

RESULTS OF THE STUDY OF NATURAL GAS FROM GAS WELLS OF THE REPUBLIC OF UZBEKISTAN

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Abstract. The present study investigates the composition of natural gas and the amount of produced water generated from gas wells at the Somontepa and Uzunshor gas fields of the Republic of Uzbekistan. Experimental investigations were carried out to determine the physicochemical characteristics of natural gas, including its hydrocarbon and sulfur-containing components, as well as the volume of water produced during gas extraction. The composition of natural gas samples was analyzed using standardized methods and relevant regulatory documents. Particular attention was paid to the content of sulfur-containing compounds and hydrocarbon components due to their significant impact on gas processing efficiency and environmental safety. The obtained results provide valuable information on the compositional characteristics of natural gas from the studied fields and contribute to the optimization of gas treatment and processing technologies. The findings of this research can be applied in the development and improvement of industrial processes for natural gas purification, transportation, and utilization.

Keywords: natural gas, gas wells, produced water, chemical composition, sulfur compounds, hydrocarbons, gas treatment.

Sulfur-containing compounds that are difficult to remove from natural gas include mercaptans (RSH), carbonyl sulfide (COS), and carbon disulfide (CS₂). In industrial amine gas treatment units designed for the removal of hydrogen sulfide (H₂S) and carbon dioxide (CO₂), organic sulfur compounds present in natural gas are scarcely removed. Therefore, specialized purification processes are employed, including adsorption on molecular sieves, absorption using physical solvents, and chemical treatment methods. In addition, low-temperature absorption processes utilizing hydrocarbon condensate as an absorbent, low-temperature condensation processes, alkaline treatment methods, and other technologies are widely applied in industrial practice [1,2].

In collaboration with specialists from JSC "NEFTGAZTADQIQOT", experimental studies were conducted to investigate the composition of natural gas obtained from the Mubarek Oil and Gas Production Department.



The primary objective of the study was to determine the component composition of natural gas. The gas composition analysis was carried out in accordance with GOST 31371.3–31371.6-2008, GOST 31371.7-2020, GOST 31371.5-2022, and GOST 31369-2021 standards. Gas sampling procedures were performed following the requirements of GOST 31370-2008. The experiments were conducted under the following conditions: atmospheric pressure of 731 mmHg, temperature of 21 °C, and relative humidity of 44%. The experimental results obtained at the gas compression station are presented in the following tables [2,3].

The compositional analysis of natural gas samples obtained from the Somontepa field demonstrated that methane (CH_4) is the predominant component of the gas mixture. The methane content ranged from 89.03% to 90.09%, indicating the high methane potential of the investigated gas reservoir.

The concentrations of ethane (C_2H_6) and propane (C_3H_8) varied from 2.02% to 4.12% and from 0.35% to 1.13%, respectively. The content of heavier hydrocarbons, including iso-butane (i- C_4H_{10}), normal butane (n- C_4H_{10}), iso-pentane (i- C_5H_{12}), and normal pentane (n- C_5H_{12}), remained relatively low, ranging from 0.02% to 0.25%.

Table 1.

Composition of natural gas samples obtained from the Somontepa field

Sampling point	Pressure, atm	Temperature, °C	CH_4 (C_1), %	C_2H_6 (C_2), %	C_3H_8 (C_3), %	i- C_4H_{10} , %	n- C_4H_{10} , %	i- C_5H_{12} , %	n- C_5H_{12} , %	C_{6+} , %
Somontepa GCS, fuel gas	53.9	32.0	89.03	4.12	1.13	0.17	0.25	0.07	0.06	0.09
Somontepa UPPG-2, separator 1/1 outlet	13.0	45.0	90.09	2.04	0.40	0.07	0.09	0.03	0.03	0.08
Somontepa UPPG-2, separator 1/2 outlet	13.0	46.0	89.99	2.02	0.35	0.06	0.08	0.03	0.02	0.09

The concentration of hydrocarbons heavier than C_6 (C_{6+}) was found to be within the range of 0.08–0.09%. The obtained results indicate that the natural gas from the Somontepa field is characterized by a high methane content and a



relatively low concentration of heavy hydrocarbon fractions. These compositional characteristics are important for the selection and optimization of gas treatment, transportation, and processing technologies.

