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2026-YIL

IYUL/7-SON, I-QISM

Milliy nashrlar

OAK: https://oak.uz/pages/4802

05.00.00 - Texnika fanlari

08.00.00 - Iqtisodiyot fanlar

Google Scholar

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INTERNATIONAL CENTRE

OpenAIRE

ISSN: 3060-463X

РЭУ.РФ РОССИЙСКИЙ ЭКОНОМИЧЕСКИЙ УНИВЕРСИТЕТ ИМЕНИ Г.В. ПЛЕХАНОВА

TOSHKENT DAVLAT TRANSPORT UNIVERSITETI

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Elektron nashr, 2026-yil, iyul.

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05.01.00 – Axborot texnologiyalari, boshqaruv va kompyuter grafikasi
05.01.01 – Muhandislik geometriyasi va kompyuter grafikasi. Audio va video texnologiyalari
05.01.02 – Tizimli tahlil, boshqaruv va axborotni qayta ishlash
05.01.03 – Informatikaning nazariy asoslari
05.01.04 – Hisoblash mashinalari, majmualari va kompyuter tarmoqlarining matematik va dasturiy ta'minoti
05.01.05 – Axborotlarni himoyalash usullari va tizimlari. Axborot xavfsizligi
05.01.06 – Hisoblash texnikasi va boshqaruv tizimlarining elementlari va qurilmalari
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05.02.00 – Mashinasozlik va mashinashunoslik
05.02.08 – Yer usti majmualari va uchish apparatlari
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05.04.01 – Telekommunikasiya va kompyuter tizimlari, telekommunikasiya tarmoqlari va qurilmalari. Axborotlarni taqsimlash
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05.05.05 – Issiqlik texnikasining nazariy asoslari
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05.06.01 – To'qimachilik va yengil sanoat ishlab chiqarishlari materialshunosligi
05.08.03 – Temir yo'l transportini ishlatish
05.08.06 – "G'ildirakli va gusenisali mashinalar va ularni ishlatish" (texnika fanlari)
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10.00.06 – Qiyosiy adabiyotshunoslik, chog'ishtirma tilshunoslik va tarjimashunoslik
10.00.04 – Yevropa, Amerika va Avstraliya xalqlari tili va adabiyoti
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MUNDARIJA • СОДЕРЖАНИЕ • CONTENTS

MUNDARIJA

EVALUATION OF TECHNOLOGICAL LOSSES OF HYDROCARBONS OF LIGHT FRACTIONS IN THE PROCESSES OF COLLECTION AND PRIMARY TREATMENT AT THE MUBARAK FIELDS OF OGPD

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Abstract: The article “Evaluation of Technological Losses of Hydrocarbons of Light Fractions in the Processes of Collection and Primary Treatment at the Mubarak Fields of OGPD” addresses the significant issue of hydrocarbon losses during the collection and initial preparation of oil at the Mubarak fields, operated by the Mubarak Oil and Gas Production Department (OGPD). The authors analyze various stages of oil loss, including evaporation, associated gas separation, and oil-water emulsion separation. The study reveals that technological losses in the collection and primary treatment stages can account for up to 9.5% of the oil produced, with the majority of these losses occurring in the field. The research emphasizes the need to reduce such losses through improved separator systems, better management of associated gas, and optimized operating conditions for oil and gas collection equipment. The article also presents empirical data from the Kukdumalak, South Kemachi, and Umid fields, outlining specific technological oil losses during evaporation, separation, and dehydration across different seasons. The findings highlight the need for effective management and advanced techniques to reduce these losses. The authors provide valuable recommendations for reducing hydrocarbon losses in the Mubarak fields and similar oil extraction sites, which would have significant implications for improving the economic efficiency of oil production and reducing environmental impact.

Keywords: primary preparation, separation, associated gas, dewatering, desalination, emulsion.

