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AN ANALYSIS OF PLATE GLASS.

[READ BEFORE THE CHEMICAL SOCIETY OF LONDON.]

BY J. S. BRAZIER, F.C.S.,

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IN going over the analyses of the different varieties of glass which have been recorded, we find that but little attention has been paid to the composition of plate glass, a material which is almost becoming a necessary of life. It is, moreover, remarkable, that no analysis of the plate glass manufactured in Great Britain, has ever been published. The following pages contain the results obtained from the analysis of three different specimens of plate glass, which were undertaken at the request of Dr. Hofmann.* These specimens were procured at the three most extensive plate glass manufactories of England.

Which are—

- I. The British Plate Glass Company, St. Helens, Liverpool.
- II. The London Thames Plate Glass Company, Bow Creek, Blackwall.
- III. The London and Manchester Plate Glass Company, Sutton, St. Helens, Liverpool.

For the purpose of analysis, these specimens of glass were reduced to the most minute state of division, which was effected by levigating in the usual manner. None of the specimens, whilst digesting in water, gave any reaction with the most delicate test papers.

To determine the extent of their solubility in water, from four to five grammes were digested in that menstruum for about forty-eight hours, the clear solution, in each case, yielded on evaporation but a slight residue, too small for determination.

* I am indebted for these specimens to the kindness of Mr. Fincham of the British Plate Glass Works.—*Dr. A. W. Hofmann.*

The specific gravity of these specimens of glass is as follows :—

British Plate Glass	-	-	-	-	2.319
London Thames Plate Glass	-	-	-	-	2.242
London and Manchester Plate Glass	-	-	-	-	2.408

A qualitative examination showed the presence of silicic acid, potash, soda, sesquioxide of iron, alumina, lime, and in one case traces of manganese.

The silicic acid was determined in the usual manner, by fusion with pure carbonate of potash. The sesquioxide of iron, the alumina, and the lime, were afterwards precipitated from the hydro-chloric filtrate.

To determine the alkalies, the glasses were decomposed by means of hydrofluoric acid, in an apparatus recommended by Brunner,* which consists of a leaden capsula with a flat bottom about six inches in diameter and four inches high, in the centre of which is placed a small leaden ring about an inch and a half high, which serves as a support for a platinum dish. The leaden capsula has a cover fitting perfectly tight.

To set the apparatus in action, it is necessary to cover the bottom of the capsula with a layer of pulverised fluorspar about half an inch in thickness, and to pour upon it some sulphuric acid, sufficient to form a thick paste. A weighed portion of the finely powdered glass, after being put in the platinum dish, is covered with water, and placed on the leaden ring. The whole is then kept at a gentle heat either on a sand bath, or by means of a spirit-lamp.

By a few preliminary experiments, the action on the glass was found to be exceedingly slow, when covered merely with water; it was then suggested to me by Dr. Hofmann to try, instead of water, a strong solution of ammonia; it was found that, the hydrofluoric acid being much more rapidly absorbed by this latter agent, the decomposition was facilitated in a remarkable manner.

The first of the two following tables shows the amount of substance employed; the results obtained are exhibited in Table II.

TABLE I.

	I.		II.		III.	
	British Plate Glass.		London Thames Plate Glass.		London & Manchester Plate Glass.	
	1 grm.	2 grm.	1 grm.	2 grm.	1 grm.	2 grm.
Quantity of glass for } general analysis	1.3429	1.1750	1.1579	1.1906	1.0508	1.1095
Quantity of glass for } estimation of alkalies	1.9400	2.1500	1.4200	1.6800	1.0200	2.0700

* Poggendorff's Annalen, XLIV., page 134.

TABLE II.

	I.		II.		III.	
	British Plate Glass.		London Thames Plate Glass.		London & Manchester Plate Glass.	
	1 grm.	2 grm.	1 grm.	2 grm.	1 grm.	2 grm.
Silicic acid - - -	1.0402	0.9180	0.9090	0.9390	0.8200	0.8630
Chlorides of potassium and sodium - - -	0.5700	0.6460	...	...	0.2675	0.5360
Bichloride of platinum and potassium - -	0.3100	0.3610	...	...	0.0925	0.1835
Chloride of sodium -	0.4735	0.5360	...	...	0.2390	0.4790
Sesquioxide of iron and alumina - - -	0.0127	0.0105	0.0320	0.0495	0.0373	0.0405
Carbonate of lime -	0.1266	0.1135	0.1245	0.1305	0.0887	0.0987
Sulphates of potash and soda - - -	...	...	0.4105	0.4940	...	...
Sulphate of baryta -	...	...	0.6645*	0.7960*	...	...

