Disposal of Sewage by Treatment With Acid

Miles Process Is Worthy of Consideration for Cities Where Large Volume of Strong Sewage Is Discharged—Causes No Local Nuisance—Paper Read Before the Boston Society of Civil Engineers—Removes 99 Per Cent. of the Bacteria

By EDGAR S. DORR† and ROBERT SPURR WESTON‡
Boston, Mass.

IN the sewage disposal realm, several ideas struggle for mastery: first, that of the economist, now many years old, that the enormous loss of fats and fertilizer caused by the discharge of human wastes into our rivers and oceans should be prevented; second, that of the sanitarian, that human excrement should not endanger human life; third, that of the lover of beauty, that nuisance and unpleasantness should be avoided; fourth, that of the engineer, that the ends of health and beauty should be obtained efficiently and economically; and fifth, that of the citizen, that he should not pay an excessive price for benefits received.

The enormous values of the products wasted with sewage have allured many engineers to attempt to recover them, as the hundreds of descriptions of patents, processes and plants, in the scientific literature of the past twenty-five years, testify.

Quite recently Dr. Samuel Rideal¶ has estimated that, from the camps in England, 40,000 lbs. of fat might be recovered daily, and from the rest of the population, 400,000 lbs. daily. Dr. Rideal also states that the pressed and dried sludge from the Dresden sewage contained 13.4 per cent. of fat, which was extracted by ethylene chloride. It has been reported that during the war many other German cities have used sewage as a source for fats; also that the city of Stockholm, Sweden, has done the same. Although these were war-time measures, the possibility of recovering the 7,300 tons of fats and the 27,000 tons of fertilizer discharged annually with the Moon Island sewage is alluring as a peace-time practice.

What has been the result in normal times of the many attempts to recover valuable products from sewage? The Chinese and others have made use of human excrement for fertilizer, and evidences of the practice are carried away in the nostrils of travellers from the Far East; but so far there are only two methods of disposal for water-borne wastes which have shown a real profit in practice, namely, farming with sewage irrigation in arid districts, and the acid process when applied to wool-scouring waste or to sewage consisting largely of wool-scouring waste, as at Bradford, England. During the war the profits of the Bradford plant were very large.

Sludge Treatment

While so far the efforts to recover fat and fertilizer from ordinary aqueous sewage have not proved profitable, several note-worthy attempts have been made to recover valuable by-products from the sludge from plain subsiding basins. At Cassel, Germany, sludge so produced was heated to boiling, acidified, filter-pressed, dried, and the grease then extracted from the dried mass with benzine. The extracted grease was then distilled with superheated steam. This plant failed to pay the cost of operation, notwithstanding the fact that the dried sludge contained 18% of grease, and the wet sludge produced 10% of cake, having a fertilizer value of 32.5 cents per 100 lbs. in addition to its grease value. (The distilled grease sold for $4.87, and the tarry residue left behind in the still for 41 cents per hundred pounds. The yield of the refined grease was 60% of the crude.§)

Experiments were conducted at the city of Frankfurt‖ to determine the feasibility of recovering the values contained in sludge. They are of chief interest in connection with this article in showing that the sludge when acidified with sulphuric acid yielded three times as much grease as the unacidified sludge.

In Wolverhampton, England, a process has been adopted based upon experiments of Dr. J. Grossman, of Oldham, England. The process was patented in 1908.* The sludge is partially dehydrated by adding 0.3% by weight of sulphuric acid to the sludge precipitated in the subsiding basins. After treatment with acid, the clear liquid is drawn off from beneath the scum, leaving a concentrated sludge, said to contain 75% moisture. This acidified and concentrated sludge is distilled with superheated steam in an externally fired, cylindrical still containing a hollow agitator with perforated radial arms through which superheated steam is passed. The process is reported profitable.

In addition to the above, many attempts have been made to utilize the sludge from chemical precipitation plants, using lime and ferrous sulphate as precipitants, but so far they have been unprofitable.

Biological Process.

In recent years engineers have turned very generally to the biological process of sewerage purification, chiefly to the method of disposal by bacteriological oxidation. In doing so, they have planned their works to oxidize the organic matter contained in sewage and to reduce the sludge by digestion. The plan has been considered most successful which produced most economically the highest degree of oxidation, or, as often expressed, the highest degree of nitrification, also the least and the least offensive sludge. The plant which best embodies these ideas comprises an Imhoff tank and a bacterial filter bed.

With one exception, no by-products of any considerable value can be recovered to offset the cost of treatment by oxidation. The one exception is the activated sludge process. This is a combination of a physical and a biological process, in which part of the organic matter is destroyed and a very complete separation of the suspended and liquid portions of the sewage is brought about. The process has the further advantage of producing an effluent of good appearance and low bacterial content, which can be discharged into many bodies of water with impunity. This feature and that of easy sludge separation have stimulated engineers to recover the fat and fertilizer values which exist in the bulky activated sludge. It is claimed by many that products of enough value can be recovered to gain a small profit over and above the cost of handling the sludge, but this value will not entirely offset the cost of the whole process. However, it will probably outweigh the cost of sludge disposal. The whole process marks a notable advance. It may be regarded as the climax of the biological processes, and if the net cost, including the cost of aëration and recovery of valuable products, may be brought within reasonable limits, the process may be applied in many cases where the conditions are favorable. It is not applicable to sewages containing those manufacturing wastes which retard bacteriological action.

The activated sludge process, and one other process to be described shortly, have served to re-stimulate interest in the possibility of recovering enough valuable products to

† Engineer of Sewer Service, Public Works Dept., Boston.
‡ Of Weston & Sampson, consulting engineers, Boston.
¶ Rideal, S., 1916. Recovery of Fats and Nitrogen from Sewage. Proceedings, Association of Managers of Sewage Disposal Works, 59, 571.
§ Hopfner and Paulmann, 1902. Die Verarbeitung der Ruckstande aus der Schmutzwasser Reiningungsanlage der Stadt Cassel. Mit, a. d. Konig. Prufungsanstalt f. Wasser, und Abwasser, 1, 146.
‖ Bechold, 1899. Untersuchungen an dem Klarbeckenschlamm zu Frankfurt a. M. Zeitschrift fur angewandte Chemie, 12, 849.
* English Pat., 16, 397, August 4, 1908.