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THE VALUE OF A WATER ANALYSIS.

BY W. P. MASON, RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.

A GREAT deal of popular misconception exists upon the subject of the analysis of potable water, and it is commonly supposed that such an examination may be looked upon from practically the same point of view as the analysis of an iron ore. That this belief is founded on fallacy may, however, be readily shown. When an iron ore is submitted for analysis, the chemist determines and reports upon the percentages of iron, phosphorus, sulphur, etc., found therein; and at that point his duties usually cease, inasmuch as the ironmaster is ordinarily capable of interpreting the analysis for himself. Even should the analyst be called upon for an opinion as to the quality of the ore, the well-known properties of the several constituents make such a task an easy one, and, assuming the sample to have been fairly selected, the opinion may be written without any inquiry as to the nature of the local surroundings whence the ore was taken.

A water analysis, on the other hand, is really not an analysis at all, properly so-called, but is a series of experiments undertaken with a view to assist the judgment in determining the potability of the supply. The methods of conducting these experiments are largely influenced by the individual preferences of the analyst, and are far from being uniform or always capable of comparison, thus often introducing elements of confusion where two or more chemists are employed to analyze the same water. Some of the substances reported, "albuminoid ammonia," for instance, do not exist ready formed in the water at all, and are but the imperfect experimental measures of the objectionable organic constituents, which our present lack of knowledge prevents our estimating directly.

Thus the numerical results of a water analysis are not only unintelligible to the general public but are not always capable of interpretation by a chemist, unless he be acquainted with the surroundings of the spot whence the sample was drawn, and be posted as to the analytical methods employed.

It is very common for water to be sent for analysis, with the request that an opinion be returned as to its suitability for potable uses, while at the same time all information as to its source is not only unfurnished but is intentionally withheld, with a view of rendering the desired report unprejudiced in character.

Such action is not only a reflection upon the moral quality of the chemist, but it seriously hampers him in his efforts to formulate an opinion from the analytical results.

For instance, a large quantity of common salt is a cause for suspicion when found in drinking water, not because of any poisonous property attaching to the salt itself, but because it is usually difficult to explain its presence in quantity except upon the supposition of the infiltration of sewage; yet an amount of salt sufficient to condemn the water from a shallow well in the Hudson valley, could be passed as unobjectionable if found in a deep-well water from near Syracuse, N. Y.

We thus see how important it is for the chemist to be fully acquainted with the history of the water he is to examine, in order that he may compare his results in "chlorine" with the "normal chlorine" of the section whence the sample is taken. A knowledge of the history of the water is no less important in order to interpret the remaining items of a water analysis. Some time since a water was sent from Florida to this laboratory for examination, and was found to contain 1.18 parts "free ammonia" per million.

Much "free ammonia" commonly points to comtamination from animal sources, and had it not been known that the water in question was derived from the melting of artificial ice made by the ammonia process, the enormous quantity of ammonia found would have condemned it beyond a peradventure. As it was, the water was pronounced pure, the other items of the analysis having been found unobjectionable.

Analytical results which would condemn a surface-water are unobjectionable for water from an artesian well, for the reason that in the latter case high figures in "free ammonia," "chlorine," or "nitrates" are capable of an explanation other than that of sewage infiltration. Even though such water should have, at a previous period, come in contact with objectionable organic waste material, yet the intervening length of time and great distance of underground flow would have furnished abundant opportunity for thorough oxidation and purification.

"Deep" samples taken from the same lake, at the same spot and depth, will greatly vary in analytical results if the temperature of the water at the several dates of sampling should be markedly different, owing to the disturbing influence of vertical currents.

Again, suppose it is desired to determine whether or not the water of a large stream is so contaminated with up-stream sewage as to be unfit for a town supply. An analysis of the water taken from the site of the proposed in-take would very probably be valueless, because the enormous dilution to which the admitted sewage would have been subjected would remove from the analytical results everything of an absolute character. Examinations of any real value in such cases should always be of a comparative nature. Samples should be taken above and below the point of contamination and again at the proposed in-take. If the difference between the first and second samples, which is a measure of the pollution, be maintained, or nearly so, at the point of in-take, then the water should be condemned no matter how completely the analytical results fall within the limits of the so-called standards of organic purity.

Thus it is that a chemist must be in full possession of all the facts concerning the water which he is asked to examine, in order that his opinion as to its purity may be based upon the entire breadth of his passed experience, for in no branch of chemical work is experience and good judgment better exercised than in the interpretation of a water analysis.

As Nichols has well said, "It is a great mistake to suppose that the proper way to consult a chemist is to send a sample of water in a sealed vessel with no hint as to its source. On the contrary, the chemist should know as much as possible as to the history and source of the water and, if possible, should take the samples himself."

In the taking of samples for so important a matter as a town supply, the chemist should unquestionably personally superintend their collection; but, for individual outlying waters, printed instructions have to be frequently depended upon. Those issued from this laboratory are as follows:—

DIRECTIONS FOR TAKING A WATER SAMPLE.

Large glass-stopper bottles are best for sampling, but as they are seldom at hand, a two-gallon, new demijohn should be employed, fitted with a new soft cork. Be careful to notice that no packing straw or other foreign substance yet remains in the demijohn, and thoroughly rinse it with the water to be sampled. Do not attempt to scour the interior of the neck by rubbing with either fingers or cloth. After thorough rinsing, fill the vessel to