The following numbers correspond with the foregoing results :—

I.—BRITISH PLATE GLASS.

	I.	II.	MEAN.
Silicic acid - - - -	77.4592	77.2700	77.3646
Potash - - - - -	2.8110	3.2192	3.0151
Soda - - - - -	12.9232	13.2028	13.0630
Lime - - - - -	5.2192	5.4096	5.3144
Manganese - - - -	"	"	"
Sesquioxide of iron -	0.9457	0.8936	0.9197
Alumina - - - - -	trace	trace	trace
	<u>99.3583</u>	<u>99.9952</u>	<u>99.6768</u>

II.—LONDON THAMES PLATE GLASS.

	I.	II.	MEAN.
Silicic acid - - - -	78.5050	78.8669	78.6859
Potash - - - - -	1.2744	1.4176	1.3460
Soda - - - - -	11.5919	11.6724	11.6322
Lime - - - - -	6.0605	6.1380	6.0992
Manganese - - - -	"	"	"
Sesquioxide of iron -	trace	trace	trace
Alumina - - - - -	2.7636	2.5970	2.6803
	<u>100.1954</u>	<u>100.6919</u>	<u>100.4436</u>

* These numbers were obtained in an indirect determination of the alkalis.

III.—LONDON AND MANCHESTER PLATE GLASS.

	I.	II.	MEAN.
Silicic acid - - - -	78.0357	77.7827	77.9092
Potash - - - -	1.7453	1.7062	1.7257
Soda - - - -	12.4373	12.2822	12.3598
Lime - - - -	4.7270	4.9816	4.8543
Manganese - - - -	traces	traces	traces
Sesquioxide of iron - -	"	"	"
Alumina - - - -	3.5495	3.6502	3.5998
	<hr/> 100.4948	<hr/> 100.4029	<hr/> 100.4488

A table is subjoined containing analyses of several varieties of plate glass, in order that the composition of the plate glass in this country may be compared with that manufactured abroad. The Venetian glass was analysed by M. Berthier, the Bohemian mirror glass by Peligot, and the French glasses by Dumas.*

	Venetian Plate Glass.	Bohemian Plate Glass.	French Plate Glass.		British Plate Glass.	London Thames Plate Glass.	London & Manchester Plate Glass.
			No. 1.	No. 2.			
Silicic acid - - -	68.6	67.7	75.9	73.85	77.36	78.68	77.90
Potash - - -	6.9	21.0	...	5.50	3.01	1.34	1.72
Soda - - -	8.1	...	17.5	12.05	13.06	11.63	12.35
Lime - - -	11.0	9.9	3.8	5.60	5.31	6.09	4.85
Magnesia - - -	2.1	...	...	...	...	...	...
Manganese - - -	0.1	...	...	...	...	...	trace
Oxide of iron - -	0.2	...	...	...	0.91	trace	...
Alumina - - -	1.2	1.4	2.8	3.50	traces	2.68	3.59
	<hr/> 98.2	<hr/> 100.0	<hr/> 100.0	<hr/> 100.00	<hr/> 99.65	<hr/> 100.42	<hr/> 100.41

Plate glass is usually considered as a double silicate of lime and soda, or of lime and potash. The following atomic expressions represent the different analyses contained in the above table; the amount of potash contained in the English varieties of glass being very trifling, this oxide has been neglected altogether in the construction of their formulæ.

Venetian plate glass - - -	2 KO, 3 NaO, 5 CaO, 22 SiO ₃
Bohemian mirror glass - - -	KO, CaO, 4 SiO ₃
French plate glass, No. 1 - - -	4 NaO, CaO, 11 SiO ₃
French plate glass, No. 2 - - -	KO, 3 NaO, 2 CaO, 14 SiO ₃
British plate glass - - -	2 NaO, CaO, 9 SiO ₃
London Thames plate glass - - -	2 NaO, CaO, 8 SiO ₃
London and Manchester plate glass - - -	2 NaO, CaO, 9 SiO ₃

* Comp. Knapp's Technology, Vol. II., p. 16.