ELECTROLYTIC DISPOSITION OF SEWAGE.

The treatment of sewage is taking on added importance as time goes on and the necessity for preventing further pollution of lakes and streams increases. Mr. F. C. Caldwell, in the June bulletin of the Ohio State University, takes up the present status of electrolytic methods of purification. In the following we present his discussion.

The electrolytic purification of sewage is not new, patents covering the system have been taken out in England nearly a quarter of a century ago. It has, however, been recently revived with such a degree of success, as makes it fitting that it should be considered by this association, to the members of which its general adoption might be of considerable importance.

The material to be handled is made up of domestic sewage, sometimes accompanied by factory wastes and more or less diluted with storm water. Domestic sewage is made up of organic matter that is animal and vegetable, partly dissolved and partly suspended in water. There are also present vast numbers of bacteria often thirty to fifty million in a cubic inch. Factory waste when present may be of any one or more of many kind and affects the problem differently according to its nature. It is therefore not considered in this paper.

The degree of dilution of the sewage to be handled will vary greatly, depending both upon the habits of the population and upon the amount of storm water. In general, it is much more dilute in this country than in Europe. The large proportion of water greatly increases the difficulties of handling the sewage.

The presence and action of the bacteria constitutes one of the most important factors in the problem. They may in general, be divided into two classes, the purifying, also called anaerobic, because they flourish without oxygen, and the oxidizing or aerobic, which as indicated by their name, require oxygen for their best development.

The purifying bacteria operate in the sewers and in any closed reservoir or septic tank in which the sewage may be held. They are helpful in that they digest or liquify any solid portions, but to their action are due the offensive odors which characterize stale sewage. It is therefore essential that their action should be for the most part stopped before the sewage is turned into rivers or other water.

The oxidizing bacteria on the other hand, oxidize or "burn up" the organic material reducing it to simple, stable and inoffensive matter in which condition it ceases to be a nuisance, especially when further diluted with river water. As indicated above, their action is promoted by the presence of air and goes on without offensive results even after the sewage has been turned into the river. They can, however, act only effectively upon finely divided matter, and it is therefore usually desirable for their action to be preceded by that of the putrifying bacteria.

There are also to be considered the disease producing bacteria, originating in the human body. Of these the most notable is the typhoid bacillus. These, if simply run into the river water will remain alive for considerable periods, but they do not flourish under such abnormal environment and are not difficult to eliminate. In many plants it is not considered necessary to sterilize against such bacteria except at times of epidemics.

Any system of purification, to be a success, must leave the sewage inoffensive in appearance and in odor. Practical elimination of the disease producing bacteria is also desirable. Generally, also, the sewage must be to such an extent oxidized that there will be no danger, under the conditions of its disposal of purification again setting in. It is not sufficient to eliminate the putrifying bacteria as there are enough to be found in the river or other water to start the process and once started the rate of increase is enormous. It has been estimated that under unnaturally favorable conditions one bacterium would in twenty-four hours give rise to sixteen and one-half millions.

Granted that a new system accomplished these functions satisfactorily, it would still remain to be demonstrated that it did so more economically than other methods already available.

Before inquiring into the effectiveness of the electrolytic method it will be well to describe its operation. The following relates to the latest plant, a description of which has been published, namely, that at Oklahoma City, (population in 1910, about 64,000). This plant was put in operation on March 29, 1911, and was designed to handle 750,000 gallons of sewage per day. One or more of three flumes 18 x 20 in cross sections and 30 feet long received the sewage. This comes from the city through a conduit about a mile in length and the flow through this is an important factor as it assists in the mechanical disintegration of the sewage as well as serving as a septic reservoir for the action of putrifying bacteria. Each flume is designed to care for 250,000 gallons of sewage per day. The electrolysis is effected by ten groups of iron plates, each group consists of 27 plates, 3-16 x 10-24 spaced ½ inch between surfaces. These may be likened to the elements of a storage battery of such size as to nearly fill up the flume, and with their faces parallel to its sides. Alternate plates are positive and negative, and are connected to bus bars run along the edges so that all the groups of plates are in parallel. The bus bars are supplied by a 3-kw. motor generator set with current at from 1½ to 3 volts. Each flume takes normally 270 amperes. A reversing switch is included in the circuit, and changing the direction of the current once or twice a day equalizes the wear on the plates and removes the deposit which forms upon them.

To prevent excessive electrolysis at the upper edge a copper binding is used. The plates are gradually dissolved and take part in the chemical action upon the sewage.

The effluent is discharged into a so-called "dry gulch," and the sediment deposited in the flumes is periodically flushed out into the same gulch.

The Oklahoma plant was established on the strength of the results obtained from one installed at Santa Monica, California, population 11,000 to 18,000, depending upon the time of year, in June, 1908, and was modelled closely after it. The Santa Monica plant, however, discharges the effluent into the ocean 1,600 feet from shore. In passing, it is interesting to note the surprising lack of knowledge of things electrical evinced in the installation of this system. For example, magnets were placed over the plate electrodes for the purpose of intensifying the action of the current upon the sewage, but were easily removed.

We come to the perplexing question—Does the electrolytic method satisfactorily "purify" the sewage? Two causes of purification are claimed, namely, the production chemicals which are strongly oxidizing or chlorinating in their nature and the production of oxygen itself in the so-called nascent state, in which it is very active chemically. That such chemicals are formed and that they do operate to destroy the bacterial life they reach and to some extent to oxidize the organic matter itself is undisputed. The part played by the nascent gases is more doubtful as it seems to have been well established by Geo. W. Fuller in an extended investigation at Louisville (see his "Sewage Disposal," page 557) that such oxygen is almost entirely used up in attacking the iron plates. Further, the gas ceases to be nascent almost immediately after its formation on the