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InterGING

Sonnenbrink 20

31789 Hameln, Germany

Inhaber: Marina Kisiliuk

Tel.: + 49 51519191533

Fax.: + 49 5151 919 2560

Email: info@dwherold.de

Internet: www.dwherold.de

Chefredakteur/Editor-in-chief:

Marina Kisiliuk

Korrektur:

O. Champela

Gestaltung:

N. Gavrilets

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31789 Hameln, Germany

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Email: info@dwherold.de

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clinicfarm@bsmu.by

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arngegechkori@yahoo.com

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Chemistry, Georgia
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teimuraz.lezhava@tsu.ge

Shota A. Samsoniya, Prof.
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shota.samsonia@tsu.ge

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tamaz.mdzinarashvili@tsu.ge

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Oncology, Belarus
aprokharau@gmail.com

Pyrochkin V., MD, PhD, MSc Prof.
Theraphy, Belarus
wlad_cor@mail.ru

Golubev A.P., BD, Prof.
Ecology, Belarus
algiv@rambler.ru

Makarevich A., MD, PhD, Prof.
Theraphy, Belarus
makae@bsmu.by

Kanunnincova N., BD, Prof.
Physiology, Belarus
n.kanunnikova@grsu.by

Giedrius Vanagas, Prof.
Internal Medicine, Lithuania
Giedrius.Vanagas@lsmuni.lt

Armuntas Baginskas, Prof.
Neurofiziologija, Lithuania
Armuntas.Baginskas@lsmuni.lt

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Meyramov Gabit, Prof.
Cytology and Histology, Kazakhstan
meyramow@mail.ru

Aisha Mohammed Abd al-salam Shahlol
Ph.D. in Medical Bacteriology, Libya
Ais.shahlol@sebhau.edu.ly

Edmundas Kadusevicius, MD, PharmD, PhD, Prof.
Pharmacology, Lithuania
Edmundas.Kadusevicius@lsmuni.lt

Ivo Grabchev, Prof., PhD.
Chemistry, Bulgaria
i.grabchev@chem.uni-sofia.bg
grabchev@mail.bg

Mariyana Ivanova Lyubenova, Prof., PhD.
Ecology, Bulgaria
ryann@abv.bg
ryana_1@yahoo.com

Tsvetanka Tsankova Marinova, MD, PhD, DMedSci,
Biologv. Bulgaria
tmarinova@yahoo.com

Evgueni D. Ananiev, Prof PhD,
Biology. Bulgaria
evgueni_ananiev@yahoo.com

Plamen G. Mitov, Prof., PhD.
Biology, Bulgaria
mitovplamen@gmail.com

Atanas Dimov Arnaudov, Ph.D.
Physiology, Bulgaria
arny87@yahoo.co.uk

Iliana Georgieva Velcheva, PhD,
Ecology, Bulgaria
anivel@abv.bg

Osman Demirhan, Prof.
Biology, Turkey
osdemir@cu.edu.tr

Jharna Ray, M. Sc., PhD, Prof.
Neurogenetics, India
Indijaharnaray@gmail.com

Marián Halás doc. RNDr, Ph.D.
Human geography, Czech
marian.halas@upol.cz

Ayfer Pazarbasi Prof.Dr.
Biology, Turkey
payfer@cu.edu.tr

Tusharkanti Ghosh Prof.
Physiology, India
tusharkantighosh53@yahoo.in

Khudaverdi Gambarov Gambarov, Prof.
Microbiology, Azerbaijan
khuda1949@mail.ru

Rovshan Ibrahimkhalil Khalilov, Prof.
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hrovshan@hotmail.com

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Linguistics

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Theology, Wells, Maine, USA
djtjohnson@earthlink.net

Satanovsky Leon MD/PhD.
Perio-odontologie, Israel
satleonid@gmail.com

Lists of references are given according to the Vancouver style

Kurta S.A.,

Doctor of Technical Sciences, Professor, Department of theoretical and applied chemistry, State university "Vasyl Stefanyk Precarpathian national university", 57 Shevchenko str., Ivano-Frankivsk, 76018, Ukraine, kca2014@ukr.net

Ribun V.S.,

Graduate student, Department of theoretical and applied chemistry, State university "Vasyl Stefanyk Precarpathian national university", 57 Shevchenko str., Ivano-Frankivsk, 76018, Ukraine, ribun.vika@mail.ru

Fedorchenko S.V.

Candidate of Technical Sciences, Associated Professor, Department of theoretical and applied chemistry, State university "Vasyl Stefanyk Precarpathian national university", 57 Shevchenko str., Ivano-Frankivsk, 76018, Ukraine, fedsof@i.ua

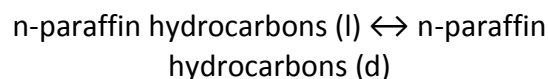
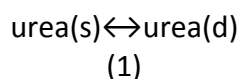
DEWAXING OF MOTOR FUELS IS THE COMPLEX METHOD OF INCREASING THE OCTANE AND CETANE NUMBERS OF GASOLINE AND DIESEL

Abstract. The process of dewaxing of diesel fuel and gasoline with the objective of increasing the octane and cetane numbers of both types of motor fuel is considering in this paper. Conducted researches were made to show the possibility of increasing the octane number (ON) of gasoline due to the removal of low-octane *n*-paraffins and the introduction of separating of diesel, with extractive dewaxing with urea and thiourea. It is established that the increase of ON of gasoline is from 3 to 10 points by the motor method is possible. At the same time it shows that the introduction of *n*-paraffins are removed from gasoline by urea, and the removal separating thiourea in diesel fuel, allows to obtain diesel fuel with increased cetane number by 5-10 points.