Annotatsiya: “Muborak NGQCHB hududlarida neftni yig‘ish va birlamchi tayyorlash jarayonlarida yengil fraksiya uglevodorodlarining texnologik yo‘qotishlarini baholash” mavzusidagi maqola Muborak neft va gaz qazib chiqarish boshqarmasi (NGQCHB) hududlarida neftni yig‘ish va dastlabki tayyorlash jarayonlaridagi uglevodorod yo‘qotishlari muammosiga e’tibor qaratadi. Mualliflar neft yo‘qotishining turli bosqichlarini, shu jumladan bug‘lanish, yo‘ldosh gazni ajratish va neft-suv emulsiyasini ajratish jarayonlarini tahlil qiladilar. Tadqiqot shuni ko‘rsatadiki, yig‘ish va birlamchi tayyorlash bosqichlarida texnologik yo‘qotishlar ishlab chiqarilgan neftning 9,5 % gacha bo‘lishi mumkin, bu yo‘qotishlarning ko‘pchiligi maydonda sodir bo‘ladi. Tadqiqot bunday yo‘qotishlarni separator tizimlarini takomillashtirish, yo‘ldosh gazni boshqarishni yaxshilash va neft-gaz yig‘ish uskunalari uchun ishlash sharoitlarini optimallashtirish orqali kamaytirish zarurligini ta’kidlaydi. Maqolada shuningdek, Kukdumalak, Janubiy Kemachi va Umid konlaridan olingan empirik ma’lumotlar taqdim etilgan bo‘lib, ular turli fasllarda bug‘lanish, ajratish va suvsizlantirish jarayonlarida aniq texnologik neft yo‘qotishlarini ko‘rsatadi. Tadqiqot natijalari bunday yo‘qotishlarni kamaytirish uchun samarali boshqaruv va ilg‘or texnikalar zarurligini ko‘rsatadi. Mualliflar Muborak hududlarida va shunga o‘xshash neft qazib olish joylarida uglevodorod yo‘qotishlarini kamaytirish bo‘yicha qimmatli tavsiyalarni taqdim etadilar, bu esa neft ishlab chiqarishning iqtisodiy samaradorligini yaxshilash va atrof-muhitga bo‘lgan ta’sirni kamaytirishda katta ahamiyatga ega bo‘ladi.

Kalit so‘zlar: birlamchi tayyorlash, ajratish, yo‘ldosh gaz, suvsizlantirish, tuzsizlantirish, emulsiya.

Аннотация: Статья «Оценка технологических потерь углеводородов легких фракций в процессах сбора и первичной подготовки на месторождениях Мубарак НГДУ» посвящена важной проблеме потерь углеводородов при сборе и начальной подготовке нефти на месторождениях Мубарак, эксплуатируемых Мубаракским нефтегазодобывающим управлением (НГДУ). Авторы анализируют различные этапы потерь нефти, включая испарение, разделение попутного газа и разделение нефтяно-водяной эмульсии. Исследование показывает, что технологические потери на этапах сбора и первичной подготовки могут составлять до 9,5 % от объема добытой нефти, при этом большинство потерь происходят на месторождении. В исследовании подчеркивается

необходимость снижения таких потерь за счет улучшения системы сепараторов, совершенствования управления попутным газом и оптимизации условий эксплуатации оборудования для сбора нефти и газа. Статья также представляет эмпирические данные с месторождений Кукдумалак, Южный Кемачи и Умид, описывая конкретные технологические потери нефти при испарении, разделении и обезвоживании в разные сезоны. Полученные результаты подчеркивают необходимость эффективного управления и внедрения передовых технологий для снижения этих потерь. Авторы предлагают ценные рекомендации по сокращению потерь углеводородов на месторождениях Мубарак и аналогичных местах добычи нефти, что будет иметь значительные последствия для повышения экономической эффективности добычи нефти и уменьшения воздействия на окружающую среду.

Ключевые слова: первичная подготовка, сепарация, попутный газ, обезвоживание, опреснение, эмульсия.

INTRODUCTION

The efficient collection and preparation of hydrocarbons are essential stages in the oil production process, directly influencing both production efficiency and economic performance. However, significant losses of crude oil and light hydrocarbon fractions occur during the collection, separation, transportation, and primary treatment of well products. These technological losses reduce the volume of marketable products, increase production costs, and negatively affect the overall efficiency of oil field operations. Therefore, minimizing hydrocarbon losses has become an important objective for oil and gas producers worldwide.

In the modern oil and gas industry, reducing the loss of extracted hydrocarbons is not only an economic necessity but also an environmental and technological priority. Improving collection and preparation systems, optimizing separator operating conditions, and enhancing process efficiency can significantly decrease product losses while increasing resource utilization. In this context, evaluating the technological causes of hydrocarbon losses and identifying practical approaches to their reduction are among the most pressing issues facing the industry.

