

be fermentative or putrefactive,* according, in a great measure, to the time allotted to each process respectively.

Without a minute discussion of the complex character of ordinary sewage, we may notice that the organic matter which it contains consists usually of an immense variety of highly complex compounds, largely nitrogenous or hydrocarbon, the decomposition of which, by the abstraction of oxygen, will naturally lead to nitrogenous compounds of simpler chemical composition, together with such stable products as water, ammonia, carbonic acid gas, marsh gas, free hydrogen, and free nitrogen.

Ammonia in solution in a liquid produced by natural causes would be taken as probable evidence of previous decomposition of organic matter; albuminoid ammonia, as indicating a danger of further putrefactive decomposition. The more stable products mentioned above, so far as danger of the latter is concerned, may be considered harmless. If a sufficient further oxidation of the ammonia compounds can be effected to convert the ammonia into nitric acid, the danger of putrefaction is averted; the net result will be that gases which have been liberated will have been returned to the air; the remaining nitrogen will experience nitrification and, in this beneficial form, will return to the earth with the liquid in which it is present in solution: so that the journey begun by the constituents originally present in soil and air, for the beneficent purpose of ministering to the needs of vegetable and animal life, ends in the return of these constituents to their original sources.

Now it has been ascertained that such changes as these, and in the order given, are precisely those effected by the instrumentality of the minute organisms to which we have referred; that these changes will infallibly be effected by them if only suitable conditions are provided for their activities, and moreover, that the micro-organisms themselves, required to effect these changes, are invariably found to be present in sewage in a crude state.

The importance of these facts cannot be over-estimated; their discovery bears distinct analogy to the recognition in medicine of the principle of the "Vis medicatrix naturae," which may, perhaps, be said to have revolutionized modern therapeutics.

Nine years ago the first efforts to provide the conditions essential to

*Decomposition (other than that due to slow natural decay), is divided by Liebig into two classes, "Fermentative" and "Putrefactive"; the products of the latter are unstable, and are generally nitrogenous compounds capable of again entering amongst themselves into more or less complex further combination. Putrefactive decomposition is usually accompanied by offensive odour. Fermentative decomposition, on the other hand, gives rise to products stable in character, and it is, generally speaking, unaccompanied by offensive odours. The first is an inseparable accompaniment to the decomposition of nitrogenous organic matter;

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