excrements, it is usual to calculate upon a basis of about 156 lbs. of solids and 200 gallons of liquids from each one thousand of population to remove daily. The sewage from clothes washing is very dangerous.

Disposal of sewage by broad irrigation over the top of land is neither efficient nor profitable in cold climates, because it takes a large space, and only about two gallons per yard per day can be put on, even when vegetation is active, because of the tenacity of the soil in holding moisture. Vegetation only takes up the manurial deposits, and the bacteria in the land must extract the foul gases or poisons, which they cannot do when the air cells of the earth get choked with fat and dirt. Then the bacteria cannot secure aeration, and so becomes useless. During heavy rains and hard frosts, the land is totally worthless as a filter or absorber of foul matter. When either irrigation land or artificial filters become water-logged too long they become asphyxiated, the organisms cease to act and oxidation is suspended until air can again be introduced to the filtrate to give vitality to the bacteria. On that ground irrigation through land can only be a success when the position is high and dry, and the water can freely escape at a depth of over four feet, and when it is composed of sand and gravelly soil. Under these circumstances, it will act as a bacteria filter, and can be made to purify sewage all the year round, by laying perforated pipes about every two feet, so that the fluid will be evenly distributed over the land. The pipes may be laid about fifteen inches below the face of the land, out of the reach of the frost in winter, and out of sight in summer, to prevent any nuisance, and to allow the land to be cultivated. By so doing, the moist air rising from the sewage will aid the vegetation growing on the surface. When this system is adopted proper arrangements must be made to discharge the sewage through the pipes at stated periods and equal quantities, giving the land periods of rest and sufficient time to secure aeration, and to supply the air to the underground pipes, flues and air circulating shafts must be constructed so that every part of the irrigating land, gravel and sand, also the microbes lodging in it, may be sufficiently supplied with oxygen. A firm in Ireland mix a solution of soda with the sewage, which it is claimed gives the bacteria all the oxygen they require without wasting time aerating. This is described elsewhere.

The marked success lately of the scientists has shown that all purification of foul fluids, whether accomplished by fresh water, by farm land, or artificial filters, is done by bacteria, and every method used to purify sewage must have proper provision made to supply these microbes with oxygen. By scientific management these friendly bacteria, which are humanity's scavengers, can be coaxed to eat up all the dirt and impurities in the sewage and discharge it into the atmosphere in the form of non-injurious gases, and by so doing saving the expense of handling the sludge.

This narrows down the art of cleaning foul fluids into being able to cultivate, to breed and use friendly microbes to advantage. When this is accomplished and the ditritus screens, the preparative storage tanks and the bacteria filters stocked with the friendly microbes and set in motion, it afterwards costs little to manage the treatment plant, for it can be made fully self-acting, only requiring the ditritus removed from the screens, and the grit removed from the syptic preparing tank about once a year.

There are several sewage purifying works constructed on the system just described working at present, and it will no doubt be generally adopted when properly understood. What is named the syptic tank, is placed underground and arched over, made air-tight and kept dark. The town's sewage goes in at one end and is almost motionless for a day, and during that time the coarser particles in suspension become deposited, and the putrefactive bacteria contained in the sewage are disintegrated, and a large portion of the inferior microbes disappear along with the sediment, after which it overflows over the opposite end, and is passed on to the bacteria filters.

Where convenient, towns should have separate drains for the collection of sewage, and they ought to be divided into small districts, each having its own sewage works. By adopting this plan only small main sewers would be needed, a better grade could be given, the sewage would arrive at the works in a fresher state, and on that account would be easier to treat, it would not have time to putrefy in the pipes, and the sewers would not need so much flushing, and the large trunk sewers might be dispensed with. By the new method of sewage purification the district plan can be easily carried out, because the whole sewage plant can be placed underground in public squares or other convenient places, out of sight and totally free from smell or nuisance, there being no machinery required or sediments to remove, and the first expense of plant will be less than by the old systems, and the cost of management after the system is put in full working order will be very small.

When proposing to lay down a sewage disposal plant there need be no stereotyped rule, nearly every place will require a little different method of arrangements in detail. The difference in the composition of the sewage, the geographical position and surroundings, and the amount of depth applicable, will each need to be considered in the style of construction. The general points to be secured are, first, that when a filter is started it must be stocked with sufficient colonies of the friendly bacteria; second, see that they are supplied at short periods with plenty of oxygen by a thorough aeration of the filter; third, never allow the filter to empty with a rush, because in that case some of the bacteria would be washed out of the filter. Rush the sewage on as quick as you please, but draw off the effluent slowly. Never allow the filter to be water-logged longer than the microbes can exist under water on the store of oxygen that is in the air cells of the filtrate and the little there may be in the fluid. Where possible to secure carbon made by carbonizing towns' garbage, use it for a filtrate. When these instructions are adopted the plant may be made to any design and placed in any position, either open or buried underground, and the results will depend on the amount of scientific management and good workmanship introduced into the construction, as to whether 200 or up to 500 gallons of sewage per superficial yard of filter space can be run through each day.

I have already described the preparatory settling tank into which the sewage first enters for treatment after being freed of all ditritus. The bacteria filter that purifies the fluid is simply a separator, that divides the sewage into small particles, and also constitutes a residence for the millions of bacteria which are brought into contact with each particle of sewage, on which they feed and from which they extract the foul gases. Any handy material that is easily wetted and easily dried and cannot be dissolved by chemicals, will answer for the filter, because it is not so much the nature of the filtrate, as it is the size, the thickness and the arrangement of the material in the filter, that is of the first importance. The best material is that which contains the largest amount of air cells to the cubic inch, in which the oxygen can be stored when the filter is getting aerated. Carbon is preferable because it is a better non-conductor than gravel, it also possesses the most air cells and is a natural deodorizer. Thus,