This study focuses on the assessment of technological hydrocarbon losses occurring during the collection and primary preparation of crude oil in oil fields. The research analyzes the main sources of losses, including evaporation, associated gas separation, and oil-water emulsion treatment, and evaluates their impact on overall production efficiency. Based on the obtained results, recommendations are proposed to improve the performance of oil collection and preparation systems and reduce technological losses.

REVIEW OF LITERATURE ON THE SUBJECT

Technological losses occurring during the collection, transportation, and preliminary preparation of hydrocarbons have long been recognized as one of the key factors affecting the efficiency of oil and gas production. The Methodological Guidelines for Determining the Technological Loss of Oil in Oil and Gas Production Enterprises of the Republic of Uzbekistan (RH 39.0-033:2013) establish the national methodological framework for identifying, calculating, and evaluating technological oil losses under various operating conditions. These guidelines serve as the primary regulatory basis for assessing hydrocarbon losses in oil production enterprises.

Research conducted by Xabibullayev, Norqulov, and their co-authors has significantly contributed to understanding the mechanisms of technological hydrocarbon losses. Their studies examined losses occurring during oil collection and preliminary preparation processes, demonstrating that evaporation, associated gas separation, and oil-water emulsion treatment represent the major sources of product losses. They also proposed methods for evaluating technological losses under different field operating conditions and highlighted the importance of optimizing separator performance to improve recovery efficiency.

The Permanent Technological Regulations for the Operation of the Kokdumalak Oil Preparation Unit (TR MNQCHB-35:2022) describe the technological sequence of crude oil treatment and define the operational parameters required to ensure stable processing performance. These regulations provide practical guidance for maintaining separator efficiency and minimizing operational losses throughout the preparation process.

Studies by Agapov, Sevrugin, Pavlov, and Setin focused on the operating characteristics of industrial separators used in oil field preparation facilities. Their research demonstrated that separator pressure, temperature, throughput capacity, and residence time directly influence the efficiency of gas-liquid separation and the amount of hydrocarbons carried away with the gas stream.

The textbook Technology of Oil and Gas Field Preparation provides comprehensive theoretical explanations of oil gathering systems, separation technologies, dehydration processes, and hydrocarbon stabilization methods. It emphasizes that proper design and operation of collection and preparation facilities are essential for reducing technological losses while maintaining production efficiency.

Lemko investigated approaches for reducing hydrocarbon losses during the operation of oil and gas condensate field gathering and preparation systems. The study highlighted the importance of improving technological processes and optimizing operating conditions to decrease hydrocarbon losses during production and treatment.

More recently, Xabibullayev, Abdukarimov, Norqulov, and Mamatova analyzed natural and technological product losses in the Kokdumalak, Umid, and South Kemachi oil fields. Their findings quantified losses at different stages of collection, preliminary preparation, and storage, providing valuable practical data for evaluating technological losses under real production conditions. These studies collectively provide the theoretical and practical foundation for assessing hydrocarbon losses and identifying effective measures to improve the efficiency of oil collection and preparation systems.

RESEARCH METHODOLOGY

The study is based on operational data collected from oil field collection and primary treatment facilities, including production records, separator performance parameters, and technological loss indicators. The obtained data were analyzed using comparative, statistical, and process evaluation methods to assess hydrocarbon losses at different processing stages and identify the main factors affecting technological losses.

ANALYSIS AND RESULTS

Developing oil fields requires significant expenditures, with a large portion of the costs being spent on building collection and transportation systems in the fields. Therefore, improving and simplifying the oil and gas collection and transportation systems is crucial for reducing both capital and operational costs, as well as shortening the development time (Figure 1, 2)[1,3].

