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# COMPOSITION OF LIQUID PARAFFINS AND THEIR FLOTATION PROPERTIES IN MODEL SAMPLES

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## Abstract

The article recommends optimal parameters for the process of obtaining liquid paraffin based on hexane, which is a secondary product of the chemical industry. Comparing the composition of domestic and “foreign analog” aprotic solvents, it is found that the efficiency is higher in solutions with a relatively large amount of the main component, the concentration output is 3.2% higher in the “foreign analog” solvent with the same consumption of two apolar collectors, the content of KCl in the float product due to the influence of local liquid paraffin the amount was found to be 0.9% more.

**Keywords and phrases:** *liquid paraffins, used hexane, hydrocarbon mixture, model samples, flotation properties*

## Introduction

Today, in the world, natural and environmentally friendly raw materials – liquid paraffins are used in medicine to relieve constipation, in the treatment of encopresis, as a binding agent or ointment in the production of capsules and tablets in pharmaceuticals, as a moisturizing and cleansing agent for skin and hair in cosmetology, in the production of paraffin paper in light industry, as flotation of reagents in the chemical industry. used in enrichment. Therefore, identifying new sources of liquid paraffins, creating effective technologies for their separation and putting them into practice remains one of the important tasks.

A number of scientific researches are being conducted in the world to identify and separate cheap sources of liquid paraffins. In this regard, special attention is being paid to expanding sources of liquid paraffins not only from oil reserves, but also from secondary hydrocarbons of the chemical industry, developing innovative methods of separation, using sylvinite ore as a highly efficient selective collector in flotation enrichment, developing and testing technologies for obtaining liquid paraffins. As it is known (Patent. No. 925793), they suggest using kerosene as a source of liquid paraffins. Typically, kerosene contains up to 30% aromatic hydrocarbons, which adversely affect the selectivity of beneficiation of sylvinite ores by flotation. In addition, naphthalene hydrocarbons are carcinogenic substances, so it is not important to involve them in the process.

As aprotic solvents, it is proposed to use gas oil and crude oil extraction products. Foamless flotation apparatus was used to study the collection properties of oil reagents. In the tests, the reagents were first dispersed with the feed in a foamless flotation apparatus. This made it possible to exclude the separation of the emulsion during the flotation process itself. The collection characteristics of the initial products of different composition and the technology of obtaining their fractions were also studied (Baichenko A. A., Ivanov G. V., Bocharova E. M., 1999; Baichenko A. A., Ivanov G. V., Bocharova E. M., Bauer L. N., Min R. S., Kukushkin V. V., 1999; 1999; Petukhov V. N., Kukushkin V. V. 1999; Petukhov V. N., Kukushkin V. V. 1999; Savinchuk L. G., Kukushkin V. V., Aglyamova E. R. 1999).

Sources (Khan G. A., Gabrielova L. I., Vlasova N. S., 1986; Ya L., Shubov, S. I., Ivankov, N. K. Shcheglova. 1986; Ya L., Shubov, S. I. Ivankov. 1992) list some aprotic reagents, such as clarified, tractor and oxidized kerosene, household stove fuel, apolar aromatic reagents AAP-1 and AAP-2, activated flotation reagent AF-2 and thermogasoyl. Clarified kerosene is widely used in the early stages of flotation and is still widely used in a small number of factories. The predominance of saturated compounds in kerosene has a more selective effect on coal flotation than aromatized kerosene, but the flotation rate is slightly lower. The advantages of clarifying kerosene are the absence of a specific smell, ease of use, smooth process, and low cost. Kerosene does not foam, and at high consumption it exhibits anti-foaming properties. For coal flotation, clarified kerosene is used only in combination with a heteropolar reagent. Its consumption is 1–3 kg/t.

Chemically, kerosene is a mixture of saturated, unsaturated and aromatic hydrocarbons. A large amount of unsaturated and aromatic hydrocarbons containing 16–24 carbon atoms per molecule compared to clarified kerosene (17%), allows tractor kerosene to increase its flotation ability. During the flotation of coals of the middle stage of metamorphism, its consumption is 1–1.5 kg / t, in the flotation of low metamorphism – 1.5–2.5 kg / t.