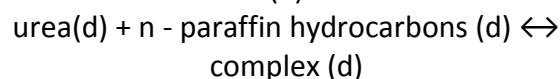
Key words: dewaxing, urea, thiourea, extraction, octane number, cetane number, *n*-paraffins, isoparaffins, gasoline, diesel fuel.

Introduction. Dewaxing is used to remove from petroleum fractions *n*-paraffin hydrocarbons that are crystallized from solution at low temperature. Among the hydrocarbons that can stand out in the crystalline state of the oil fractions are *n*-paraffin hydrocarbons (NPH), including naphthenic and aromatic hydrocarbons with long side alkeline substituents, normal and slightly branched structure. Low paraffin solid hydrocarbon at room temperature is hexadecane (C16) with the melting point of 18 ° C and the boiling point 287°C[1]. Earlier studies have been conducted and presented data about the effect of fractional composition of *n*-paraffin hydrocarbons in low-temperature characteristics of diesel fuel (DF) and shown that the removal of the DF of *n*-paraffin hydrocarbons higher C18 significantly improves these characteristics [2].

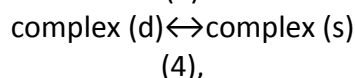
One of the types of dewaxing is urea dewaxing, the so-called extractive crystallization. The formation of complexes with urea are formed by the following equilibrium system at Zimmirshed [1]:



(2)



(3)



where indices s, l, and d corresponds to solid, liquid and dissolved phases.

In a homogeneous liquid phase the basic equilibrium of the complexation of urea and the NPH is characterized with the equation (3) [1]. Adding to this mixture of 5-10% methanol causes a violent reaction of formation of the complex. Among such activators there also are other alcohols, ketones, and the reaction with the solid urea and water. The activator and its amount should be chosen experimentally [3]. When used in the complexation process as a solvent – activator methyl ethyl ketone (MEK) improves the filtering properties of the solid phase complex. The wax secreted, contains fewer impurities (8,8%) than with methanol [4]. Since the stability

of complexes decreases with increasing temperature, the complexation process is carried out at low temperatures, effect on the dewaxing concentration of ethanol is observed. While using 60% alcohol more NPH is separated and a pour point is reduced to a lesser degree than with 70% alcohol, but it makes possible to extract the NPH with a higher number of C atoms in the molecule of paraffin than in the original fuel NPH and removed with 60% solution of alcohol [5].

When the water content in crystalline urea is 0.1 - 10% wt., very small crystals of the complex are formed, that coalesce into balls with a diameter of 10 mm or more. The concentration of urea in solution with water or alcohols should be such that the solution is still saturated. Saturation of the solution with urea is carried out at higher temperatures. With increasing the degree of extraction of n-paraffins content of low-boiling paraffin hydrocarbons increases. Content of impurities increases too [5].

Objective. Our researches show the possibility of increasing the octane number (ON) of gasoline by the removal of the urea of low octane n-paraffin hydrocarbons of normal structure. The process is based on the use of catalysts, activators and adsorbents on the basis of highly dispersed pyrogenic silica. A number of process variants, are based on the use as raw material distilled gasoline as products of catalytic reforming. The increase in ON of gasoline may depend on the process conditions and the characteristics of the feedstock from 3 to 10 points by the motor method. Therefore, the study of conditions and improvement of technology of dewaxing motor fuels with increased octane and cetane numbers is an important issue.

Materials and methods. Urea dewaxing of petroleum feedstock can be carried out in a stationary layer of crystalline urea, and also in dynamic conditions of quasi-liquefaction or mechanical mixing. The latter carry oil dewaxing with a solution of urea. Exact amount of gasoline or diesel, and pre-crushed in a porcelain mortar urea or thiourea was taken, adding the solvent (isooktan, petroleum ether or water) placed in a flask and was intensely mixed. For dewaxing of diesel fuel and gasoline the mixture of the calculated amount of activator (methyl or ethyl alcohol, acetone, MEK or water) was placed in a

separating funnel. The number of urea, thiourea, solvent and activator for dewaxing of gasoline or diesel fuel, as well as the optimal initial and final temperatures of the experience were determined experimentally. For some time the mixture of motor fuels, solvent and urea or thiourea thermostatic at an elevated temperature and continuous stirring, and then dropwise introduced activator. It is recorded that the induction period is equal to the time elapsed from the introduction of the first drops of activator to start the reaction of complex formation (crystallization). The latter is characterized by an increase in temperature of the reaction mixture, which was fixed thermometer at a constant temperature. The temperature gap between the temperature and the heat carrier depends on the content of complexing hydrocarbons in the raw material, which is subjected to dewaxing. The process of complexation is conducted at a reduced temperature and constant stirring and is completed in an hour. After the beginning of the complexation the temperature is adjusted within the specified limits.

After complexation the contents of the flask are transferred to a filter, filtered in vacuum and the complex washed twice with water, in the amount of 100% by mass of the initial urea or thiourea, and all of the filtrates collected together. The washed complex is transferred to a beaker and decomposed with water (at 80-90 °C), with a volume of at least 1l. The decomposition of the complex form two layers: the upper – solution NPH or separating, in an appropriate solvent and a lower aqueous solution urea which is separated with separating funnel. A solution of n-paraffins or separating which are washed with water to remove traces of urea or thiourea and the activator, filtered on a double filter paper to remove traces of water.

