from water closets, sinks, and also manufacturing wastes, and in those cities having the combined system of sewerage, various substances from the streets. The quality of sewage in different cities varies considerably, the difference being largely caused by the nature of the manufacturing wastes which are received into the sewers. A gallon of ordinary sewage contains about 100 grains of solid matter, 30 grains being in suspension and 70 in solution, 60 grains of which are mineral and 40 organic matter, the analysis of which would yield to each 100,000 parts the following results:

Total Solids.	Suspended.	Alum.	Free Ammonia.	Organic Ammonia.
140	40	20	5	1

What is required to be done is the removal of all matter in suspension and as much as possible of the organic matter in solution. The organic ammonia or albuminoid ammonia is generally considered by chemists to be the most reliable index of the amount of polluting matter present in the sewage. The removal of the suspended matter is at present best done by means of chemical precipitation, but the effluent so obtained still contains organic matter in solution, which unless discharged into a large body of pure water is liable to set up secondary decomposition. The removal of the organic matter in solution contained in the tank effluent may be almost completely done by filters composed of either coal, coke, polarite, land, etc.

The advocates of the biological method of purification say that the matter in suspension may be liquefied by liquefying bacteria, which are cultivated and sustained by the air and sewage contained in the filter, and by this means the sludge would be entirely done away with. But grave doubts are expressed by sewage experts as to the ability of these bacteria or micro-organisms to perform this office, or in plain language they do not believe that they can "get away" with the sludge, and the opinion is generally held that with average town sewage there will be the sewage sludge accompaniment. A writer on this subject facetiously remarked that if the bacteria can be utilized to eat up the sludge, what a pity it is they cannot be trained to drink up all the liquid.

TANKS.

Precipitation tanks are made both circular and rectangular—their capacity being based on the maximum daily flow of sewage. If the quiescent system is adopted the tanks should be so arranged as to permit the liquid sewage to have at least a rest of 1½ hours. If the continuous flow system be adopted, then sufficient capacity must be allowed so that two hours at least will elapse during the passage of the sewage through the tanks. Provision has also to be made for the tank when not in use, and for the first part of storms. Experience has demonstrated that they should be of medium size, as very large ones have been found more difficult to manage. The parts in contact with the liquid sewage must be smooth, and the sludge drains should have quick slopes towards the sludge well. Experience has shown that no danger from freezing may be apprehended in this latitude in winter time. The precipitants most commonly used are lime, alum, soluble salts of manganese, sulphate of iron.

FILTERS.

A well-designed and well-operated filter, all agree, is a most excellent and efficient purifier of sewage. Formerly it was believed that its action was merely mechanical, or that of a fine strainer. Subsequently it was found that those polluting organic matters in solution contained in the sewage which had an affinity for oxygen underwent chemical decomposition and were transformed into new products of an innocuous nature, and this result was brought about by minute living organisms called nitrifying bacteria, so that in fact the purification was chiefly due to these bacteria. A filter should be so constructed that air can permeate its whole structure. It must also have periods of rest. The most modern way is to allow the clarified tank effluent to completely fill the filter so that the liquid just appears over the top of the filter; after remaining there for about an hour it is discharged by opening a valve situated at the bottom of the filter. Very good results have been obtained, however, by allowing the sewage to be distributed over the surface of the filter by means of gutters, and allowing the liquid to filter slowly through. The filters should be several in number and each allowed a period of rest. The very best results have been obtained from filters composed of coal, the depth being about 4 feet and the sizes varying from ½ inch cubes to 1-16 inch cubes. It is said that coal produces a better effluent than any other substance experimented with, having a chemical as well as bacteriological action. I have been making experiments with coal filters and also with mixtures of coal and slag, and with sand and coke, and certainly the effluent from the coal filter is the best. It is necessary that all suspended matter be removed before the effluent reaches the filter. Sewage disposal has been more studied and has made more advancement in England, Germany and France than in any other parts of the world, but this has probably been caused, especially in England, by dense populations situated on the banks of comparatively small bodies of water (this does not apply to those cities situated on the seaside); whereas in America with the huge fresh water lakes and gigantic rivers into which the sewage is discharged, evil effects are not felt for many years, and it is only when the cities reach a large size that sewage purification becomes necessary and imperative. Now, both in the United States and Canada, cities and towns are beginning to feel the necessity of disposing of their sewage. Much may be learnt by experience gained in Europe, still I am of opinion that climatic differences and other purely local conditions will lead the American and Canadian mind, so prolific in invention, to perhaps improve on the European methods of purification, or at any rate to evolve some plans which will be particularly adapted to the needs of our climate and country.

The following practical deductions from the consideration of this subject suggest themselves: The sewage farm should only be selected when land situated near the city is suitable in character, and below or very little above the sewer outlets, and of reasonable price. If such land is not available and a high rate of purification is required, clarification in tanks by chemicals, followed by filtration, is the best plan. Collect by means of intersecting sewers all sewage to one station, so that all can be under one management. If part of the sewage needs pumping and part could be carried to purification station by gravity without pumping, then two stations might be the most economical. Such would be our case in Hamilton. In building a filter select the very best material, which I would say, without hesitation, is coal. It will give a better effluent and necessitate a less area than any other material.

The researches and experiments made by Mr. Adeney, of the Royal Dublin Society, on polluted waters, are of great value to the subject of sewage purification. He examined the gases contained in polluted water and the changes which took place in these gases, due to fermentation. These changes were caused by living organisms, and he discovered that it was necessary to supply them with oxygen in order to promote healthy bacteriolysis.