The saponifiable matter in each case consists for the most part of free fatty acids and a very small portion of neutral grease or combined glycerines. This is, of course, anticipated by the fact that the greater part of the grease present in sewage sludge comes from hydrolyzed soap solutions, or through the action of bacteria and ferments, neutral grease has been broken down into fatty acids and glycerine. In any event, the neutral grease present gives no hope of glycerine recovery, so at once the so-called grease falls into the grade of poor-class fatty acid stock. Of the total fatty acids present in a number of analyses, from 1 to 15% of the total consist of rosin acids. These again are from the soap solutions.

The unsaponifiable matter varies from 10 to 30%, but a majority of samples analysed show an average of 20%. As may be supposed, the lowest percentages are found in strictly domestic sewages, where they are traceable to body waxes and products of physiological action. In mixed sewage from manufacturing towns, the unsaponifiable is highest, as it is made up of mineral oils thrown out from different factories, wells, etc.

A small percentage of metallic soaps of calcium, iron, aluminum and magnesium are present, but upon proper treatment are broken down into fatty acids and mineral salts, washed out as sulphates or chlorides (depending upon the sort of acid used for refining).

Very Low-Grade Material

From these premises it is necessary to conclude that sewage grease can be regarded only as a very low-grade fatty acid stock containing 70 to 75% of fatty acids and 25 to 30% of unsaponifiable. These fatty acids, depending on the sewage from which they are extracted, will vary in color from a dark ruby red to a black, tarry-looking mass. In consistency the variation is between a soft, buttery mass and a hard, solid cake. This is quite readily explained; the former is very high in fluid mineral and industrial refuse oils, the latter from domestic sewage in which the high-melting-point fatty acids have been hydrolyzed and precipitated from the soap liquors, whereas the oleic-acid soaps or oleic acid present in mixed soaps, remain in solution and pass off with the effluent.

Fatty acids of this type have no legitimate market at this time. Such materials are only valuable as they are refined and made into marketable products. A purchaser of sewage grease would have to expect by his own efforts to give it all of the value it might ultimately have, and having created something out of nothing, he would care to pay little for the raw material. That sewage grease in refined or manufactured form has value is not to be questioned. Such a grease as that indicated by the analyses of Pleasantville sludge grease, upon distillation in the manner usually employed for fatty acids, gave the following yields:—

Light colored distillate,	85%
Still returns,	6%
Stearine pitch,	6%
Loss,	3%

The distillate was orange yellow in color and of high titre, and upon pressing gave 50% of good colored stearic acid of titre 53.3C., and 50% of red oil containing 38.25% unsaponifiable. Upon pressing, all unsaponifiable matter passes out of seeded or crystalline cake in the red oil, leaving good stearic acid behind. This red oil is marketable for grease-compounding and as wool oil. In other words, sewage grease must be manufactured to have value. Once its value is established, a market will be automatically created for the raw grease.

Shall Municipalities Combine Efforts?

Upon whom shall the burden of carrying out these operations fall? Shall each sewage plant carry out the whole work from sewage to finished product? Shall a number of sewage plants pool their sludge, or their raw grease and tankage, and finish at a central plant, or shall a number of plants interest directly a corporation or individual able to carry out the refining operation? At this point sewage sludge ceases to be a problem for the scientist and becomes a purely business proposition.

Returning to the question of disposition of the tankage, it would require considerable propaganda to place upon the fertilizer-goods market a low-grade 3% ammoniate, cursed with the name sewage sludge, though in the old days of poudrette it had an enhanced value in the public mind far greater than its chemical value indicated. The great diluent of sewage tankage is insoluble ash or mineral matter, running from 40 to 70%, with 60% as an average. It is not impossible to concentrate this, though methods are not yet complete for doing so. A number of experiments conducted by the University of California indicate that for percentage of nitrogen contained, degreased sludge has higher plant-food value than that in dried blood or high-grade tankage.

Even with reasonable markets for the tankage and grease, it is a question whether it is possible to recover enough materials to defray the cost of the operation. In the opinion of the writer, and from experience in the garbage-reduction business, it does not seem impossible, though there would be little margin of profit left. But the sludge would be disposed of, its disposition paid for and a large amount of needed materials returned to active use, assisting in helping out the world's supply of chemicals and greases. The individual city would receive no monetary return, probably, but virtually to create actual concrete products of economic value, to pay for the creation and at the same time solve a troublesome disposition problem, is something well worthy of consideration.

With ordinary sedimentation of suspended solids, it is not at all unreasonable to expect from the sewage of a town of 150,000 people, daily recoveries of 5 tons of tankage and 1 ton of grease. There are many towns of this size. Any city of this class which can return to a useful cycle $50,000 worth of needed materials annually should consider well the disposition of its sludge pile.

Solving the problem of sludge disposition is not impossible, but it is difficult. No chemist, engineer, business man or politician can solve it alone. That co-operation which has not existed must first be accomplished before there may be any hope of solution.

Approximately 100 miles of road have been resurfaced this year in Elgin County, Ont., and eight culverts and two bridges have been built. The total expenditure on construction, maintenance and overhead has amounted to about $140,000.

Four by-laws have been passed in Calgary, voting $350,000 for a sewage disposal plant; $278,316 for extensions to the waterworks system; $155,978 to be added to a sum previously voted for building a concrete bridge to replace the Louis bridge over the Bow river; and $155,000 for a fireproof addition to the hospital.

Hon. Peter J. Veniot, minister of public works in the New Brunswick government, speaking at St. John, N.B., stated that New Brupnswick, of all provinces in Canada, is the only one that constructs and maintains its roads entirely from provincial funds. In the past three years, the sum of $2,125,000 has been spent on public roads, and it is hoped that during the next ten or fifteen years it will be possible to repair and maintain in good condition all the 17,000 miles of main trunk roads in the province.

With the intention of supplying Halifax with 7,800 h.p. at an estimated cost of $1,200,000, the Nova Scotia Power Commission has been authorized to proceed with the development of the water powers at St. Margaret's bay. The preliminary plans call for the establishment of storage dams at various points on the Northeast and Indian rivers. The water of the Northeast river will be collected by a head dam at Coon pond, and thence directed by a flume to a power-house at the head of Mill lake, where a head of 160 ft. will be obtained. The water of the Indian river, collected at a head dam at the foot of Sandy lake, will be directed to the same power-house, giving a head of 100 ft. A third flume will conduct the water from this power-house to a second power-house, which is to be established at tidewater, where the head is 90 ft. The power will be transmitted to Halifax on a wooden pole transmission line, 20 miles long.