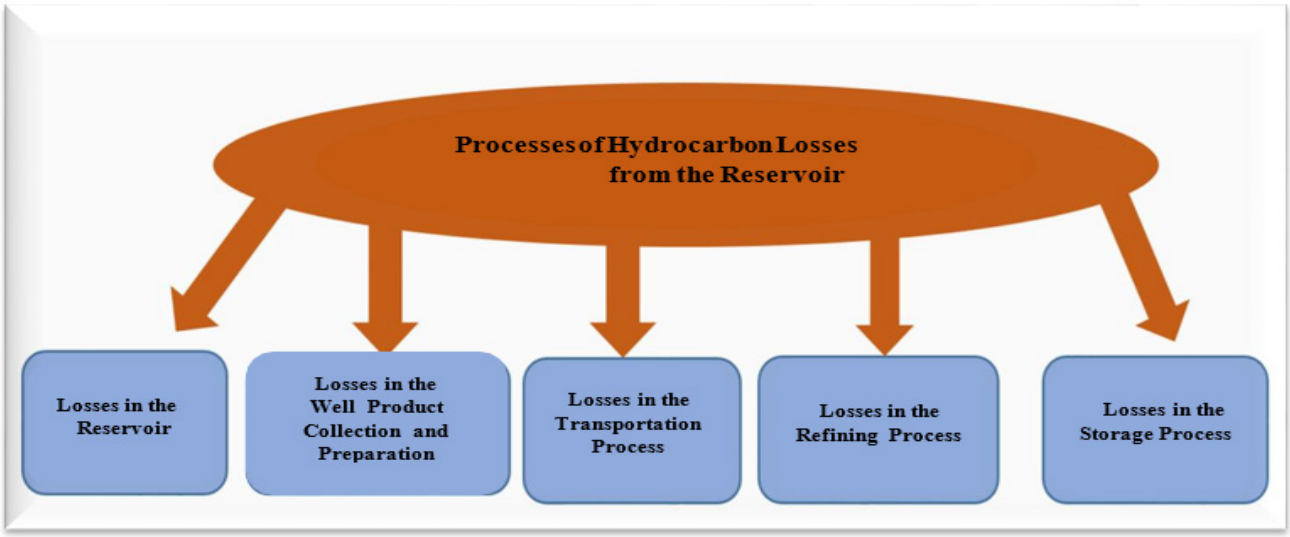

Figure 1. **Classification of hydrocarbon and its product losses**

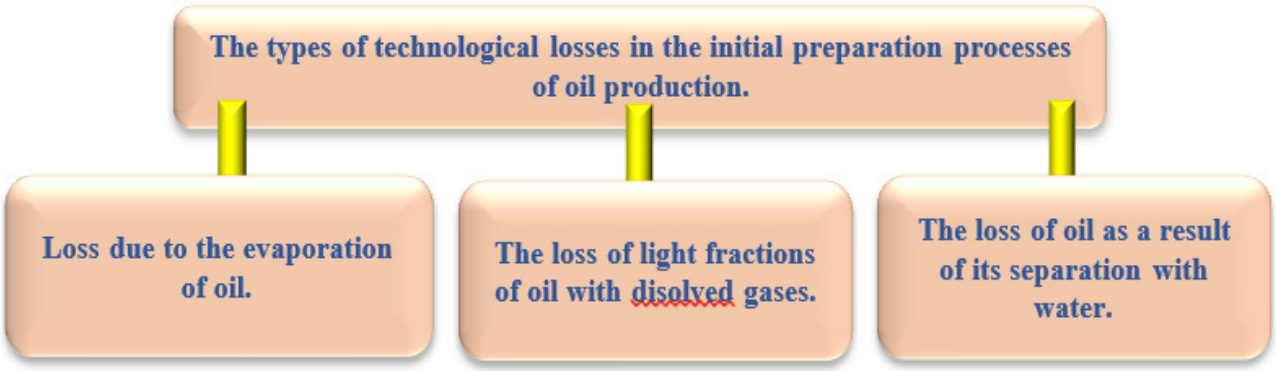

Figure 2. **Stages of Well Product Preparation**

Based on the results of experiments and scientific research, it is known that up to 9.5% of the extracted oil and its products can be lost in the collection and preparation systems, as well as during storage and refining processes. Specifically, the losses in the fields are 4%, in the refining plants are 3.5%, and in the transportation and storage processes, the losses amount to 2%. This clearly indicates that the majority of the losses of extracted oil and its products occur in the field, particularly in the collection and preparation systems.[2]

In the oil collection and preparation systems, attention should primarily be given to the following indicators:
The technical and economic indicators of oil and gas collection and processing;
The level of automation of technological (facility) equipment and systems;
The specific consumption of metal;
The number of service personnel;
The specific consumption of electrical energy, and others (Figure 3, 4; Table 1).

