either charcoal, carbon made from garbage, coal, spar, marble or gravel chips, clinkers, slag, sandstone, gravel, coarse sand, hard burnt clay or cinders will answer to charge the filter with.

If there is about 20 feet of depth between the bottom of the outfall sewer and the high-water mark of the fresh water channel into which the clear effluent is intended to be discharged, a free hand can be used in the construction of the works to the advantage of the paymasters; but if there be only five feet between the two points, a plant may still be made to work without the aid of pumps or other water lifting machinery. In places where there are combined storm-water and sewage sewers, it is unnecessary to treat sewage when a violent rainstorm is on, except that portion which is forced forward at the first rush, and which is really the scourings of the drains, because when 25 per cent. of sewage is well mixed with 75 per cent. of fresh water it becomes harmless, because the bacteria that are always in fresh water are in the ascendant, and will devour the small amount of foul matter the sewage contains. But when sewage is emptied into fresh water without being properly mixed and shaken up, it holds itself apart, and the *bacillus coli communis* and fecal microbes rapidly breed and thrive with the help of the adjoining fresh water, and resist the attacks of the scavenger bacteria by keeping in a compact body.

Filters can be constructed so that a constant current of air will flow through the body of the filtrate, simultaneously with a flow of sewage continually passing on and downward through the filtrate; and where the space is limited and room for a syptic tank cannot be secured, then in place of the dark syptic tank an upward flow roughing filter composed of crushed clinkers will answer for the preparatory process.

I have recently received the plans of a very simple and inexpensive mode of purifying sewage that is continuous in action, and requires no sieves, or screens, or any attention. If the sewage is weak because storm water gets a little mixed in, it goes through a little quicker to make up for it. It is well understood that it is the top twelve inches of a filter that does the work, and that there the bacteria slime rests because it is there where the air can be got the easiest, so the inventor forces the sewage in at one end of the filter and it moves along under the surface to the other end and passes out, thus the bacteria can secure air from the dry surface at any time.

There are a great many expensive sewage-disposal works now in use that discharge their finished effluents in a state that cannot be purged of the putrefactive matters that are held in solution, and that contain many colonies of active and dangerous microbes These impure effluents are either discharged unfiltered, or are passed through filters which are rendered useless by the fact that they are never aerated.

For THE CANADIAN ENGINEER.

THE OXYGEN SYSTEM OF SEWAGE PURIFICATION.

BY W. M. WATSON.

The Sewage Purification Company, of Dublin, Ireland, has been good enough to send us a small pamphlet explaining their patented system of purifying town's sewage. There are several new features in the process worth noting. The company tells us that they use extra deep settling tanks, with sumps to collect the sludge, that they use baffle plates to throw down the solids, and that they supply the micro organisms with the necessary oxygen they require by the use of nitrate of soda in place of and as a substitute for atmospheric air. They say that the oxidation of sewage is brought about by the operations of micro-organisms, and that the organisms which live on dead organic matters will quickly multiply in sewage, and will rapidly set up an oxidation of the organic matter it contains, making the sewage harmless if there is a regular and continuous supply of oxygen to all parts of the liquid under operation sufficient to sustain vitality during their life processes; and the sewage is preserved until acted upon in a neutral or slightly alkaline condition, and continued so during the activity of the organisms. When these conditions are maintained, several chemical changes take place. When the sewage passes through the first or roughing tank, the heavy solids are extracted; when passing through the second settling tank, the sewage, by the help of a precipitant, is converted into ammonia carbonic acid and water; and by the third and last process the ammonia is turned to nitric acid by microbes or bacteria. They say that they have succeeded in estimating the amount of air the microbes require to perform their work well. Thus, for very foul sewage, it takes 1,400 volumes of air to 1,000 volumes of fluid to remove the suspended matter, and even three times the bulk of air to one of fluid to finally and perfectly purify trade sewage. They point out that oxygen must be regularly supplied to the micro-organisms; if not, they will at once set up putrefaction, emitting offensive and dangerous odors. This would appear to mean that they hold that the intermittent method of aeration is a failure.

It will explain the remarks more fully by stating that the process of filtering is at present as far as sewage is concerned an artificial means of supplying the micro-organisms with oxygen. Therefore it is necessary to arrange appliances so that they will continually aerate every particle and item of the filtrate where the microbes that clean the sewage lodge. On this ground every description of filtrate must be open and porous, whether it be sand, crushed stone, clinkers, coke, fine pea coal or charcoal, and packed together in a way that will divide the sewage into small thin films that will move from one item to another on its downward passage through the filter, allowing the bacteria the filtrate contains to devour all the dead matter, also to allow a free passage of air to every particle of filtrate, so that the micro-organism it contains can be amply supplied with oxygen.

This so-called oxygen system consists of three processes, the roughing tank, then clarifying by a precipitant called manganese, often called Condy fluid, and the final process by the microbes, which are supplied with air or oxygen by the use of nitrate of soda without the help of filter beds, such as is described in the preceding paragraph, and that as thus far being in general use as a lodgment for the microbes and a medium for the circulation of air to supply them with oxygen.

The advantages of their system appear to be that by using nitrate of soda as a substitute for atmospheric air to supply the bacteria with the oxygen, they are able to sustain activity in a gradual and regular form, thus preventing any danger of the sewage setting up putrefaction during the process of purification. This, of course, assumes that oxygen can be properly supplied from nitrate of soda. The second advantage is that by using deeper tanks, baffle plates and nitrate of soda, they can keep up a rapid continuous flow through each of the three processes required, thereby purifying about 60 per cent. more sewage than can be done by other appliances used to mechanically purify foul fluids; taking only about one-third of space that other systems do for plant, having no expensive machinery pumps or fans, no tanks stand-