Table 2.

Physicochemical characteristics of natural gas samples obtained from the Somontepa field

Sampling point	ΣC_5+ , %	CO ₂ , %	H ₂ S, %	N ₂ , %	O ₂ , %	Molecular weight, g/mol	Density at 20 °C, kg/m ³
Somontepa GCS, fuel gas	0.22	4.75	0.00	0.33	0.10	18.619	0.7769
Somontepa UPPG-2, separator 1/1 outlet	0.14	4.52	2.52	0.13	0.00	18.333	0.7646
Somontepa UPPG-2, separator 1/2 outlet	0.14	4.73	2.42	0.21	0.02	18.359	0.7657

As shown in Table 2, the concentration of carbon dioxide (CO₂) in the natural gas obtained from the Somontepa gas compression station (GCS) was found to be 4.75%, while hydrogen sulfide (H₂S) was not detected in the gas composition. The nitrogen (N₂) and oxygen (O₂) contents were determined to be 0.33% and 0.10%, respectively. The molecular weight of the gas mixture was 18.619 g/mol, and its density at 20 °C was measured as 0.7769 kg/m³.

For the natural gas samples collected from the UPPG-2 facility of the Somontepa field, the carbon dioxide content ranged from 4.52% to 4.73%, while the hydrogen sulfide concentration varied between 2.42% and 2.52%. The nitrogen content was within the range of 0.13–0.21%, whereas the oxygen concentration did not exceed 0.02%. The molecular weight of the gas samples ranged from 18.333 to 18.359 g/mol, and the density at 20 °C varied from 0.7646 to 0.7657 kg/m³.

The experimental results indicate that the natural gas from the Somontepa field is characterized by a relatively high concentration of carbon dioxide and the presence of hydrogen sulfide in the gas streams from the gas treatment unit. These findings are important for selecting and optimizing gas purification technologies and ensuring compliance with industrial processing requirements.



In addition, the composition and physicochemical characteristics of natural gas produced from the Sosontepa field were also investigated during the experimental studies.

As shown in Table 3, the methane (CH_4) content in the natural gas reached 90.543%, indicating that methane is the dominant component of the gas mixture. The concentrations of ethane (C_2H_6) and propane (C_3H_8) were determined to be 2.642% and 0.868%, respectively. The concentration of iso-butane ($\text{i-C}_4\text{H}_{10}$) was found to be 0.149%, while the contents of other heavy hydrocarbon fractions remained relatively low.

Table 3.

Composition and physicochemical properties of natural gas

Parameter	Value, %
CH_4	90.543
C_2H_6	2.642
C_3H_8	0.868
$\text{i-C}_4\text{H}_{10}$	0.149
$\text{n-C}_4\text{H}_{10}$	0.203
$\text{i-C}_5\text{H}_{12}$	0.075
$\text{n-C}_5\text{H}_{12}$	0.055
C_6H_{14+}	0.108
N_2	0.971
CO_2	4.306
H_2S	0.080
Density of natural gas at 20 °C and 760 mmHg, g/m^3	0.76
Molecular weight of natural gas	18.282
Pressure, MPa	4.3–5.6
Mechanical impurities, g/m^3	0.03

The density of natural gas at 20 °C and atmospheric pressure was determined to be 0.76 g/m^3 , while the molecular weight was calculated as 18.282 g/mol. The operating pressure of the produced gas varied from 4.3 to 5.6 MPa. In addition, the concentration of mechanical impurities in the gas was found to be 0.03 g/m^3 . These results indicate that the investigated natural gas is characterized



by a high methane content and relatively low concentrations of heavy hydrocarbons and impurities.

According to the data provided by the specialists of the Somontepa and Uzunshor gas field laboratories, the average daily natural gas production amounted to 3,073,456.2 m³/day, while the average daily amount of water separated from the produced natural gas was determined to be 14.897279 tons/day. These results indicate a stable water production rate associated with natural gas extraction and provide essential data for the optimization of gas dehydration and produced water treatment processes.

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