The removal of gasoline from NPH complex with urea use diesel fuel (DF). Soluble complex in the DF, and heated under stirring until complete dissolution and filtered the resulting solution. NPH of gasoline dissolves and passes into solvent (diesel fuel). Filter remains the only urea.

When extraction with water, a complex of urea with a NPH of gasoline is dissolved in boiling water. Urea dissolves. On the surface of the water is the layer of NPH. Filtration of hot solution is

carried out. Urea moves into the filtrate and on the filter the NPH remain.

To separate the removal of diesel fuel from their complex with thiourea gasoline is used. Soluble complex with separating isoparaffins and thiourea in gasoline, heated under stirring until complete dissolution and filtered the resulting solution. Isoparaffins dissolve and pass into the solvent (gasoline) and on the filter remains thiourea.

When extracting with water, the complex of thiourea with a diesel separated isoparaffins is dissolved in boiling water and thiourea dissolves. The layer of isoparaffins is formed on the surface of water. We carry out the filtration of hot solution. Thiourea passes into the filtrate, and on the filter separated isoparaffins remains [4].

Determination of the CN of diesel fuel brand L-0,2-40 and ON of gasoline A-76 and the pour point of diesel fuel was carried out by using the laboratory analyzer fuel and lubricants brand "Octanemeter" type Shatox sx-100k. [6]. Evaluation of ON of gasoline on the motor way was made in the laboratory of quality control of the firm OKKO in Galich of Ivano-Frankivsk region of Ukraine.

Proposed by the authors [7-11] mathematical calculation of determining the ON allows with sufficient accuracy to predict the change in the ON of gasoline fraction of catalytic cracking of the mixed raw materials while changing the composition and quality characteristics.

Results and discussion. The essence of the work is to improve ON and CN gasoline and diesel motor fuels. As a result of preliminary studies a composition was found, which allows to increase significantly the octane number of gasoline and cetane number of diesel fuel. Detailed and elaborate mixtures of different compositions using activators (isopropyl alcohol, MEK, methyl alcohol, ethyl alcohol, etc.) and water as a catalyst were analyzed. The conducted research gave the chance to create an optimal composition, which would satisfy all the conditions of the process [12].

When specified below in tab.1 composition is a mixture of wet powder of urea and other components. There is important to prevent coalescence particles of the mixture that is obtained by adding experienced a certain amount of urea and thiourea for gasoline and diesel fuel respectively. Less than the subject content of urea

and thiourea in the compositions leads to deterioration of the removal of paraffins from gasoline and separating of diesel fuel. The greater of their number is not technologically suitable, because it makes impossible the process of mixing and contact phases, as well as significantly increase the loss of motor fuels. The composition is presented in table 1.

As it can be seen from table 1 for determination there such indicators of motor fuels as refractive index, density, before and after dewaxing. The data show that the density of diesel fuel after dewaxing decreases and refractive index increases. As for gasoline density, it partly increases, and the refractive index increases slightly, which can be explained by the changes in fractional composition of motor fuels.

Precipitation of complexes of urea and thiourea, obtained after dewaxing of diesel fuel and gasoline, were analyzed for paraffin and isoparaffin content and separated before drying, after drying and after extraction with water or gasoline [13]. Data from these experiments are presented in table 2.

As it can be seen from table 2 the number of n-paraffins from diesel fuel precipitated urea activator with ethanol and SiO₂ wetted with water does not exceed 3.9% before drying, and 1.6% after drying and 1.19% after the extraction of urea with water. For DF cleared with thiourea the amount of isoparaffins are 8,3%, 2,2%, 2,0%.

For gasoline dewaxing which is performed by the urea, activated with ethanol and SiO₂ wetted with water, the content of n-paraffins, which were deparaffinated amounted to drying of 4.52% for the dried precipitate was 0.6%, and after extraction with urea and water was 0.39 percent.

In general we can say that the number of n-paraffins and separating which is derived from the DF does not exceed 1.19 and 2%, and the number of n-paraffins from gasoline to 0.39 – 0.6 percent. Under such conditions, can add that separating in DF are much smaller, and the extraction of their gasoline results in partial contact with the thiourea in gasoline, which distorts the results.

Distillation and fractionation of gasoline and diesel fuel. To assess the quality of diesel and gasoline was additionally carried out their distillation into fractions in the lab. For this comparison dispersed of conventional motor fuel,

Table 1

The composition of the reactants used to dewax motor oil and their main characteristics before and after cleaning

