

Brief information about the project

Name of the project	AP09058525 «Research and development of the process of obtaining high-quality motor fuels from stable gas-condensate hydrocarbon raw materials of Kazakhstan»
Relevance	Currently, the problem of removing sulfur from various hydrocarbon fractions is becoming more urgent due to the deterioration of the quality of the extracted raw materials. At the same time, the structure of sulfur compounds differs in different hydrocarbon raw materials. It should be noted that among the sulfur-containing compounds present in the extracted hydrocarbon raw materials, the greatest problems arise when the content of mercaptans is high. Mercaptans are the most toxic and corrosive compounds present in the extracted raw materials. In particular, the problem of formation of sulfur-alkaline effluents is also associated with the lack of effective solutions for removing mercaptans.
Purpose	Research and development of a method for obtaining high-quality motor fuels by selective extraction of sulfur-containing compounds, such as mercaptans and sulfides from stable gas-condensate hydrocarbon raw materials, by soft oxidation of these compounds in the presence of catalytic systems based on hydrogen peroxide and variable metals.
Objectives	<ol style="list-style-type: none">1. Obtaining high-quality gasoline fractions from stable gas-condensate hydrocarbon raw materials by selective oxidation of organosulfur compounds in the presence of catalytic systems based on hydrogen peroxide and variable metals.2. Selective extraction of organosulfur compounds from gas-condensate hydrocarbon raw materials by oxidative desulfurization in the presence of catalytic systems based on hydrogen peroxide and variable metals.3. Obtaining the gasoline fraction by selective oxidation of mercaptans and sulfides in a sample of gas condensate in the presence of catalytic systems based on hydrogen peroxide and variable metals.4. Conducting a detailed physical and chemical analysis of a sample of gas condensate and its distillates, including the structure and group composition of sulfur-containing compounds before and after desulfurization.5. Comparative analysis of gasoline fractions obtained from initial and pre-desulfurized stable gas condensate. Determination of the effect of selective oxidative desulfurization on the quality of gas condensate and gasoline fraction.
Expected and achieved results	1. Gasoline fractions were obtained from stable gas condensate hydrocarbon raw materials by selective oxidation of organosulfur compounds in the presence of catalytic systems based on hydrogen peroxide and peroxocomplexes based on sodium molybdate (Na_2MoO_4 ·

	<p>H₂O) at a temperature of 60⁰C. Total sulfur content decreased by 89.9% from 4880 ppm to 490 ppm.</p> <p>2. A method for oxidizing sulfur-containing compounds in gas condensate has been developed and the influence of various factors (various salts of transition metals, such as Na₂MoO₄ · H₂O, NH₄VO₃ and Na₂WO₄·2H₂O, process temperature 20;40;60;80⁰C, concentration of hydrogen peroxide to sulfur 2:1 ; 4:1; 6:1) on the process of oxidative desulfurization of gas condensate hydrocarbon raw materials has been studied. The optimal conditions of the gas condensate oxidation process (4 h, 60⁰C, Me=Mo, molar ratio Mo: S = 1:100 and H₂O₂: S = 4:1) were selected.</p> <p>3. Effective methods for extracting oxidation products of sulfur-containing compounds by extraction - N-N- DMF and adsorption – silica gel ASCG are proposed. As a result, the total sulfur content decreased by 91% from 7540 ppm to 680 ppm. According to the results of elemental analysis, it was proved that after the oxidation process of gas condensate, oxidation products, such as sulfones and sulfoxides, are adsorbed 2 times more on silica gel from 0.7% to 1.8%.</p> <p>4. It was shown for the first time that by oxidation with subsequent rectification of gas condensate, it is possible to obtain a gasoline fraction with an ultra-low sulfur content of 9 ppm, corresponding to the Euro-5 standard.</p>
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<p>List of publications with links to them</p>	<ol style="list-style-type: none"> 1. Muktaly D., Myltykbaeva Zh.K., Smaiyl M.B. Peroxide oxidative desulfurization of gasoline fractions of gas condensate. XL International Scientific-Practical conference «EurasiaScience». Moscow. 2021. P. 21-22 [in English] 2. Muktaly D., Myltykbaeva Zh.K., Smaiyl M.B. Desulfurization of straight-run gasoline fraction of gas condensate. XIII International Scientific and Innovative Youth Conference. Tambov, 2021. p. 141. [in Russian] 3. Muktaly D., Myltykbaeva Zh.K., Smaiyl M.B. Study of oxidative desulfurization of diesel fuel in the presence of cocatalysts. Chemical Journal of Kazakhstan, 2021. №4(76). p. 88-96. [in Russian]

	<p>4. D.Muktaly, Zh. K. Myltykbaeva, A.V. Akopyan, M.B. Smayl, N. Muftieva. Oxidative desulfurization of straight-run gasoline fraction of gas condensate of Karachaganak field //Chemical Journal of Kazakhstan. 2022.№ 2,T 78.P.132-141. [in Russian]</p> <p>5. D.Muktaly, Zh. K. Myltykbaeva, A.V. Akopyan, M.B. Smayl. Peroxide Oxidative Desulfurization of the Gas Condensate from Karachaganak Field // Petroleum Chemistry, 2022. T 22, №6, P. 1-6. [in Russian]</p> <p>6. D. Muktaly, Zh. K. Myltykbaeva, A.V. Akopyan, M. B. Smayl. Peroxide Oxidative Desulfurization of the Gas Condensate from Karachaganak Field // Petroleum Chemistry. 2022. P. 1-6. DOI: 10.1134/S0965544122090080. [in English]</p> <p>7. D.Muktaly, Zh. K. Myltykbaeva, Zh.T. Eshova. Method of cleaning gas condensate from sulphur compounds. Application for the patent of the Republic of Kazakhstan for the invention has been filed. [in Russian]</p> <p>8. D.Muktaly, A. Akopyan, Zh. Myltykbaeva., Y.Imanbayev. Gasoline Fraction High-Efficient Sweetening by Gas Condensate Oxidation and Rectification. Processes 2023, 11(10), 3017. https://doi.org/10.3390/pr11103017. [in English]</p>
Patents	