

utilize the nitrogen and grease found in it to the best advantage. Some boards might say that they have done all that is required of them by controlling effectually an enormous potential nuisance, such as is represented by arresting from 300,000 to 400,000 tons of sludge and converting it into a non-smelling dry substance (which under no circumstances can be reconverted into malodorous sludge) without establishing a huge municipal trading concern for the recovery of waste products, but the Drainage Board realize the possibility of doing more than they have done, and further that it is their duty to do more if that is possible, and with that in view they entered into a contract with the Anglo-Continental Fertilizers Syndicate, Ltd., just before the war began, by which that company agreed to treat about one-fifth of the Birmingham sludge with the view of recovering from it both fats and fertilizers, but chiefly fertilizers. The outbreak of war upset the project for the time being, the Treasury absolutely forbidding the expenditure of money on work of this kind, with the immediate result of encouraging the gas works experiments, which have turned out as well, and now that the war is over the company's plans are to be put into the hands of builders whose initial work is essential before the company can begin to fulfil their agreement.

#### Fertilizer Company's Scheme

The scheme put forward by the company is one which the author hopes to deal with in a subsequent communication, but briefly it is as follows: The sludge is warmed to a temperature of about 90°F., when a small amount of yeast (from 0.5% to 1%) is added, and the mixture allowed to remain in suitable tanks for a period of 24 hours, provision being made to keep the mixture at the optimum temperature of 90°F. As the result certain important changes take place in the character of the sludge, the particles coagulating into a compact mass which separates from the water and rises to the surface, being buoyed up by the gases evolved from the ferment. The water is run off through perforated pipes, which, whilst allowing the liquid to pass, holds back the thick sludge, and enables the separation of the water from the sludge to be effected easily and quickly, and with a minimum of labor.

Some changes other than physical are brought about by the process, and the colloids are affected to some extent, with the result that the sludge is improved for subsequent treatment.

Fermentation reduces the sludge from, say 90% water content—which is the average of ordinary sludges—to 80%, equal to the reduction of one-half the water content, thus reducing the cost of treatment. The operation being a static one the cost of working is small.

The heat used for warming the sludge is obtained from the drying process, and may be either furnace gases, or hot air and vapor from the dryers, which would be otherwise wasted.

#### Product Reduced to Powder

The further treatment of the sludge depends to some extent on local conditions. Moisture may be got rid of by treatment in dryers heated by means of hot air, by direct heat, or in steam-jacketed drying-pans. It can also be reduced to about 50% by an intermediate process of pressing in ordinary sludge presses, and the cake, after being broken into small pieces, finally dried to a moisture content of from 10% to 15%.

The product is reduced to a fine powder for easy application to the land; it is then in a suitable condition for further treatment if grease is present in sufficient quantity to justify its recovery.

This process is too complicated to be disposed of in a few sentences, and the writer proposes to give a detailed account of it when the works are erected and in full operation.

In the end of 1918 a committee appointed by the Institution of Municipal and County Engineers impressed upon the government the need for investigating the whole question of recovering from sewage sludge products which are worth salvaging. One of the government departments (the National Salvage Council) had already made preliminary

inquiries at the Bradford and Huddersfield sewage works, which convinced them that grease was being recovered profitably at both of those works, and the reply of that department was both prompt and sympathetic; later, the Board of Agriculture and the Local Government Board took cognizance of the institution's demands, and in consequence a committee was formed consisting of one representative of each of the following—viz., the Local Government Board, the Board of Agriculture, the National Salvage Council, the Institution of Municipal and County Engineers, and two experts on the salvage of grease from sewage sludge—the one an engineer and the other a chemist.

This committee, formed under the ægis of the government, has just issued their report, from which the writer makes the following extracts, with the cognizance and approval of the Assistant Director of the National Salvage Council, who acted as chairman of the committee:—

"We recommend that inquiry should be instituted in other towns\* as to the grease content of local sludges, as we are of opinion that where a sludge after acidification contains 15% of grease calculated on a perfect dry basis, it is profitable to recover the grease, provided the selling price is not less than £15 per ton and 100 tons of wet sludge are available for treatment daily. In these figures no note is taken of the value of the dried degreased sludge; but this is saleable, and provided the nitrogen content is 2% or more, has a market value of 10s. to 30s. per ton.

"We are satisfied that there is a shortage of organic fertilizers in the country, and that it is likely to continue.

#### Nitrogen Lost by Delay

"It may be taken that the amount of wet sludge produced annually in England and Wales is roughly about 250 tons per thousand of the population drained. Assuming the population drained to treatment works to be 24,000,000, the average quantity of wet sludge produced annually is about 6,000,000 tons, equal to 600,000 tons dry matter (based on 90% moisture in wet sludge), of which quantity we estimate from the data before us that not more than 12½% is utilized for fertilizing purposes.

"We are of opinion that although the sludge, as at present disposed of by local authorities after air-drying or pressing, does not contain sufficient nitrogen to enable it to compete with artificial fertilizers in manurial value, there is sufficient nitrogen in the fresh sludge, as it is removed from the tanks, to give it a definite fertilizing value. We are further of opinion that considerable quantities of nitrogen are lost by delay in disposal, in some instances as much as 50% or more of the original quantity in the sludge, and that the nitrogen so lost is the most valuable from the point of view of the possible fertilizing value of sewage sludge.

"We consider that before any attempt is made to impress upon local authorities the advisability of utilizing sewage sludge as a fertilizer, efforts should be made to increase the manurial value of sludge by some method of treatment designed to fix more of the original nitrogen in the sludge. If this could be done, it would probably add a value of 10s. per ton for each additional per cent. of nitrogen retained in the sludge for use as a fertilizer. In this connection it has to be borne in mind that at the present time many local authorities are not only unable to sell the sludge, but in some instances are called upon to pay for its removal from the works even after it has been pressed into cake.

#### Activated Sludge More Valuable

"We recommend that controlled experiments be carried out on a suitable scale at selected disposal works in order to ascertain the best method of dealing with sludge so as to retain as much as possible of the original nitrogen and produce a fertilizer or fertilizer base.

"We have not specifically inquired into the results to be obtained from sewage treated by the activated process, but as a result of visits made by the committee to the Manchester

\*Reference had been made to towns engaged in the woolen industries.