No	DF (brent S-0,2-40) dewaxed with thiourea			Gasoline (brent A-76) dewaxed with urea			DF (brent S-0,2-40) dewaxed with urea		
	The mixture of reagents for dewaxing a motor fuel								
	Reagent	Weight, g	Content, %	Reagent	Weight, g	Content, %	Reagent	Weight,g	Content, %
1	DF	1000	85-84	Gasoline	1000	86,8	DF	1000	84,9
2	Thiourea	160-165	13,5-14	Urea	140	12,1	Urea	160	13,6
3	C ₂ H ₅ OH	8-9	0,67-0,75	C ₂ H ₅ OH	6	0,5	C ₂ H ₅ OH	8	0,67
4	H ₂ O	8-9	0,67-0,75	H ₂ O	6	0,5	H ₂ O	8	0,67
5	SiO ₂	2-4	0,16-0,3	SiO ₂	1	0,1	SiO ₂	2	0,16
	Σ	1178-1187	100	Σ	1153	100	Σ	1178	100
	Basic indicators of motor fuels before dewaxing								
	n ₂₀ =1,46771 ρ=0,830			n ₂₀ (H ₂ O)=1,3344 n ₂₀ (C ₂ H ₅ OH)=1,3642 n ₂₀ =1,4285 ρ=0,745			n ₂₀ =1,46771 ρ=0,830		
	Basic indicators of motor fuels after dewaxing								
	m= 860g m _{sediment} =188,0g (15,9%) n ₂₀ =1,46874 ρ=0,822 m _{loss} =130g			m=860g m _{sediment} =189,2r(16,4%) n ₂₀ =1,4287 ρ=0,746 m _{loss} =103,8g			m =960g m _{sediment} =183r(15,5%) n ₂₀ =1,46874 ρ=0,820 m _{loss} =35g		

Table 2

The results of an experiment dewax motor oil and wax extraction with water or gasoline

Reactants weight for dewaxing, m,g	Sediment weight before drying, m,g	A number of waxes before drying, %	Sediment weight after drying, m,g	A number of waxes after drying, %	sediment weight after extraction m,g	A number of waxes after extraction, %
Gasoline (brent A-76) dewaxed with urea						
1153	189,2	4,52	156,88	6,0	0,39	0,6 (Water)
DF (brent S-0,2-40) dewaxed with urea						
1178	183	3,9	179,0	1,6	16,35	1,19(Water)
DF (brent S-0,2-40) dewaxed with thiourea						
1178	188	8,3	184,0	2,2	157,33	2,0 (Gasoline)

dewaxed and enriched with n-paraffins and isoparaffins [14-17].

The results of the distillation of gasoline fraction are presented in table 3. As can be seen from table 3 and the graph (fig.1) change in % of volume fractions for gasoline dewaxed with urea is changed to decrease the light fractions and the increase of heavy fractions, but more than by 1-3%. Obviously this is due to the fact that urea takes out of gasoline while dewaxing of n-paraffins low-boiling light fractions, almost without changing the content of the medium fraction with a boiling point in the range of 100-185°C. From this it can be concluded that the concentration of urea, for more efficient dewaxing of gasoline should be higher than 12%.

At the same time dewaxed with urea gasoline enriched separate removed from diesel fuel with thiourea, significantly reduces (by 10%) the content of fractions with a boiling point in the range of 100-185°C and raises the content of heavy fractions of the 180-200°C twice (tab.3, fig.1.). This phenomenon can be explained by the entering in gasoline these medium and heavy fractions separating taken out of diesel fuel when dewaxing thiourea. Considering Fig.1, which shows the dependence of the content of the gasoline fractions from the distillation temperature (curve 3, reflecting that the enrichment of purified from gasoline isoparaffin hydrocarbons are withdrawn from the DF, we can say the following:

Table 3

The results of the experiment of the distillation of gasoline A-76 on fraction

No	Fraction weight m, g	Fraction volume V, ml	The refractive index of the fraction, n_{20}	Number, wt. %	Distillation time, min.	Temperature of distillation, °C
Gasoline A-76						
1.	26,34	39	1,389	13,17	13	20-67
2.	48,99	71	1,406	24,495	37	67-100
3.	100,53	130	1,442	50,265	54	100-185
4.	4,03	6	1,474	2,015	55	185-200
5.	4,00	5	1,483	2,55	55	>200
Σ	183,89	245	1,4285	92,0	55	-
Loss:	16,11	-	-	8,0	55	-
Overall:	200	-	-	100	55	-
Gasoline dewaxed with urea A-76						
1.	21,55	31	1,419	10,775	13	20-67
2.	54,72	71	1,406	27,36	10	67-100
3.	99,8	130	1,446	49,9	35	100-185
4.	6,47	8	1,475	3,235	39	185-200
5.	8,66	11	1,481	4,33	39	>200
Σ	191,2	251	1,4287	95,4	39	-
Loss:	8,8	-	-	4,6	39	-
Overall:	200	-	-	100	39	-
Dewaxed gasoline A-76 enriched separate taken thiourea with DF						
1.	24,23	37	1,386	12,115	15	20-67
2.	51,58	80	1,401	25,79	20	67-100
3.	79	95	1,445	39,5	25	100-185
4.	12,32	15	1,476	6,16	25	185-200
5.	17,39	15	1,483	8,695	25	>200
Σ	184,52	242	-	92,26	25	-
Loss:	15,48	-	-	8,39	25	-
Overall:	200	-	-	100	25	-

