A NEW GLASS OF LOW SOLUBILITY.[1]

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Received June 7, 1902.

The statement in a recent number of *Science*[2] to the effect that American glass is inferior to that made in Germany is without doubt true if for "Germany" we read "Jena". The grounds for the claim that at least one glass made in this country heretofore has been equal to anything made on the continent except Jena glass, I submit herewith. I have here, also, samples of a glass of my own devising which I believe is the equal of the Jena glass as regards its resistance to water, acids and carbonates, and superior in its resistance to caustic alkali solutions. Before presenting the figures, however, a brief résumé of the method by which they were obtained and the reason for its choice in preference to others is submitted.

In deciding upon this method for testing the comparative solubility of different glasses, I have passed over the beautiful work of Pfeiffer, Kohlrausch, Mylius and Foerster, all of whom have compared different glasses by determining the amount of bases which go into solution upon treating them with water, either by conductivity or purely chemical methods, for a method which is not particularly novel, but gives results in the ordinary units of the chemist.

The method employed was as follows: pint, globe, flat-bottomed flasks were rinsed in chemically pure ammonium hydroxide, then in water, then in chemically pure hydrochloric acid, then in water, and finally with alcohol and ether, after which they were dried at the temperature of the room by a current of dry air, carefully wiped with a towel, and allowed to stand exactly one-half hour before weighing. The weighing was carried to 0.1 mg. with the ordinary precautions of analytical chemistry. I am aware that the glass could not have been free from water at the time of weighing, but every effort was made to insure as uniform a state as regards moisture as possible.

The flasks after weighing were partially filled with exactly 300

[1] Read at the Pittsburg meeting of the American Chemical Society, July 2, 1902.

[2] "It is claimed that American glass is inferior to German in quality and power of resistance to chemicals." Excerpts from the Report of the Census Committee of the American Chemical Society, *Science*, **15**, 813.

cc. of a 1 per cent. solution of sodium carbonate, attached to an inverted condenser by a rubber stopper, and boiled for exactly three hours over an asbestos plate one-sixteenth inch thick heated by a Bunsen burner, the latter being so regulated as to produce as slow but constant an ebullition as possible. The level of the liquid was not appreciably lowered in the three hours. At the end of this time the flasks were disconnected, emptied, rinsed with water three times, then treated precisely as before the boiling, and weighed. 300 cc. of water were next used, then 300 cc. of a solution containing 0.4 per cent. of hydrochloric acid, and finally the same quantity of a 1 per cent. solution of sodium hydroxide, the weighing, rinsing and drying always being carried out as above described.

That this method gives results sufficiently accurate for factory control I have proved repeatedly. It has the great advantage that it can be applied by any one in almost any laboratory, as it only requires the ordinary forms of apparatus and reagents, and if used for comparing two samples of glass, no particular care as to the exact strength of the solutions used is necessary, provided only both are treated alike. The greatest cause of variation in testing the ordinary quality of chemical ware is that the surface layer of the glass, after partial extraction with the solvent, is more or less completely removed by the mechanical action of the escaping steam. This cause of variation becomes almost nothing, however, in testing glasses like the Jena normal glass and the new glass.

Mylius and Foerster[1] found that the ratio of the bases to silicic acid in the aqueous solution obtained by boiling water five hours in flasks, varied from 1 : 0.21 to 1 : 1.6, the figures being for a poor glass from Thuringia and Kavalier's glass respectively. From this it is plain that no conclusions as to the total amounts going into solution can be drawn with safety from the results of any method which only gives the amount of bases taken up. It is also clear that such a method cannot be used for comparing glasses so totally different in composition as those made by Schott at Jena and by Kavalier in Bohemia. While the unavoidable variations (when testing by the method I used) between different results with the same glass are sometimes rather large, it is also certain that they are equally great in using the ware, so that an average of

[1] *Ztschr. anal. Chem.*, 31, 245.

a sufficient number of results comes nearer representing actual practice than anything else that has been proposed.

Each of the following figures is an average of three results and represents the loss in milligrams sustained by flasks when tested as described:

LOSS PER FLASK EXPRESSED IN MILLIGRAMS.

	Whitall-Tatum Co.	Kavalier.	Jena.	New glass.
One per cent. sodium carbonate solution	134.4	126.6	30.6	32.3
Water	8.4	20.6	1.1	0.7
Two-fifths per cent. hydrochloric acid solution	4.7	16.2	1.3	1.5
One per cent. sodium hydroxide solution	100.1	78.4	97.1	89.0
Total loss	247.6	241.8	130.1	123.5

The variations between the new glass and the Jena glass are, with the exception of the solubility in 1 per cent. sodium hydroxide solution, within the limits of factory practice. In resisting caustic soda solution, however, the new glass is undoubtedly superior to the Jena glass.

It may not be out of place at this time to call attention to the fact that beakers made of either the new glass or Jena glass can be used for evaporations on the water-bath without danger of cracking. A few tests of beakers made from other kinds of glass will convince one that very few pieces will stand exposure to steam for more than fifty hours. I have exposed beakers of both the new and Jena glass to the action of steam for over 200 hours continuously, without any sign of fracture appearing.

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June 4, 1902.

NOTES.

Rapid Volumetric Method for Determining Phosphoric Acid in Fertilizers.—In describing the following volumetric method for the determination of phosphoric acid in fertilizers and fertilizing materials very little that is strictly original is claimed. The method is a modification of the volumetric method as published by the Association of Official Agricultural Chemists. The most important change consists in shaking the solution after adding the ammonium molybdate.