[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF LAFAYETTE COLLEGE.]

SILICA AND INSOLUBLE RESIDUE IN PORTLAND CEMENT.

BY P. W. SHIMER.

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IT is desired, in this brief note, to call attention to a possible source of error in the determination of silica in cement, as usually carried out in many laboratories. In the method almost universally used the steps are as follows: Solution, with careful stirring, in either hydrochloric acid alone, or with addition of nitric acid; evaporation to dryness; solution, filtration, and ignition of the siliceous residue, without treatment with hydrofluoric acid. The insoluble residue is calculated as silica. The results are claimed to be accurate to within 0.20 per cent., and it is no doubt true, as claimed, that it is not possible to get duplicate samples of cement from the same bins, in which the average disagreement will be less than this. If the error in the silica determination were no greater than 0.20 per cent., it would not, practically, be important.

The writer has recently met with four samples of Portland cement in which the differences between the silica determined by solution in hydrochloric acid and by the fusion method were 2.48, 2.46, 1.10, and 1.00 per cent. If the silica determined by the acid method were treated with hydrofluoric acid, there is no doubt the results by that method would be sufficiently accurate.

In the case where there was a difference of 2.48 per cent. between the silicas by the two methods, we have complete analyses of the cement by each method of solution. The silica by the acid method was 2.48 per cent. high, while all the other determinations were correspondingly lower than the determinations by the fusion method. Alumina was 1.24 per cent. low; ferric oxide was 0.64 per cent. low; lime, 0.28 per cent.; magnesia, 0.12 per cent.; and sulphur trioxide was 0.14 per cent. low. The total of these differences is 2.42 per cent., thus showing conclusively to what the contamination of the silica by the acid method was due.

The discrepancies in the other three analyses are similarly accounted for. The excess of 2.46 per cent. in the silica by the

acid method in the second sample, is balanced by a deficiency of 2.30 per cent. in the other determinations. The excess of 1.10 per cent. in the silica by the acid method in the third cement, is balanced by a deficiency of 0.96 per cent. in the other determination.

The excess of 1.00 per cent. in the silica by the acid method in the fourth cement, is balanced by a deficiency of 1.12 per cent. in the other determinations. It is interesting to note, in this connection, that the physical tests of the first two samples of cement, which showed differences of 2.48 and 2.46 per cent. between the two silicas, showed marked inferiority as compared with the two samples in which the differences between the silicas were 1.10 and 1.00 per cent.

This would point to insufficient clinkering or sintering of the first two cements. In other words, the burning of the cement was not at a high enough temperature, or was not continued long enough to completely decompose the insoluble silicates of alumina and to convert them into silicates and aluminates decomposable by hydrochloric acid. I have no doubt whatever, that when a Portland cement is properly compounded and correctly burned, the silicates and aluminates are easily decomposable by hydrochloric acid, and therefore the silica may be determined with very close approximation to the correct figures by the acid method. On standard cements, of good reputation, I have never found a greater difference than 0.20 per cent. between the silicas by the two methods. However, when the cement is not properly compounded and correctly burned, there will be a notable difference between the two silicas. The determination of silica by the two methods would thus appear to furnish an excellent means of getting valuable information as to the quality of the cement. When the two silicas agree, it means that all silicates and aluminates are decomposed by hydrochloric acid, and therefore are in an active hydraulic condition. When there is a large difference between the two silicas, it means the presence in the cement of unconverted and inert silica and alumina. In other words, the clay matter that the burning should have converted into active hydraulic combinations with lime, remains unconverted and inert.

In a sample of natural cement of low grade the silica by fusion

was 26.90 per cent.; by the acid method it was 31.45 per cent., a difference in this case of 4.55 per cent., proving conclusively that, while the acid method may be very useful when used by an experienced chemist at a cement works making regularly a uniform product, it is not at all to be relied on as a universal method to be used indiscriminately for the determination of silica in all cements.

[CONTRIBUTIONS FROM THE UNITED STATES LABORATORY, BOSTON, MASS.]

ANALYTICAL RESEARCH ON SOD OIL.

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EXCEPTING among the tanners very little is known of this oil, and among them it is known only in its principal application. Its chemical properties are little known and the aim of this paper is to state the main chemical facts regarding this oil, thousands of tons of which are used each year in the currying of leather.

To better understand what sod oil is, let us say that it is an oil which has for its basis various non-drying oils and greases, but almost exclusively cheap fish oils. These oils are put into the leather for currying purposes and the excess is extracted by various methods. The extracted oil has undergone a change from the original oil by coming in contact with the leather and becomes what is known in commerce as 'sod oil,' more highly valued by the tanners than the original oil.

In "Oils, Fats and Waxes," Benedikt and Lewkowitsch describe this oil as follows: "Sod oil or dégras is the waste fat obtained in the chamoising process and is used for currying purposes; *i. e.*, dressing bark-tanned leather." Dégras proper might be said to be the oil obtained from skins in the manufacture of chamois leather, while its allied substance, sod oil, is the oil obtained from ordinary leather.

The principal oils used from which to make sod oil are menhaden and cod oils, but various oils (even olive oil) and greases may be used, and hence give to the sod oil a variation in constants which have so extended a range that they might not be constants at all.