

EFFECTS OF THE SOLUBLE CONSTITUENTS OF GLASS  
UPON THE VISCOSITY OF WATER AT VERY  
LOW RATES OF SHEAR.

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IN the *Philosophical Magazine* for May, 1905, Professor A. W. Duff gives an account of certain experiments upon the viscosity of water at low rates of shear — about five radians per sec. The method of flow through horizontal glass tubes under very small pressures was used. Values were obtained for the coefficient that were in some instances nine or ten per cent. higher than those found by the ordinary methods. After varying the experiment in a number of ways to find the explanation of this increased value for the coefficient Professor Duff arrived at the conclusion that "Very minute quantities of the constituents of glass dissolved out by water have very large effects on the viscosity of water at low rates of shear."

Two experiments were performed to test this conclusion using the apparatus and methods described in the preceding paper.

*Experiment 1.*

About a square foot of window glass was carefully cleaned, laid between pads of filter paper and crushed into a coarse powder with a hammer. The powdered glass was then put into a litre bottle of distilled water and allowed to stand for a week. It was then filtered off into the outer cylinder, the apparatus adjusted, set in motion and the deflection observed for the smaller inner cylinder. The glass solution was then replaced as quickly as possible by freshly distilled water and the deflection observed under similar conditions. The following observations are averages for intervals of fifteen minutes. The rate of shear was about .66 radian per sec.

	<i>s</i>	<i>t</i>	<i>st</i>	Temp.	<i>st</i> Reduced.
Glass solution.	15.61	48.97	764.5	25.00	764.5
Pure water.	16.48	48.78	803.7	22.95	767.4

In the last column the two valves of  $st$  are reduced to the same temperature and scale distance.

*Experiment 2.*

Five or six feet of soft german sodium-glass tubing of the sort described by Professor Duff was crushed between filter paper, put in a mortar and reduced to a fine powder. This was soaked in a litre bottle of distilled water for a week, the bottle being occasionally shaken up, and the viscosity of the solution compared as before with that of pure water by noting the deflections of the small inner cylinder when immersed in them under similar conditions. This experiment also differs from the preceding one in that a guard ring was used to eliminate possible surface effects and that several sets of observations were taken. The rate of shear as before was about .66 radian per sec.

	$s$	$t$	$st$	Temp.	
Glass Solution.	14.90	49.10	731.8	23.05	Average value of $st$ reduced = 787.9.
	14.91	48.91	729.3	"	
	14.94	49.98	731.3	"	
	14.85	49.10	729.3	"	
Pure Water.	14.86	48.65	722.9	23.32	Average value of $st$ reduced = 784.5.
	14.77	49.05	724.4	"	
	14.78	48.98	723.7	"	
	14.71	48.98	721.0	"	
	14.86	48.60	722.0	"	

*Conclusion.* — In these experiments whose parts were carried out under precisely similar conditions, no differences between the viscosities of glass solutions (which must have been far stronger than those used by Professor Duff) and those of pure water were found that could not be accounted for by observational errors. The results do not, therefore, appear to sustain the contention that the viscosity of water is noticeably increased at low rates of shear by minute quantities of the soluble constituents of glass.