bottles were filled with this liquid. A number of these bottles were colored in the proper proportion with methylene blue, the others remained as "blanks" for the determination of the residual available oxygen. The results are given in the accompanying Table I.

These tabulated results indicate the following conclusions: A very serious mistake can be made by assuming that the decolorization of the sediment in silt-bearing waters is the correct measure of the "relative stability." Experiments 3, 4, 5, 6 and 7 show that the decolorization lags far behind the elimination of the available oxygen in such liquids or, in other words, the methylene blue, once absorbed, is largely inert as an indicator. This bears out Doctor Hale's assumption. The absorbed liquid is, however, not entirely inert, as otherwise the sediment would never decolorize. The fact that the sediment decolorizes only under prolonged ultra-anærobic conditions makes such an observation useless for quantitative purposes. Reliance on the decolorization of the liquid is equally doubtful because we cannot tell to what extent the decolorization is really absorption. We can only be fairly certain of obtaining accurate "relative stabilities" if we knew that 0.4 cc. or less of the coloring matter per 150 cc. bottle capacity would remain in excess over the absorption requirements, and that the absorbed methylene blue was entirely inert. This cannot be insured under practical conditions, but remains a matter of chance. If more than 0.4 cc. of the coloring matter remains in solution, the antiseptic qualities of the dye would make itself felt and higher "relative stabilities" would result. The absorption of the coloring matter seems to bear a definite relation to the amount of colloidal matter present, and indeed some German observers have recommended a quantitative procedure for determining colloids on this basis. The Methylene blue test in waters carrying colloids is, therefore, of negative value only; i.e., if the blue color of the liquid persists irrespective of absorption, the "relative stability" is 100, or an excess of oxygen may be present.

A number of coagulants, such as freshly precipitated aluminum hydrate, magnesium hydrate, calcium carbonate and calcium oxide were employed to mechanically settle the colloids previous to introducing the coloring matter. The results were not sufficiently encouraging to follow this line of experiment. The addition of electrolytes to sewage, such as common salt, did not accelerate the sedimentation sufficiently to be of practical advantage.

The writer is forced to conclude that it is useless to determine "relative stabilities in turbid waters by the methylene blue method. This is unfortunate, since it robs us of a simple and convenient field procedure. To obtain the correct oxygen demand in such waters, the following procedure is requisite:

Determining the initial available oxygen. The free oxygen has to be determined on the spot. A sample for nitrate and nitrate determination can be preserved with chloroform and shipped to the laboratory. Three other samples should be collected carefully to avoid aëration. To one sample add either a certain quantity of fresh water (free of nitrites and nitrates) with a known oxygen content or a definite quantity of saltpeter. Personally, the writer prefers to add saltpeter, since it is a much simpler procedure. The other two samples remain as originally collected. All of these samples are now incubated in closed bottles for ten days at 20° C. At the end of this incubation period, the residual available oxygen is determined in the samples devoid of saltpeter or additional water. The other sample is examined quantitatively for nitrites and nitrates. If free oxygen remains at the end of incubation the residual saltpeter oxygen need not be determined. All figures are referred to one litter of original river water. The nitrite nitrogen multiplied by 1.7 and the nitrate nitrogen multiplied by 2.9 express equivalents of oxygen. The initial available oxygen minus the residual oxygen expresses the biochemical oxygen demand. When the water is very badly polluted, the free oxygen sample need not be incubated for the reason that the free oxygen is certain to be absent after incubation. In connection with these incubations, it is important to keep in mind that the nitrites and nitrates are attacked while free oxygen is still present. As a rule, the nitrites and nitrates begin to be attacked when the free oxygen content is reduced by about 50 per cent.

THE RAIN-GAUGE IN RAINFALL COMPUTATIONS.*

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THE basis of any method of computation is the rain-gauge, and this it is quite unnecessary to describe, premising only that it is of approved pattern and of sufficient capacity. It must, however, be remarked that the rain-gauge furnishes a record simply of the rain which finds its way into the gauge glass, and that such record is not of necessity and by itself a record of the actual rainfall of any particular area, and in order to constitute the rain-gauge a record of the actual precipitation, even in its immediate vicinity, it is necessary that it shall be located and fixed with the utmost care in view of the surrounding conditions.

Assuming the rain-gauge to be so constructed and placed that it shall correctly record the precipitation in its immediate vicinity, the next question which arises is, to what area can the rainfall so ascertained be properly applied? And it will be apparent that the fact that a number of gauges distributed over a tract of country yield varying results involves the limitation of the area to which each record applies.

A common way of computing the total precipitation over an area is by establishing a number of rain-gauges within the area and making an arithmetical mean of their records, applying that figure to the total area.

Assume, for instance, an area of 10,000 acres on which four rain-gauges are established giving records of 25, 27, 29 and 31 in. per annum, respectively. The arithmetical average of the four gauges is 28 in., and applying the factor of 22,600 gallons per inch of rain per acre, we have a total rainfall for the area of 6,328 million gallons. It is evident, however, that this method assumes that the record of each of the several gauges applies to an equal area. In practice this will not be the case, and it might easily be that the reading of the 25-in. gauge applied to half the area, the 27-in. to one-quarter, and the 29 in. and 31-in. records to one-eighth each. Under these conditions the total precipitation on the area would be 6,045 million gallons, an appreciable reduction. Conversely, if one assumed a larger proportion of area for the higher readings, the computation for the whole area would be correspondingly greater.

*From a paper read at the 4th annual meeting of the Municipal Waterworks Association, held at London, October 1st, 1915.