their work, so that the averages given below may suffer some small modification in the future.

AMERICAN COMMITTEE.

	Standard No. 1.	Standard No. 2.	Standard No. 3.	Standard No. 4.
Carbon	1.44	0.807	0.452	0.16
Silicon	0.270	0.202	0.152	0.015
Sulphur	0.004	0.004	0.004	0.038
Phosphorus	0.016	0.010	0.015	0.088
Manganese	0.254	0.124	0.140	0.098

The German committee has devoted much attention to the study of methods of analysis in connection with the international standards, but has not yet announced its results. The French committee has made no report.

STANDARDIZING THE TORSION VISCOSIMETER.

BY O. S. DOOLITTLE, CHEMIST, P. & R. R. CO.

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IN the article published in the June number of *Drugs, Oils, and Paints*,[1] on the Torsion Viscosimeter, the method recommended for expressing the viscosity was in the number of degrees of retardation between the first and second complete arcs. Further experience has shown that although this is the best method for any one instrument, yet when it comes to comparing different instruments it is too delicate. It has been found that two instruments cannot be made to show the same number of degrees of retardation throughout a wide range of viscosity without requiring an amount of care and exactness in the manufacture which greatly adds to their cost.

In order to overcome this difficulty each instrument is now standardized against pure cane sugar solutions, after the manner proposed by Mr. S. M. Babcock (*J. Anal. Chem.*, **1**, 151,) in a similar case, the viscosity being expressed in the number of grams of sugar contained in 100 cc. of the syrup at 60° F., which will give the retardation designated at 80° F. These readings are obtained by taking a number of solutions contain-

[1] See this JOURNAL, March, 1893.

ing known amounts of pure cane sugar, and determining the retardation of each. A curve is then mapped out on a piece of plotting paper, the number of grams of sugar in 100 cc. of the different syrups representing the abscisses, and the degrees of retardation, the ordinates. This curve enables us to interpolate the value of each degree of retardation in terms of pure cane sugar, and in this way a table of viscosities is drawn up and furnished with each instrument. This table renders the results obtained by different instruments strictly comparable.

Incidentally while experimenting with these sugar solutions I have been able to show the influence which specific gravity has on the determination of viscosity, when made by the class of instruments which allow the liquid to flow through an orifice, and express their results in the number of seconds required. The viscosity on the torsion viscosimeter of a certain oil having a specific gravity of 0.9 was found to be 86.4. I then made a sugar solution showing exactly the same viscosity, and found its specific gravity to be 1.4. These two liquids having identically the same viscosity as shown by the torsion viscosimeter but differing in specific gravity, were then run through the Saybolt viscosimeter. The oil required $35\frac{1}{4}$ seconds, while the sugar solution ran through in $30\frac{1}{4}$ seconds, thus showing that the difference in specific gravity caused an error of five seconds on this instrument by forcing the sugar solution through the orifice faster than the oil. To demonstrate still further the presence of this error, the viscosity of an oil of 0.9 sp. gr., was ascertained to be $35\frac{3}{4}$ seconds on the Saybolt instrument. I then made a sugar solution which gave exactly the same figure on this viscosimeter, showing a specific gravity of 1.48. The viscosity of these two liquids was then taken with the torsion viscosimeter, when it was found that the oil showed a viscosity of 86.8, while the sugar solution gave 91.8. In other words it was necessary to make a solution of sugar of decidedly higher actual viscosity than the oil, in order to overcome the error due to difference in specific gravity and show the same reading on the Saybolt viscosimeter.

From this it would seem clearly evident that the viscosity as determined by any instrument based on the principle of allowing the liquid to flow from a receptacle through an orifice, has a very appreciable error due to the specific gravity of the oil.

The torsion viscosimeter is manufactured and sold by Bullock and Crenshaw, 528 Arch street, Philadelphia.

PROGRESS IN THE MANUFACTURE AND USE OF ARTIFICIAL COLORING MATTERS.[1]

BY OTTO N. WITT, PH.D., PROFESSOR AT THE POLYTECHNIC INSTITUTE OF BERLIN.

HAVING been requested to deliver an address before this congress, I know of no better subject to call your attention to than the one with which I have been familiar from the beginning, the chemistry of artificial coloring matters and their relation to dyeing and calico printing.

Unfortunately the subject is one of such vast dimensions, that I should fail to give you anything like a complete description of it, even if I could venture to trespass much longer upon your valuable time than it is my intention of doing. I had to choose a certain chapter from it, and in so doing I have preferred, mindful of the eminently practical turn of this country, to bring before you rather the practical side of the recent development of coloring matters, than the theoretical one. Thus I shall avoid among other things the use of complicated structural formulas which, though indispensable to the modern organic chemist, are apt to be looked upon with disfavor by no small number of eminent and accomplished chemists.

The question of artificial coloring matters is, I am sorry to say, one which has hitherto been left entirely in the hands of the chemists of the old world, who, I need not assure you, would be only too glad to collaborate in this matter as well as in so many others, with their colleagues in the United States. But it seems that quite peculiar conditions are required to develop this particular flower on the vigorous and imposing tree of general chemistry and we have, even in the old world, noticed the remarkable fact that the industry of artificial dye stuffs, born in France, has left that country to settle in England; and here again it has not been able to reach its full development, but has

[1] Read before the World's Congress of Chemists, August 21, 1893.