is to be expected, therefore, that effluents from such towns will contain high figures for albuminoid ammonia, which are not derived necessarily from "excrementitious matter."

In the case of Manchester, the albuminoid ammonia figure, and to a greater extent the oxygen absorbed figure, is affected by trade effluent, more particularly by phenolic compounds and by sulpho-cyanates contained in the ammonia recovery liquors, which are turned into the sewers in large quantities by the gas works, and by manufacturers, who work up the liquors from other towns.

It is the custom of the rivers authorities in the northern manufacturing centres to adopt different standards, in the case of manufacturers' effluents, from those employed in judging the effluents from sewage works. Provided suspended solids are removed, much higher figures are allowed for oxygen absorption and for albuminoid ammonia in the former than in the latter case.

It is no doubt rightly considered that, apart from the inherent difficulties of treatment, manufacturers' effluents are less dangerous—from the point of view at any rate of producing nuisance—than the effluents from sewage works. It should, however, easily be possible to determine within limits what proportion, say, of the oxygen absorbed figure is due to trade refuse, and what proportion to sewage proper, by comparison—e.g., with purely domestic sewage of corresponding strength or by special methods of analysis. Thus it has been possible, by means of the "clarification test," to show that Manchester sewage contains an abnormal proportion of oxidizable matter in true or "crystalloidal" solution, which diminishes at times when ammonia recovery liquor is not present in the sewage.

All these and other difficulties in interpretation of the various analytical figures made use of as provisional standards, are sought to be overcome by the two simple tests suggested by the Royal Commission which may usually be here mentioned in full. The Royal Commission state that an effluent would generally be satisfactory if it complied with the following conditions:—

(1) That it should not contain more than three parts per 100,000 of suspended matter; and (2) that after being filtered through filter paper it should not absorb more than (a) 0.5 parts by weight per 100,000 of dissolved or atmospheric oxygen in twenty-four hours; (b) 1.0 part by weight per 100,000 of dissolved or atmospheric oxygen in forty-eight hours, or (c) 1.5 parts by weight per 100,000 of dissolved or atmospheric oxygen in five days.

In connection with the suspended matter determinations Mr. Thompson has pointed out the differences already mentioned due to the presence of colloidal matter, apparently fearing that the estimation of suspended solids is likely to be unfairly high unless the sample is analyzed at once after collection. The danger would seem to be rather in the other direction. On the other hand, the filtration through paper, which is recommended, is likely to cause retention of colloidal matter, and consequently diminution in the amount of dissolved oxygen ultimately taken up.

It might be suggested that the dissolved oxygen should be determined after the sample has been allowed to settle, say, for one hour. In the case of a bright effluent from a percolating filter this would afford time for the humus to deposit, the absorption of dissolved oxygen could then be determined in the decanted liquid, when, if colloidal matters were present, the oxygen absorbed by these would be taken into account. It may be objected that this method is less precise than the one given by the Royal Commission, but with reasonable care it would appear likely more truly to indicate the real nature of the effluent.

Mr. Thompson's suggestion that one determination of the dissolved oxygen absorbed after twenty-four hours would be sufficient would certainly result in saving of time, and probably in the majority of cases would be adequate. In presence of antiseptic substances, or of difficult oxidisable matter, a possibility of error might arise. On the whole, however, the Royal Commission tests, especially if slightly modified as suggested, should distinguish between weak and strong sewage, and generally enable a fair conclusion to be drawn as to the probable effect of the effluent upon the stream into which it flows.

The test is ultimately based on the careful researches of Adeney, who has shown that when organic matter of various sorts is submitted to the action of dissolved oxygen in presence of bacteria oxidation takes place in two well-defined stages, viz., the oxidation of carbon to carbon dioxide, and of nitrogen to nitric acid. It may, however, be questioned whether this sequence, which holds for mixtures of polluted matter and water containing an excess of dissolved oxygen, exists equally under the conditions of purification of a sewage works. There are reasons for thinking, in the writer's opinion, that, e.g., in high-speed percolating filters the ammonia in the sewage may be oxidized in large measure to nitrates, while the more resistant organic matter is far from completely attacked.

In the case of contact beds, moreover, the first portion of the discharge is certainly less well ozidized than the last drainings, and, while the average effluent may fulfil all requirements, a portion, at any rate, of the albuminoid ammonia may be due to less perfectly oxidized organic matter. Although this may not absorb a great amount of dissolved oxygen, it may make its presence felt in the encouragement of certain kinds of growth which become apparent at the outlet of the filters, or in the stream below the effluent outfall.

This leads up to the second part of this paper, viz.:—

2. The Effect of Effluents upon Streams.

Just as the efforts of what may be called the chemical era of sewage purification were directed to clarification, with little regard to the chemical composition of the clarified liquid, so the activity of the last decade has been in the direction of the mineralization of dissolved organic matter, with production—e.g., of nitrates, without much consideration of the possibilities of re-absorption of these products into the cycle of organic life. Where final land treatment is resorted to these mineral constituents are usefully absorbed. In the majority of cases, however, such effluents, if non-putrefactive, are allowed by the Rivers Board to pass into streams without further treatment. If thorough mixing takes place with a large body of water, no detrimental effects are, as a rule, observable, even if purification is not carried to the fullest possible extent.

On the other hand, cases are accumulating where effluents, satisfactory from the point of view of mineralization of the greater part of the organic matter, and consequent non-putrescibility, are yet capable of causing considerable growth of organic life, which subsequently may enter into decomposition with production of nuisance. The mineralized matter has, in fact, again become organic.

A classic instance, is of course, Belfast, where the researches of Dr. Letts have shown that the seaweed ulva latissima is capable of absorbing nitrogen, not only from crude sewage, but also from the ammonia and nitrates present in effluents from ordinary filter beds. The subsequent decomposition of the ulva is the cause of very serious nuisance, owing to the development especially of sulphuretted hydrogen. . . .

(To Be Continued.)