UDK 687.174:665.71

INVESTIGATION OF OIL FILTRATION INTENSITY THROUGH OIL CLOTHING MATERIALS

ИССЛЕДОВАНИЕ ИНТЕНСИВНОСТИ ФИЛЬТРАЦИИ НЕФТИ ЧЕРЕЗ ТКАНЕВЫЙ МАТЕРИАЛ

G.A. GANIYEVA, M. KANDIDAT, M. BAIMAKHANOVA, ZH. USENBEKOV
Г.А. ГАНИЕВА, М. КАНДИДАТ, М.Б. БАЙМАХАНОВА, Ж. УСЕНБЕКОВ

(Алматинский технологический университет, Республика Казахстан)
(Almaty Technological University, Republic of Kazakhstan)
E-mail: gaziza_ganieva@mail.ru; k_mika_14_10@mail.ru;
moldir.baymakhanova@mail.ru; zh.usenbekov@mail.ru

The study of oil permeability by the method of pouring petroleum products on the fabric and determining the amount of filtered product in time. Determination of the coefficient of oil permeability from the slope of the approximating straight line in the graph. Determination of the coefficients of oil conductivity for clothing packages. The research technique allows you to select a rational package.

Тема статьи – исследование нефтепроницаемости методом наливки нефтепродуктов на ткань и определение количества фильтрованного продукта во времени. Авторы решали задачу определения коэффициента нефтепроницаемости по углу наклона аппроксимирующей прямой на гра-

фике, а также рассчитывали коэффициенты нефтепроницаемости для пакетов одежды. Предлагаемая методика исследования позволяет подобрать рациональный по составу пакет одежды.

Keywords: oil product, filtration, clothing package, continuity equation, leakage intensity, oil conductivity coefficient, liquid head, permeameter.

Ключевые слова: нефтепродукт, фильтрация, пакет одежды, уравнение неразрывности, интенсивность просачивания, коэффициент нефтепроницаемости, напор жидкости, пермеаметр.

Influence of petroleum products on the properties of clothing to this day is still not sufficiently investigated, requiring the development and development of a methodology for predicting the parameters of a package of materials [1], [2].

Consider a vertical cylindrical transparent tube 4 in which there is a layer of a sample of fabric 2 of thickness L above which oil product 1 is poured (Fig. 1 – simplified scheme for measuring oil permeability (1 - oil, 2 - tissue sample, 4-tube, 5-vessel, 6 - ruler)).

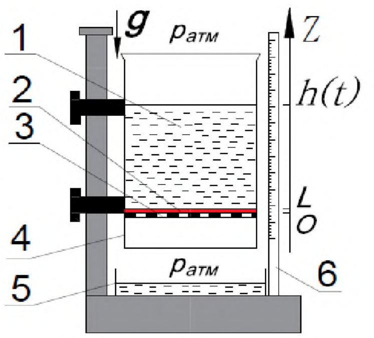

Fig. 1

Under the action of gravity, the fluid seeps through the pores of the tissue and is collected in a vessel 5 below; While the liquid level above the tissue goes down. The tissue layer is kept from below by a horizontal permeable septum (grid) 3, whose resistance to liquid motion can be neglected.

Direct the Oz axis vertically upward, selecting the origin at the level of the mesh surface held by the fabric. If the coefficient of oil permeability C is constant, then the filtering velocity vector u is directed vertically downward, and the pressure p and the projection u of the oil permeability velocity on the vertical axis can depend only on the time and the coordinate z. It follows from the continuity equation that the rate of oil permeability depends only on time. In this case, the Darcy Law will take the form:

$$\frac{dh}{dt} = -C\frac{\partial H}{\partial z}, \qquad H = \frac{p}{\rho g} + z.$$

Where after integration over z we obtain the relation:

$$z\frac{dh}{dt} + f(t) = -C\left(\frac{p}{\rho g} + z\right).$$

Where, f (t) is the integration constant, depending on the time.

Substitution of the boundary conditions z = 0, z = L, p = p_{atm}, in the given problem assuming the form p = p_{atm} + g (h-L) and obtain the equation:

$$h(t) = h(0)\exp\left(-\frac{C}{L}t\right).$$

Where, h (0) is the coordinate of the free surface of the liquid at the initial instant of time. The last relation can be rewritten as a linear relationship between the logarithm of the dimensionless coordinate of the surface (-η) and the time t:

$$\eta = \frac{C}{L}t, \quad \eta = \frac{h(t)}{h(0)} > 0.$$

Thus, having determined in the experiment the coordinates of the free surface of the oil product for several instants of time, one can find the value of the filtration coefficient C.