## The purpose of the study

The secondary product of the chemical industry is the development of technology for obtaining liquid paraffins based on used hexane and the identification of their effective areas of application.

The waste of JV “Uz-KorGasChemical” LLC, which was chosen as a **research object,** is liquid paraffin produced by dissolving various hydrocarbons in secondary hexane. Liquid paraffins are mostly saturated hydrocarbons with linear structure having carbon numbers C5–C18.

## Experiments section

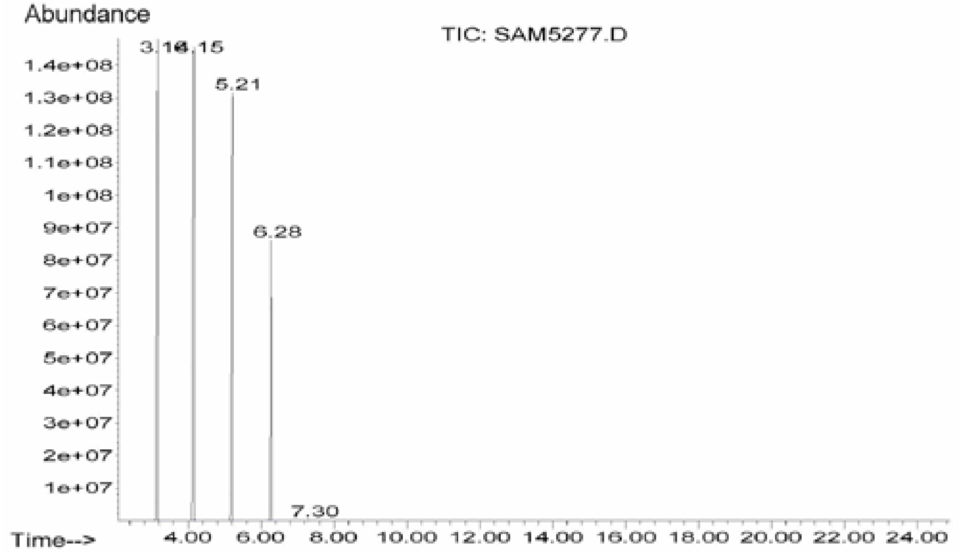
Recycled hexane is known to contain low molecular weight and high molecular weight compounds according to regulations. Therefore, the main task of achieving this goal is to separate the mixture into low molecular and high molecular components. In the first distillation, the light volatile part was separated to separate the liquid paraffin mixture, and then the main part of the product was separated.

The cubic residue was separated from the residual mass of the main component by filtration.

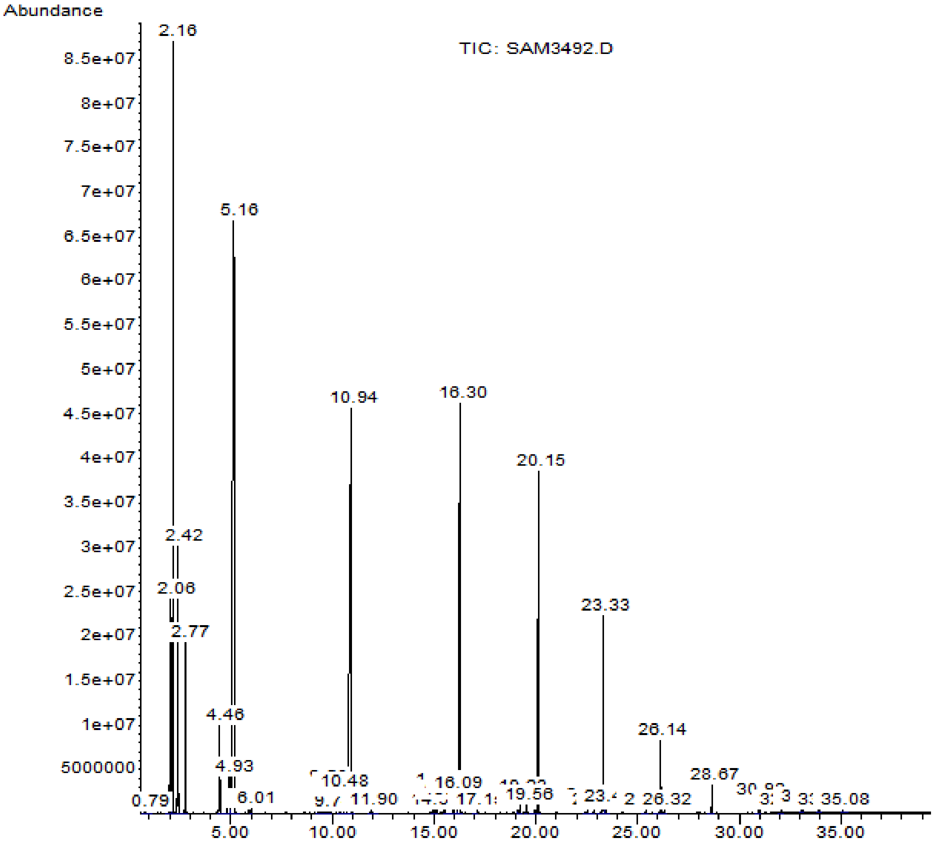
To determine the composition of the initial and obtained flotation reactants, we used chromate-mass spectroscopy in a 5% solution of phenylmethylsiloxane in dimethylsiloxane using a 30m × 0.25 mm capillary column using an Agilent Technology GS 6890 / MS 5973N device, using hydrogen as a carrier gas and an injector temperature 280 C, the temperature of the MS source 230 C, MS square field temperature was 180 C. When programming the temperature of the column thermostat from 100 to 280 C, the temperature rise rate is 10 C/min, and the sample volume is 1 μl. The resulting chromatogram is shown in Figure 2.4 (b). At the same time, Figure 2.4 (a) shows the chromatogram of liquid kerosene – an imported foreign analogue.