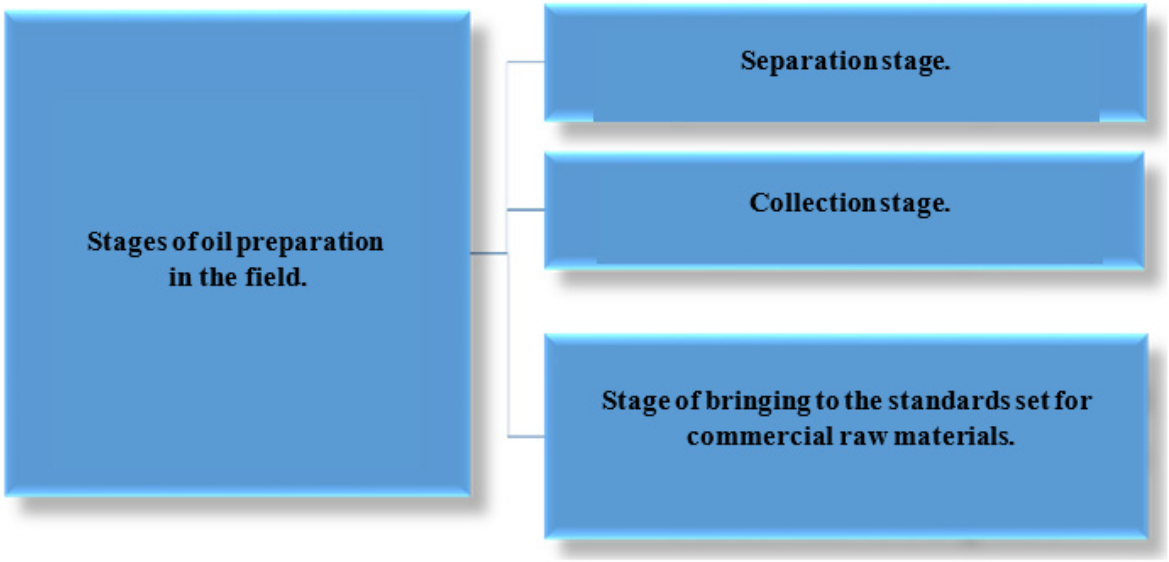

Figure 3. **Preparation of extracted oil at the field**

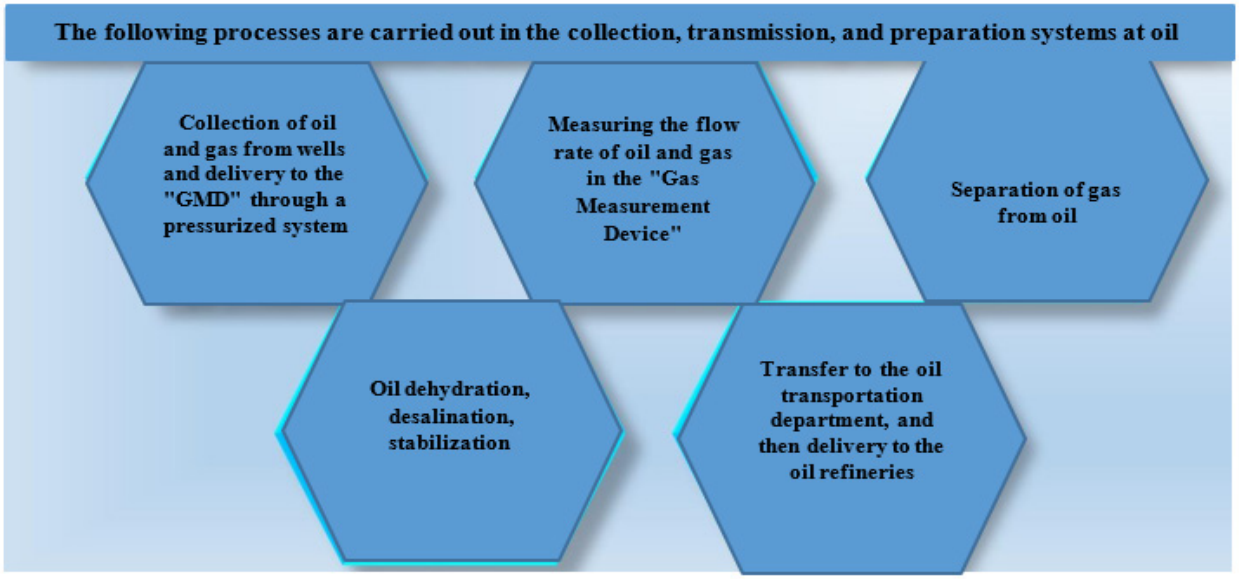

Figure 4. **The following processes are carried out in the collection, transmission, and preparation systems at oil**[1]