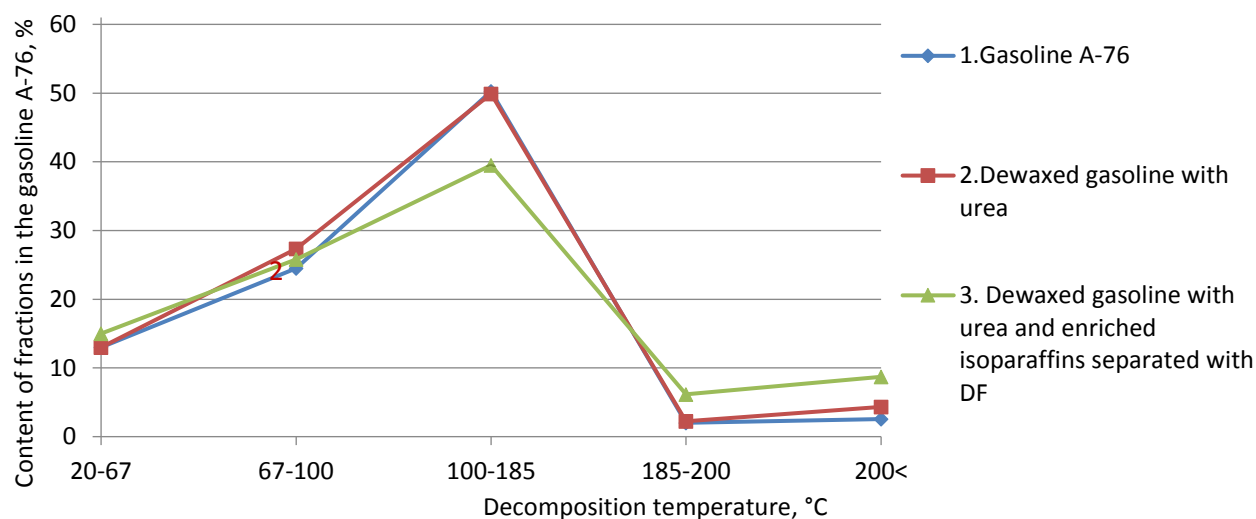


Fig.1. A graph of the % content of fractions in the gasoline A-76 to the temperature of distillation: 1 –gasoline A-76; 2 – dewaxed gasoline with urea; 3 – dewaxed gasoline with urea and enriched isoparaffins separated with DF(tab.3).

1) when dewaxing content increases the low temperature fractions of gasoline boiling in the range of 20-40°C, while there is the tendency of growth of low-boiling fractions compared to the normal (curve 1) and purified (curve 2) gasoline. This confirms the assumption that dewaxing with enrichment provides the fuel with improved combustion efficiency when you start the car, both under summer and winter conditions;

2) dewaxing at the same time decreases the content of gasoline fractions boiling in the range of 100-150°C. When their content exceeds 40% (curve 3), this gives us the opportunity to obtain gasoline which can be used in uprated engines with increased power, for example in sports cars when you need to quickly set the engine from small speed to large and vice versa That is, the gasoline provides an opportunity to increase the starting speed of the vehicle and shorten the time to gain the maximum power;

3) in addition to deparaffinization and at the same time enriched gasoline (fig.1, curve 3) decreases the contents of high boiling fractions, in the range of 150-180°C. This enables more efficient usage of gasoline, to achieve more completeness of the combustion in the cylinders of the engine, leading to fuel savings and reduction of environmental pollution.

Further analysis of the refractive index of the fraction of gasoline purified urea in comparison with the untreated gasoline is shown in fig.3. As it can be seen from fig.3 there was a significant increase of the refractive index in the range of light fractions (boiling point=20-67°C), which

confirms the increase of light fractions in the range of 20-67°C, and do not change the characteristics of gasoline fractions in another bands.

Diesel fuel was also distilled into fractions. In table 4 and figure 2 are presented the results of the distillation of gasoline dewaxed using urea DF (curve 2, fig.2) and thiourea (curve 3, fig.2) and DF-enriched congregation removed from gasoline A-76 (curve 4, fig.2) in comparison with the content of distilled fractions for DF (curve 1, fig.2).

Further analysis of the refractive index of the fraction of gasoline purified urea in comparison with the untreated gasoline is shown in fig.3. As it can be seen from fig.3 there was a significant increase of the refractive index in the range of light fractions (boiling point 20-67°C), which confirms the increase of light fractions in the range of 20-67°C, and do not change the characteristics of gasoline fractions in another bands.

Diesel fuel also was distilled into fractions. In table 4 and figure 2 are presented the results of the distillation of gasoline dewaxed using urea DF (curve 2, fig.2) and thiourea (curve 3, fig.2) and DF enriched congregation removed from gasoline A-76 (curve 4, fig.2) in comparison with the content of fractions for DF (curve 1, fig.2).

As it can be seen from the data presented in the curves (fig.2) and in table 4, in dewaxed with DF increases significantly (to 11%) content of light fractions, which are distilled in the range of 145-200°C and simultaneously decreased (12%) content of heavy fractions that are distilled in the