**Figure 1.** *Chromatogram of studied samples: a) imported paraffin; b) domestic liquid paraffin*

*a) 1) tetradecane; 2) pentadecane; 3) n-cetane; 4) n-heptadecane; 5) n-octadecane*



*b) 1) 2-methylpentane; 2) 3-methylpentane; 3) hexane; 4) cyclopentane; 5) cyclohexane; 6) 2-ethylhexane; 7) trans-1-ethyl-3-methylcyclopentane; 8) n-octane; 9) ethylcyclohexane; 10) octane; 11) 5-methylnonane; 12) 9-methylleucosan; 13) 3-methylnonane; 14) 2-heptenal; 15) dean; 16) 1-cyclohexyl; 17) 4-ethyldecane; 18) undecane; 19) 3-methyl-undecane; 20) 1-hexyl-3-methylcyclopentane; 21) dodecane; 22) 1-hexylcyclohexane; 23) tridecane; 24) 3-methyltridecane; 25) n-tetradecane; 26) 5-methyltetradecane; 27) pentadecane; 28) n-hexadecane; 29) nonyl-cyclohexane; 30) 5-methylpentadecane; 31) n-octadecane; 32) cyclohexylmethane; 33) n-eicosan; 34) n-docosane; 35) 2-methylcyclodecanone; 36) n-tetracosane; 37) Z, Z-3,13-octadedecedien-1-ol; 38) hexacosane*



## Analysis of results

The obtained results show that the imported paraffin analogue contains saturated hydrocarbons with carbon numbers ranging from C14 to C18. However, the composition of the waste is multi-component. It consists of low molecular and medium molecular hydrocarbons of cyclic and acyclic structure. Chromatograms show peaks characteristic for unsaturated hydrocarbon radicals, as well as for hydroxyl radicals that disappear after cubic residue separation. Peaks characteristic of pentane, hexane and heptane isomers also disappear after distillation.

The resulting aprotic solvent liquid paraffins were used in the process of flotation beneficiation of potassium ore, and the reagents were first tested on model samples. The gas chemical complex of JV "UzKorGasChemical" LLC prepared local liquid paraffins (MSP) obtained on the basis of secondary hexane as an apolar solvent, R1 – R3 composition solutions. As an object of comparison, "foreign analogue" (FA) purchased from abroad and used by JSC "Dekhkanabad potash plant" for beneficiation of sylvinite ores was used.

