TEMPERATURE DEPENDENCE OF THE DYNAMIC VISCOSITY OF THE WORKING LIQUID OF A CONTINUOUS-MEDIUM HYDRO-INTEGRATOR

V. P. Dushchenko, and I. P. Lesnoi

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Results are presented of an experimental determination of the dynamic viscosity of solutions of Vinipol in vaseline oil.

The flat channel [1–3] is widely used for modeling nonsteady seepage problems. In essence, it is a continuous-medium hydro-integrator [4]. The use of such channels to investigate seepage phenomena is based on the known analogy between the laminar flow of water in porous media and the laminar flow of a viscous liquid in a narrow slot formed by two parallel walls.

The main inaccuracies of this method of modeling stem from inaccuracies in the construction of the narrow slot. These inaccuracies may easily be avoided by increasing the slot width and then using more viscous working liquids. A working liquid that can be used for these purposes is a solution of Vinipol in medicinal mineral oil in the proportions: 1/3 Vinipol and 2/3 oil.

Vinipol is a product of polymerization of vinyl butyl ether [5, 6]. The viscosity of the solution may be varied over a wide range by changing its Vinipol content and temperature. An investigation of the viscosity of Vinipol solutions in the temperature range 0–75° C was carried out using a Höppler [7, 8] falling ball viscometer, and also a RV-8 Volarovich [9] rotating viscometer, the most suitable instruments for this purpose [10]. The liquid densities required for the calculations were determined with a pycnometer.

The test data were analyzed using the mean value method in the form of the empirical formula $\eta = A \exp(B/T)$, which is good enough approximation to the temperature dependence of the dynamic viscosity, not only of simple, but also of more complex liquids, at constant external pressure [11].

The test data are given in the table. The temperature of the liquids investigated was held constant by thermostating to an accuracy of ±0.05 degree.

NOTATION

η—dynamic viscosity ($N \cdot sec/cm^2$); T—thermodynamic temperature of liquids (° K); A and B—coefficients of empirical formula.

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Gor'kii State Pedagogical Institute, Kiev

Temperature Dependence of Dynamic Viscosity

Composition of solutions by weight	Temperature range, ° K	Coefficients of empirical formula $\eta = A \exp(B/T)$		Mean error, %
		A	B	
Mineral oil	288—348	$3094 \cdot 10^{-12}$	5211.8	3.54
0.1 Vinipol + 0.9 mineral oil	283—348	$6765 \cdot 10^{-11}$	4682.1	4.02
0.2 Vinipol + 0.8 mineral oil	273—308	$3784 \cdot 10^{-12}$	5890.7	3.62
the same	313—348	$1604 \cdot 10^{-10}$	4792.7	1.71
0.3 Vinipol + 0.7 mineral oil	273—303	$22994 \cdot 10^{-12}$	5626.9	4.81
the same	308—348	$5594 \cdot 10^{-10}$	4878.5	3.32
0.4 Vinipol + 0.6 mineral oil	273—308	$86118 \cdot 10^{-13}$	620.3	3.13
the same	313—348	$20095 \cdot 10^{-10}$	4510.2	5.31
0.5 Vinipol + 0.5 mineral oil	278—303	$20756 \cdot 10^{-13}$	6840.9	2.70
the same	308—348	$4810 \cdot 10^{-10}$	5209.7	2.90