HOW TO ANALYZE CLAY: PRACTICAL METHODS FOR PRACTICAL MEN

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HOLDEN M. ASHBY

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By HOLDEN M. ASHBY

Late Professor of Organic Chemistry, Harvard Medical College

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INTRODUCTION.

The purpose of this little work is to describe the analysis of clay so that a clayworker may make his own analyses with sufficient accuracy for all the practical purposes of every day work.

The methods which an experienced chemist uses with almost absolute accuracy generally give very poor results in the hands of a beginner, with whom a far less accurate method would give better results; therefore, practical utility and chemical accuracy have been combined as far as possible.

In cases where the determination may be improved upon with greater experience, a second and more accurate method is also given.

HOW TO ANALYZE CLAY.

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Our intention in this article is to tell the brickmaker in ordinary everyday English how to make a clay analysis that will be moderately accurate, and how to use it.

Chemists will probably laugh at the idea of anybody not specially trained, making such a difficult analysis as that of clay, nevertheless it is possible for an intelligent man to learn the routine of one single analysis, and be able to do it with sufficient accuracy to obtain practically useful results. Then it must be borne in mind that when a technical worker in clay has mastered even the simplest chemistry of his craft, his technical knowledge will lead him to make investigations which it would never occur to a chemist to make, and it is just this kind of research that is most needed.

For many years practical clayworkers have looked askance at the very mention of the word chemistry and with the best of reasons. Nowhere is the adage that a little knowledge is a dangerous thing better exemplified than in the application of chemistry to the arts; and up to a few years ago our knowledge of the chemistry of ceramics was in a very elementary state. Now, however, thanks to the magnificent example set us by both the German scientists and manufacturers, we are beginning to move in the right direction. Ceramic chemistry

has now been developed to such an extent that if the clay-worker will only listen to advice from the ceramic chemists, he will realize that it means a saving of actual dollars and cents. Until the hard times in 1893, brickmakers were in sufficiently easy circumstances to decline to trouble themselves with chemistry, but now, when a bare living is all that can be hoped for, a stoppage of a previous waste of from 2 to 7 % will often mean easy circumstances. And that is just what chemistry has done in other cases and can do in this. One does not have to seek far for instances where chemistry has stepped in and utilized waste products or otherwise helped a business in such a way as to create fortunes.

Look at the Armour Packing Company, the Carnegie Steel Works, the United Alkali Company, etc. All these concerns could not pay such dividends but for the help they have received from science.

Now let us see just where the ceramic industry can be benefited by chemistry, and before going any further, perhaps it would be as well to state where to get our information. There is one solitary book that is written by an American, namely Langenbeck's "Chemistry of Pottery," and that, dealing as it does almost exclusively with enamels and glazes, does not quite meet our wants. For the main part of our information we have to rely almost entirely on the German publications with a few in French on the finer china ware. These foreign works are gradually translated and re-edited for the American public, in which work "Brick" is taking a leading part, but as yet they are not in a very accessible condition. For those who cannot study the foreign works, some information is to be gained from isolated magazine articles and portions of text books.

As most of our readers will be especially interested in the discussion of the chemistry of clay as applied to brick and tile making, we shall confine ourselves in the present article to that side of the question.

When a man starts out to make an analysis of a brick clay, what he wants to know finally is, what his clay is good for, what it will make, or, if he wants to make one certain thing of it, how to treat that clay in order to attain his end with the least possible outlay and waste. He does not care to know the exact proportion in which the different elements are pres-

ent. because even to the cleverest ceramic expert the percentage of silica, alumina, iron, lime, water, etc., does not give any reliable data, but he does want to know whether the clay will make a good paving brick, or a good, rough building brick, and he does want to know what proportion of sand to add to make it a good fire brick.

To be able to do this, it is true, he must know the proportion of the elements, but that is only one step, and unless the others are taken the first step is useless.

To obtain such data as the color of the burned brick, it is best to burn a small piece of clay, because although we can make a pretty good guess from the chemical analysis, our information is not yet sufficiently accurate and varied to give us absolute results. The first step then is to have a small brick burned.

The next step is to mechanically divide up the clay into the various degrees of fineness; this can be done either by sifting or slumming. A large amount of useful information may be gained by this method, of which more hereafter, but by far the most valuable is the chemical analysis, so we will deal with this first. As stated above our final object is to find out what the clay can be used for, and to do this we have to first find out what the clay is composed of and then turn to records of previous analysis and see what results such component parts will be likely to produce. When we speak of the composition of the clay we do not mean the proportion of the elements present, but the proportion of real clay, sand, and undecomposed rock. Each of these bodies behave in a certain way when burned and if we cannot obtain data concerning other analysis, we can always get a good idea of the behavior of the clay from the average of its composition, which of course we could never do from the mere proportion of its elements.

Now to state in a few words how the proportion of minerals is found before going into details. When a clay is treated with warm concentrated sulphuric acid for 12 hours all the real clay substance is dissolved, and the sand and undecomposed rock is left. The two are separated and the undissolved portion is subjected to chemical analysis. We know that the undecomposed rock is feldspath and that there is in feldspath a certain definite proportion between the alumina and silica, so