**Table 1.** *Results of flotation of liquid paraffins in model samples at a temperature of 22 ± 1 C*

| Indicators | Model samples | | | | | |
|---|---|---|---|---|---|---|
| | $P_1$ | | $P_2$ | | $P_3$ | |
| | FA | DLP | FA | DLP | FA | DLP |
| Yield, %: | | | | | | |
| Concentrate | 42,3 | 39,1 | 31,5 | 31,2 | 17,5 | 19,4 |
| residual | 57,7 | 60,9 | 68,5 | 68,8 | 82,5 | 80,6 |
| Mass fraction of KCl, %: | | | | | | |
| Concentrate | 89,2 | 90,1 | 89,4 | 88,9 | 87,4 | 87,9 |
| residual | 21,26 | 24,25 | 7,55 | 8,12 | 5,70 | 3,84 |
| Separated KCl, %: | | | | | | |
| Concentrate | 75,46 | 70,46 | 84,5 | 83,21 | 76,56 | 85,26 |
| residual | 24,54 | 29,54 | 15,5 | 16,79 | 23,44 | 15,74 |

It can be seen from the table that the "foreign analog" solution has a high concentration in solutions with a relatively large amount of the main component. If these two apolar collectors are compared with the "foreign analogue" and domestic liquid paraffin in terms of the concentrate yield and the amount of KCl in its content, it can be seen that the concentrate yield is 3.2% higher in the first apolar solvent at the same consumption. But at the same time, under the influence of local liquid paraffin, the amount of KCl in the flotation product is 0.9% higher, which indicates that local liquid paraffin is more effective. These results are of practical importance and are the basis of high selectivity activity of native liquid paraffin. Hence, the mass ratios of the initial salts in the model samples greatly affect the efficiency and selectivity of the apolar solvent.

The original model example shows that as the temperature of the initial solution increases, the total amount of salts in the saturated brine increases mainly due to the increase in the amount of potassium chloride. But an increase in temperature causes an increase in the surface activity of the additives in the composition, as well as the activity of the collecting reagents. Therefore, the temperature dependence of the efficiency of apolar collectors was also studied. Figures 2 and 3 show the results of these studies.

At the limits of all investigated temperatures, the concentrate yield is higher in the imported foreign analogue: an increase in temperature from 10 C to 40 C increases the concentrate yield by 23%, with an increase in aproton consumption by 5 g/t, a 5% increase was observed in the R1 model sample even at low flotation temperatures. With an increase in temperature at 45 C, there were no sharp changes in the yield of the concentrate.

**Figure 2.** *Yield of flotation concentrate of R3 model sample when collector consumption is 10 g/t: 1) FA; 2) DLP*

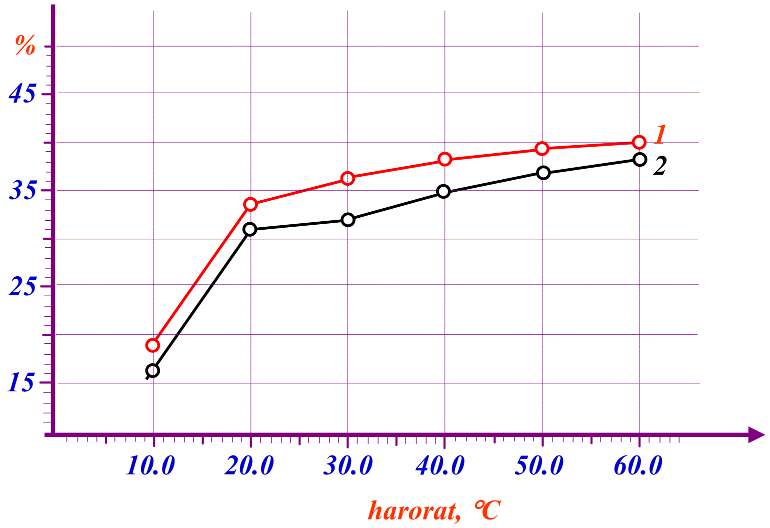
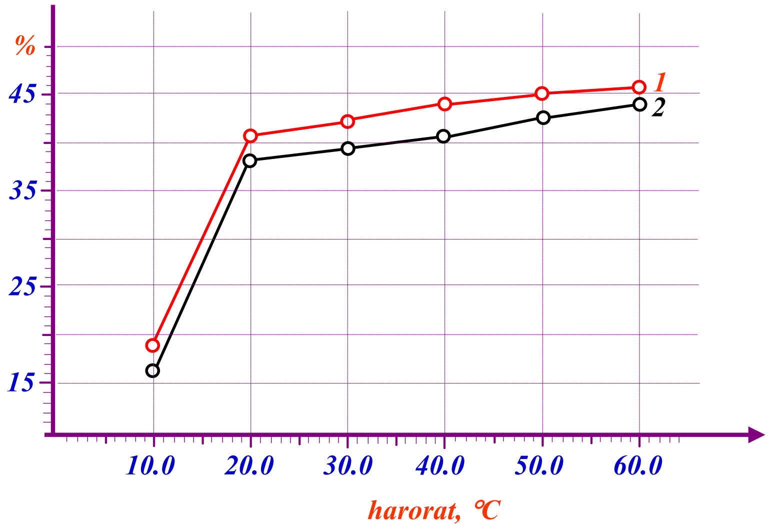