The installation for carrying out the experiment is a vertical transparent tube, in the lower part of which there is a layer of tissue sample between two fine-meshed meshes (see Fig. 1). The free liquid at the top of the unit seeps through the material and drains into a vessel installed at the bottom of the unit.

Before the beginning of the experiment, we measure the thickness of the material L. Through the upper end of the pipe, we pour oil into the unit. After the vibration of the free surface has ceased, and the sample of the material is completely filled with liquid - oil, we turn on the stopwatch and simultaneously fix the initial coordinate of the free surface h (0) on a scale strengthened on the installation. As the free surface descends, its coordinates h are determined for several instants of time t.

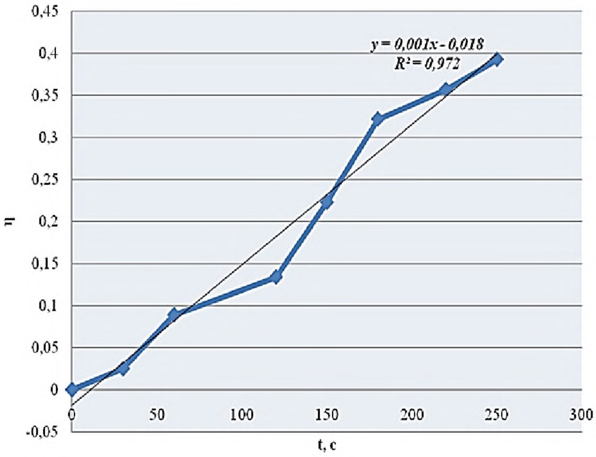

Fig. 2

As an example for a sample (for the fabric "Premier Cotton Rich 230A" article 18450a-M), based on the results of the processed data in Table 1, a graph of the linear dependence of η on t is constructed (Fig. 2 – graph of the dependence of the dimensionless surface coordinate and time observation).

The coefficient of oil permeability C is determined from the slope of the approximating straight line in the graph.

The use of this method is associated with long-term experiments, as well as not always applicable for packages of clothing and oil products with high densities and viscosity. For petroleum products with high viscosity, the head from the liquid height is not always sufficient and does not allow to determine the permeability coefficient with sufficient accuracy.

The determination of the oil conductivity for several layers of packages was used by the ApatheK-Dubna device complex, installed in the laboratory of expertise of Saraptau LLP. The device consists of a container for the test liquid that is supplied to the surface of the packets fixed inside the permeameter, a permeability meter.

The tank was filled with crude oil viscosity of 60.8 mm2 / s. Next, packs of materials consisting of each of the fabric of the top, heater and podkalada are laid in permeamert, after which the upper plate of permeamer is closed .. The results of the experiment are processed by a computer and displayed on the monitor screen.

As a result of experimental studies at the same pressure and test time, the volume of filtered oil products and the permeability coefficients were obtained for different packets of materials. Table 1 (comparative analysis of the coefficient of permeability of materials) shows the results fragment for the material packages.

Table 1

№ t/n	Package	Oil permeability coefficient
1	Premier Standart250 + Synthepon + coarse calico	0,0043
2	Premier comfort 250A + Synthepon + coarse calico	0,0033
3	Premier CottonRich 230+ Synthepol + coarse calico	0,0055
4	FlameFort 210A + Synthepon + coarse calico	0,0035
5	Premier Comfort 250 + Synthepon + coarse calico	0,0041

As can be seen from the results of the experiments given in Table 1, the permeability coefficient of the materials tested is different. Packages of materials No. 2 and No. 4 have the lowest coefficient of oil permeability.

The application of the installation shown in Figure 1 is applicable for individual layers of fabric and does not require large expenditures.

Investigations with the use of crude oil, with the use of a complex ApatheK device, allows for a short period of time to determine the values of the permeability coefficient.

R E F E R E N C E S

1. *Ganiyeva G.A., Ryskulova B.R.* Metodika opredeleniya neftepronitsayemosti materialov dlya izgotovleniya spetsodezhdy dlya rabochikh neftyanoy otrasli // Tez. dokl. XVI Mezhdunar. nauchn.-tekhn. konf.: Sovremennyye kontseptsii nauchnykh issledovaniy / YESU, M., 24-25 iyulya, 2015. S.46…48.

2. *Ivashchenko I.N.* dissertatsiya ... kandidat tekhnicheskikh nauk: 05.19.04 / Ivashchenko Irina Nikolayevna. - [Mesto zashchity: Tsentr. nauch.-issled. Int shveynoy prom-sti] .- Moskva, 2008.- 199 s .: il. RGB OD, 61 08-5 / 1556.

3. *Braslavskiy V.A.* Kapillyarnyye protsessy v tekstil'nykh materialakh. – M.: Legpromizdat, 1987.

Рекомендована кафедрой технологии, конструирования изделий и товаров. Поступила 29.08.17.