

OPERATING EXPERIENCES WITH ACTIVATED SLUDGE PROCESS FOR FACTORY WASTES*

BY GEORGE W. FULLER
Consulting Engineer, New York City

ON the outskirts of Boonton, N.J., the E. A. Stevenson & Co., Inc., have a plant for refining crude coconut oil and the manufacture of cooking oil, soap bases and butter from coconut oil and milk products. The refined product is marketed for the most part as an edible oil of a melting point of 76 to 92 degs. F. under the trade name of "Cobee," and as nut margarine under the trade name of "Spredit."

Character of Wastes

The average amount of combined wastes to be dealt with from the factory is about 150,000 gals. daily at rates ranging from about 30,000 to 300,000 gals. daily, and at an average temperature of 40 degs. C. Some 100,000 gals. of clean, hot, condensing water was diverted to a nearby brook as part of the treatment program.

Refinery wastes, about 70,000 gals. daily, and discharged at rates varying from 20,000 to 100,000 gals. daily consist for the most part of condensing water with which is discharged some 450 gals. of volatile oil. Some of this oil combines with caustic soda used in the process and forms a liquid soap. Probably 70%, or some 315 gallons of this oil is recovered in the grease traps. These wastes are discharged every day of the year, 24 hours a day.

Charcoal is often and Fuller's Earth always present in these wastes.

The average temperature of the refinery wastes is about 50 degs. C., but are often as high as 70 degs. or more.

The dairy wastes discharged during 8 hours of 6 days in the week consist on an average of about 50,000 gals. of milk and churn wastes, containing some 1,000 gals. of buttermilk, 20,000 gals. of floor and apparatus washings and 1,400 gals. of acid wastes daily. Maximum rates are about double the average rates, although milk and churn flows are often three times the average. Dilute sulphuric acid from the digestors is discharged with these wastes intermittently in amounts varying from 700 to 2,000 gals. daily, the strength ranging from 100 to 3,000 parts per million. The actual rate of discharge is about 100 gals. per minute, the operator at the plant being notified in advance to allow him to by-pass them to the re-aerating tank for treatment.

Toilet and wash room discharges from the 200 employees at the factory amount to about 10,000 gals. daily.

Dairy wastes are conducted to the plant through a separate pipe and discharge into the inlet trough to the aerating tanks without preliminary treatment.

Former Disposal Experiences

Previous to the installation of the present treatment works, waste matters from the refinery and dairy and condensing water were discharged together into a grease trap of about 20 minutes' capacity at average rates. From this trap they were conducted to lagoons roughly formed with cinder banks, the discharge from which was over weirs protected by scum boards to hold back the grease and oils to a small brook leading to a mill pond and ultimately into the Passaic River. There was more or less sedimentation of the heavier matters, charcoal and Fuller's Earth, by this process and a large proportion of the floating oil was removed by skimming.

Toilet and wash room wastes were discharged to two cesspools which satisfactorily disposed of them.

Pollution of the brook resulted in complaints from property and mill owners and ultimately required improvements in the method of disposing of these wastes. The writer's firm was called upon late in the autumn of 1918 to advise as to remedial measures.

The desirability of minimizing the investment for obtaining the necessary treatment of the wastes sufficient to avoid difficulty from a suit brought by riparian owners below

as well as the restricted area of available land and the oily nature of the wastes brought about a decision against filtration as a finishing process and a resort to the activated sludge process with such operating procedures as the local conditions demanded.

New Treatment Works

The plant as constructed consists of preliminary grease traps, aerating tanks, re-aerating tank, final settling tank and necessary operating appurtenances.

During the construction of the plant the jet condensers used in the refinery were replaced with surface condensers and this hot condensing water diverted through a new pipe line directly to the brook. This eliminated some 100,000 gals. of hot water which would have required cooling to prevent destruction of bacterial growths in the aerating tanks.

An attempt was also made to store and neutralize the acid discharge, but this was later abandoned for the procedure described beyond.

The new grease traps supplementing the old one are in three units of a total capacity of about one hour's flow at normal rates or about 5,000 gals. They are each 10 ft. in length, 6½ ft. in width with a sloping bottom to flow-off drains allowing for an average depth of 3½ ft. wide.

The aerating tanks are in two units of a combined capacity of about 45,000 gals., each of them being 30 ft. long, 10 ft. deep and 10 ft. wide.

To insure thorough mixing of the activated sludge with the wastes treated, vertical baffles were placed across the aerating tank. The baffles are 3 ft. apart longitudinally, with a waterway 2 ft. deep, alternately above and below them.

The re-aerating tank is 30 ft. long, 5 ft. wide and 10 ft. deep and contains about 11,000 gals.

The final settling tank is of the Dortmund type to provide for a vertical upward flow. It is circular, 11.2 ft. in diameter, 10 ft. deep to the bottom of the cone and with capacity of about 6,000 gals. The sewage enters the tank through a 12-in. vertical trough enlarged at the lower end to about 2 ft. square; the discharge is 6 ft. below the water level; the outlet is over weirs to troughs placed near the side of the tank.

Provision is made for the introduction of milk of lime at the inlet to the aerating chambers and also to the final settling tank. The former is to correct acidity and the latter to facilitate clarification.

Air Supply and Piping

Air is supplied from two motor driven No. ½ Root blowers, each of a normal capacity of 150 cu. ft. per minute at 5 lbs. pressure. Main air piping to the tanks is 4-in. wrought iron pipe with 2-in. drop pipes in duplicate to 1-in. air distribution grids. These distribution pipes are spaced 12 ins. apart, with ¼-in. circular openings spaced 3 ins. apart and staggered on the lower quadrant of the pipe. Sludge is pumped by a 4-in. air lift discharging to a trough from which the sludge can be delivered either to the re-aerating or aerating tanks as desired. The blowers after operation for three months showed a serious reduction in capacity and arrangements are now being made for furnishing air from the main compressors at the factory and which with regulating valves will provide for an available pressure up to 100 lbs. if desired. This change will overcome irregularities in blower performance and assist in maintaining the air pipes free of clogging.

Clogging of the air pipes has been caused more by the settlement of heavy suspended matters around them during the early period of operation when experiments with humus, peat, etc., were being conducted, than by solid matters entering the openings in the pipe. Filtros plates and other similar devices were considered for air distribution but rejected because of the unusual quantity of grease and oil in the waste to be treated and which it was feared would clog the pores of the plates. While the comparatively large openings in the distributing piping compel the use of a greater amount of air than would have been the case with filtros plates, it also provides for ease in cleaning out these openings by the use of air under pressure. Experience has shown that it is

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