**Figure 3.** *Yield of flotation concentrate of R3 model sample when collector consumption is 15 g/t: 1) FA; 2) DLP*



At low temperatures, when native liquid paraffins are used as an aprotosolvent, the concentrate yield is low, but at high temperatures, it is possible to see an improvement in the concentrate yield.

## Summary

The results of the comparative analysis of flotation sodium show that the flotation activity of the imported apolar solvent is lower than that of domestic liquid paraffins. This can be justified by the presence of high-molecular carbon rods with a cyclic structure and relatively large molecular sizes, which accelerate hydrophobization of floating potassium chloride particles in the composition of local liquid paraffins.

## References

Patent. No. 925793. Republic of Belarus. Collector for flotation of potassium-containing ores. E. I. Shcherbina, E. I. Grushova, A. E. Polyakov, N. I. Vorobyov, I. B. Makhlyankin, Z. S. Podlesnaya, V. G. Zelenkina, A. S. Malakhov, M. A. Gamilov, V. T. Bor. Claimed. 28.01.80; Publ. 07.05.82. Bull. 17. (In Russian)

Baichenko A. A., Ivanov G. V., Bocharova E. M. / Effect of electrolytes on coal flotation // Vestn. Kuz STU, No. 4 1999. – P. 66–71. (In Russian)

Baichenko A. A., Ivanov G. V., Bocharova E. M., Bauer L. N., Min R. S. Effect of electrolytes on the force of particle detachment from an air bubble during flotation // Proc. of the scientific-technical conf. November 19–20, 1999. – Kemerovo: Kuzbassvuizdat, 1999. – P. 93–100. (In Russian)

Kukushkin V. V. Study of the influence of structural features of organosilicon compounds on their flotation activity // Issues of Applied Chemistry: Collection of scientific papers. – Magnitogorsk, 1999. – P. 76–81. (In Russian)

Petukhov V. N., Kukushkin V. V. Search for new reagent-modifiers and development of technology for their use in coal flotation // Beneficiation, processing and complex use of mineral raw materials: Proceedings of the scientific and technical conference. – Kemerovo, 1999. – P. 83–87. (In Russian)

Petukhov V. N., Kukushkin V. V. Flotation of difficult-to-beneficiate coals using reagent-modifiers // Coke and Chemistry. 1999. – No. 9. – P. 9–12. (In Russian)

Savinchuk L. G., Kukushkin V. V., Aglyamova E. R. Study of adsorption of flotation reagents on the surface of coals based on gas chromatographic measurements // II Congress of Beneficiators of the CIS Countries: Collection of abstracts of reports. – M: MISIS, 1999. – P. 74–76. (In Russian)

Khan G. A., Gabrielova L. I., Vlasova N. S. Flotation reagents and their application. – M.: Nedra, 1986. – 271 p. (In Russian)

Ya L., Shubov, S. I., Ivankov, N. K. Shcheglova. Flotation reagents in mineral raw material enrichment processes. Handbook: In 2 books / Ed. L. V. Kondratieva. – M.: Nedra, 1990. – Book 2. – 263 p. (In Russian)

Ya L., Shubov, S. I. Ivankov. Patented flotation reagents: Reference manual. – M.: Nedra, 1992. – 362 p. (In Russian)

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