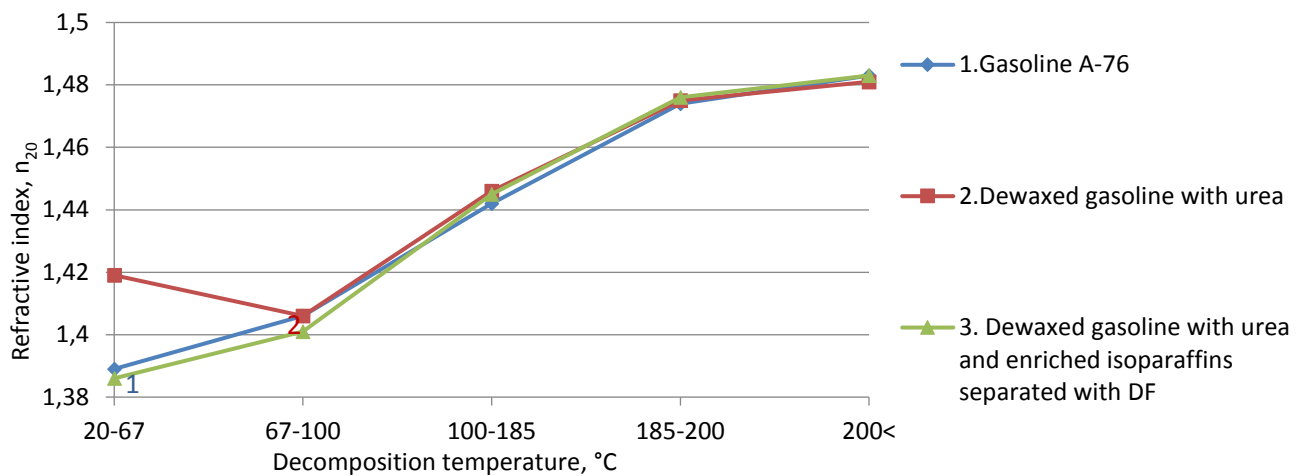


Fig.2. A graph of the refractive index of the fraction of gasoline A-76 to the temperature of distillation: 1 – gasoline A-76; 2-gasoline dewaxed with urea; 3-gasoline enriched isoparaffins separated from the DF.

Table 4

The results of the experiment of distillation of diesel fuel into fractions

№, n/n	Fraction weight m, g	Fraction volume V, ml	The refractive index of the fraction, n ₂₀	Number, wt. %	Distillation time, min.	Temperature of distillation, °C
Diesel fuel (brent S 0,2-40)						
1	17,71	23,5	1,447	8,86	10	145-200
2	118,6	146	1,465	83,66	55	200-290
3	48,72	62	1,480	0,795	75	290-340
4	1,59	1.2	1,497	0.31	75	>340
Σ	186,62	232,7	1,46771	93.0	75	-
Loss:	13,38	-	-	6,69	75	-
Overall	200	-	-	100	75	-
Diesel fuel (brent S 0,2-40) dewaxed with urea						
1	22	29	1,452	11	5	145-200
2	148,56	180	1,467	74,28	20	200-290
3	16	20	1,483	8	35	290-340
4	2,6	2.0	1,489	1,3	35	>340
Σ	189,16	231.0	1,46771	94.58	35	-
Loss:	10,84	-	-	5,42	35	-
Overall	200	-	-	100	35	-
Diesel fuel (brent S 0,2-40) dewaxed with thiourea						
1	16,1	21	1,449	8,05	5	145-200
2	104,4	130	1,462	52,2	12	200-290
3	61,86	78	1,478	30,93	32	290-340
4	9,31	12	1,489	4,66	32	>340
Σ	191,67	241	1,46771	95,84	32	-
Loss:	8,33	-	-	4,16	32	-
Overall	200	-	-	100	32	-
Diesel fuel (brent S 0,2-40) dewaxed with thiourea and enriched n-paraffins taken by dewaing from gasoline						
1	20,1	27	1,447	10,05	12	145-200
2	120,5	150	1,464	60,25	55	200-290
3	23,5	28	1,480	11,75	70	290-340
4	10,5	13	B	5,25	70	>340
Σ	174,6	218	1,46771	87,3	70	-
Loss:	25,4	-	-	12,7	70	-
Overall	200	-	-	-	70	-

range of 200-290°C, which indicates a high effect of dewaxing (removal) of the high-boiling fractions of n-paraffins with the DF.

In fig.4 the change dependence of the refractive index for different fractions of DF of distillation temperature is shown. (S 0,2-40); 2-DF dewaxed with urea; 3-DF dewaxed thiourea; DF dewaxed with thiourea and enriched n-paraffins taken by dewaxing from gasoline

As for DF, which is purified with thiourea and enriched paraffins extracted from gasoline A-76 (curve 4, fig.2), it is possible to say the following:

1) dewaxing and enrichment gives the possibility to obtain DF with a reduced content of the fractions, which boil in the range 250-340°C how it was like for DF dewaxed with urea (curve 2, fig.2). This partially increases the content of the fractions, which boil in the range 145-200°C.

