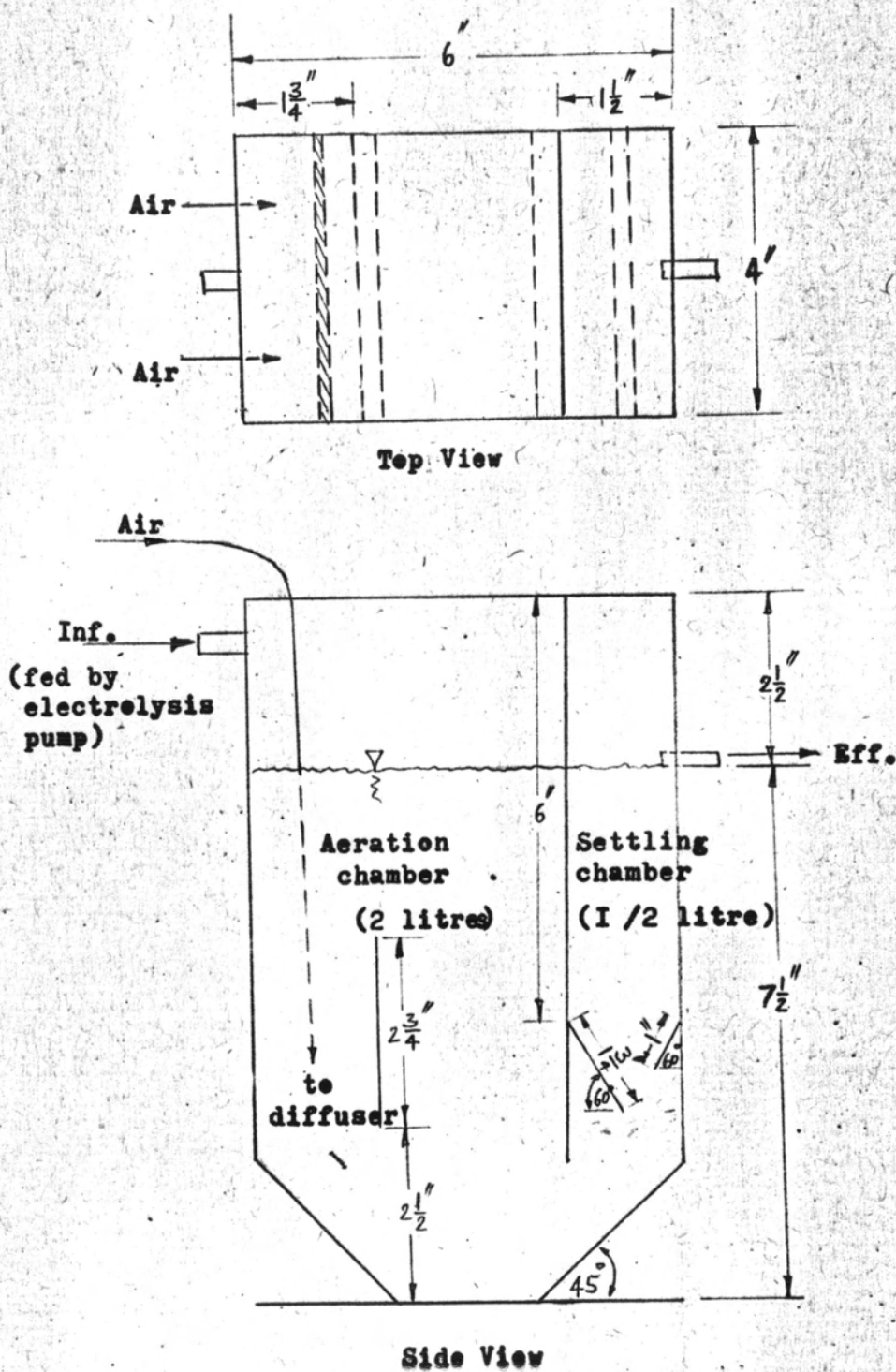


Fig.2 Continuous-fed Activated Sludge Unit

and settling compartments was adjusted to 60° angle to prevent air disturbance in settling chamber and to provide sludge in settling chamber enter aeration chamber, assuming 100 per cent returned sludge. Six diffusers were used to supply air. The total air diffused was 8280 cc/min. which make dissolved oxygen in aeration chamber saturated. The influent was discharged to aeration chamber by means of electrolyte feeding which can be adjusted to the desired loading. Platinum wires were used as electrodes and 2%  $H_2SO_4$  as electrolyte.

The normal organic loadings for a continuous complete mixed activated sludge for domestic sewage range from 0.5 - 0.7 kg  $BOD_5$  per kg MLSS per day. So the applied loading was started at about 0.2 kg COD/ kg MLSS - day and was increased until difficulties occurred. Because of sufficient nutrient requirement, only  $K_2HPO_4$  was added to the settled waste to rise pH to neutrality before discharging to aeration chamber. The influent COD and suspended solid must be determined. At any particular loading rate, MLSS, MLVSS, COD and suspended solids of effluents from settling chamber were determined when the system was in the steady state. Sludge accumulation and sludge volume index were also determined. The sludge must be removed to maintain MLSS about 2000 - 3000 mg/l.