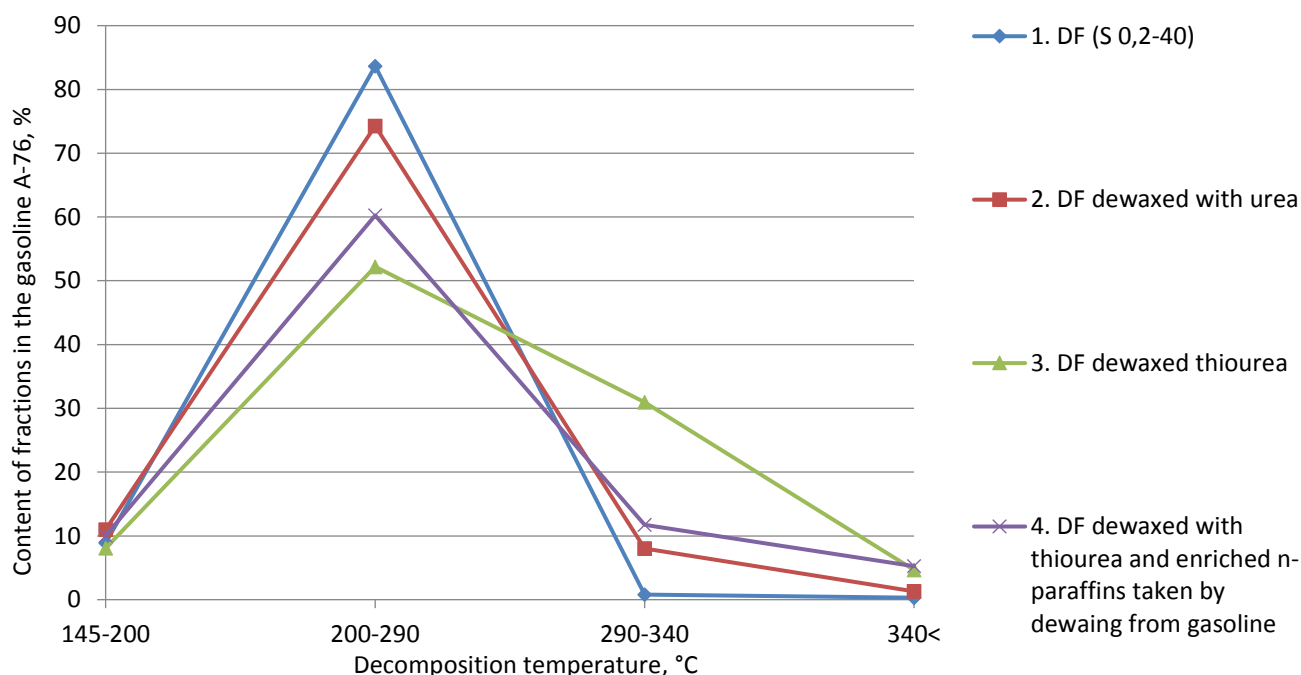


Fig.3. A graph of the % content of fraction of DF (S 0,2-40) to the temperature of distillation: 1 - DF (S 0,2-40); 2- DF dewaxed with urea; 3-DF dewaxed thiourea; DF dewaxed with thiourea and enriched n-paraffins taken by dewaxing from gasoline

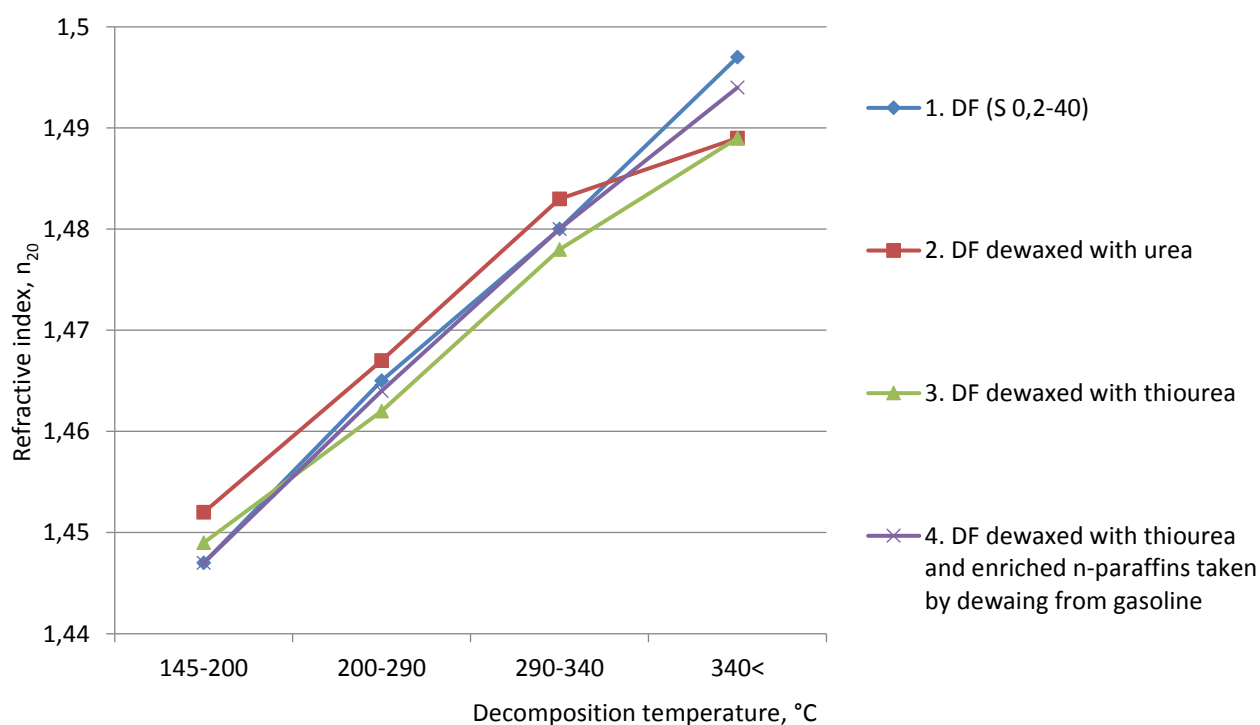


Fig.4. A graph of the refractive index of the fractions of DF on the temperature of the distillation: 1 - DF

That will result in DF, which is more efficient to evaporate in the spray nozzle in a diesel engine, and simultaneously to decrease the content of high boiling fractions which boil in the range of 240-340°C and give us the fuel completely burnt in the cylinders [18-20]. Therefore, the combustion process is optimized in all temperature range. The data in Fig.3 and Fig.4 confirm the previously made conclusions, namely a slight increase of the refractive index and density of gasoline and diesel fuel that will give us the opportunity to get a better quality fuel that has more octane and cetane number, respectively.

Measurement octane number of dewaxed gasoline and cetane number of dewaxed diesel fuel:

In addition, dewaxed gasoline and diesel fuel were analyzed for octane and cetane number with the octanemeter PE 7300 and by motor method. As it can be seen from fig. 5 and fig.6, the obtained values of octane and cetane number allows us to come to the conclusion that the way we have chosen their increase was justified. The octane number of dewaxed gasoline (curve 2, fig.5) is higher than conventional gasoline A-76 (curve1, fig.5). Much higher is the octane number of gasoline enriched by separation of hydrocarbons that have been extracted when dewaxing with thiourea diesel fuel (curve 3, fig.5). Overall, therefore, it is possible to increase the octane number of no milovanich gasoline direct distillation by 3-7%.

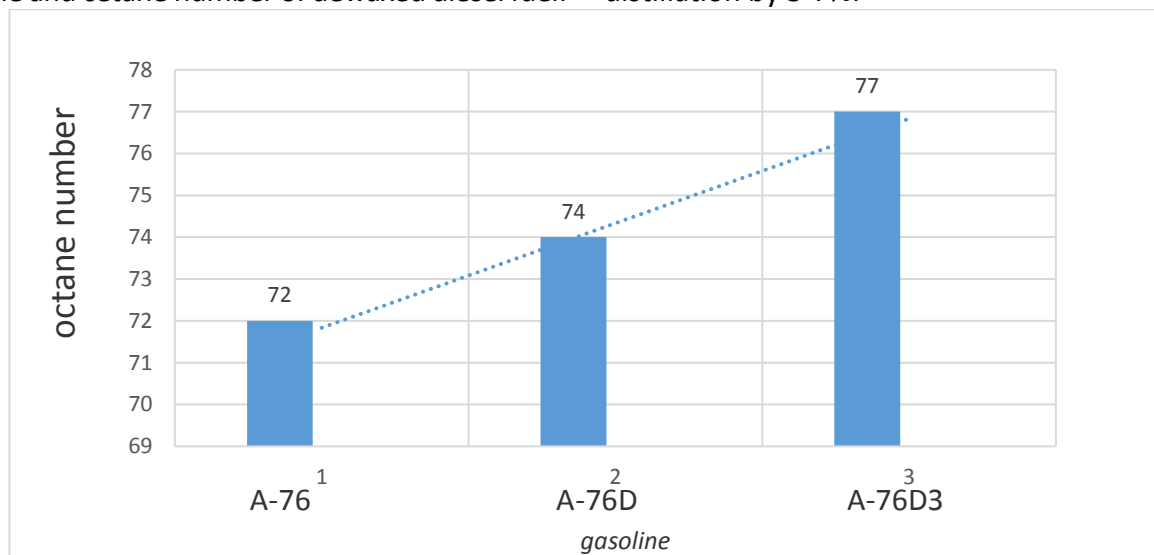


Fig.5. The dependence of the octane number of gasoline (defined PE-7300) of the method of dewaxing and enrichment isoparaffins separated by dewaxing of diesel fuel (1-A-76 without treatment; 2 - A-76 dewaxed with urea; 3-A-76 dewaxed with urea and enriched separated by dewaxing of DF with thiourea

At the same time cetane number deparaffinizing DP-D (curve 2, fig.6.) also increases in comparison with the original DF (Fig.6.curve1). We even more increases of the cetane number of diesel fuel, dewaxed and enriched normal paraffins, separated by dewaxing of gasoline A-76 investigated. Therefore, it is possible to increase the cetane numbers of summer and winter grades of diesel fuel by 10-20% without adding special additives [21-24].

Conclusions. 1. Gasoline and diesel fuel are the main types of motor fuels for internal combustion engines the most common in the world, that is why dewaxing of diesel fuel and gasoline can be carried out with the aim of changing the fractional composition and increase the octane and cetane

numbers of both types of motor fuel.

2. The obtained results indicate the possibility of content regulation normal and separating as in gasoline and diesel fuels by dewaxing. An increase in the density and refractive index dewaxing of gasoline results is a positive result.

3. The detailed fractional analysis of dewaxing of gasoline and diesel fuel by distillation into fractions and identified the ratio of these fractions before and after dewaxing, is shown that they differ significantly from each other.

4. Therefore, the process of dewaxing of diesel fuel by processing it with thiourea removing isoparaffins can be combined with the dewaxing process of gasoline by urea with the removal of n-paraffins. The received diesel fuel isoparaffins we

can enter in the gasoline A-76. And, as the studies shows the octane number of gasoline may rise on average by 3-7%.

5. At the same time, if the n-paraffins which were removed from gasoline by dewaxing with urea, enter in the DF (to enrich it), it is possible to obtain diesel fuel with a high potential for spontaneous combustion and improve combustion efficiency, and higher cethane number by 10-20%.

6. By combining these two technological processes, namely, dewaxing of diesel fuel and gasoline with thiourea and urea, it is possible to conduct a comprehensive isoparaffins using the obtained n-paraffins to improve the octane number of straight run low-octane grades of gasoline and cethane number of summer and winter diesel fuel.

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