1 Source: Developed by the author.

Table 1.
Indicators of Kukdumalak, South Kemachi, and Umid oil fields (for the year 2020) [2]

№	Fields	Annual oil production, tons	Technological oil loss, %,					
			Evaporation			Separation	Dehydration	Total
			Hot season of the year	Cold season of the year	**Average**			
1	**Kukdumalak**	74 829,1	1,260	0,945	1,1025	0,0031	0,0178	1,1234
2	**South Kemachi**	19 338,5	1,075	0,90	0,9875	0,0008	0,0285	1,0168
3	**Umid**	2 502,7	1,075	0,90	0,9875	0,1623	0,0181	1,1679

The residual gas is separated from the oil in order to bring the oil's saturated vapor pressure to 66.7 kPa (500 mm Hg). The final stage separators operate at atmospheric pressure (0.105 - 0.12) MPa and temperatures of (10 - 45) °C. They produce oil with a low residual gas factor ranging from 3 to 18 for light oils. Additionally, the oil entering the separators cannot undergo continuous phase separation in the pipeline, as it is halted directly in front of the separator.

The gas extracted from the final stage separators has a high density of (1.5-2.2) kg/cm³ and cannot be used for additional compression or technical needs without preparation[6].

As can be seen from the above, there are significant differences in the operating conditions and requirements of separators that accept and separate oil and gas.

For the unconstructed system being analyzed, the absorption of gas in the oil is considered negligible (0.009-0.031) m³/m³. The data obtained did not determine that the free entry coefficient of gas is dependent on the amount of liquid and the time the oil spends in the separator unit.

All the devices are intended for final or hot separation, and therefore, during the research period, they operate at temperatures of (15 - 20)°C and (35 - 45)°C with a pressure of (0.105 - 0.115) MPa. The volume of the separators ranges from 50 m³ to 100 m³. The specific capacity of the liquid in the device was 16.2 t/m³ per day. The measured entry of oil droplets ranged from 35 mg/m³ to 769 mg/m³. Additionally, in many cases, a large amount of droplet entry corresponds to a device with a high specific capacity. For example, separators operating under a capacity of 32 t/m³ pass oil droplets of up to 216 mg/m³ per day (7 units), while five units pass up to 134 mg/m³ (Table 2).

Table 2.
Comparison of the impact of separator operating parameters on oil loss values[3]

№	Name	Measurement Units	Separation Parameter Indicators	Equivalent Oil Loss Value, %
1	Oil droplets carried out with gas	mg/m³	35 - 769	Less than 0.0005
2	Oil carried out with free gas	m³/m³	0,01 – 0,03	1,0015 – 0,0053
3	Oil carried out with dissolved gas	m³/m³	1,04 – 1,94	0,17 – 0,33

Below, we will evaluate the types of technological losses. The loss of oil due to evaporation mainly occurs during the oil collection processes. Specifically, this happens as a result of the evaporation of the light fractions of the oil accumulated in the reservoir. The second type of technological loss is associated with the separation of associated gases from the oil. In this process, the associated gases separated from the oil take away a portion of the light hydrocarbons contained in the oil. In the third type of technological loss, there are several issues during the separation of the oil-water emulsion, and losses occur at this stage as well. Below, we will analyze these processes in detail.[4]

As seen in the table above, the extracted associated gas carries a certain amount of oil with it. Below, we will present the quantity for each month in a graph. For example, in January, 9,836 tons of oil and 373 m³ of associated gas were extracted. During the separation process in the separators, the highest combined output with associated gas is shown as 0.0005 + 1.0015 + 0.33 = 1.332%, which represents the highest amount.[5]

2 Source: Developed by the author.
3 Source: Developed by the author.

CONCLUSIONS AND SUGGESTIONS

Thus, the associated gas has carried out approximately 50.25 tons of oil with it in 2018. If we control this with the working pressure of the separator, we could further reduce this amount. Currently, this quantity only accounts for the oil carried away with the associated gas, while losses in the water and collection processes could cause this amount to increase even further (Figure 5).[9]

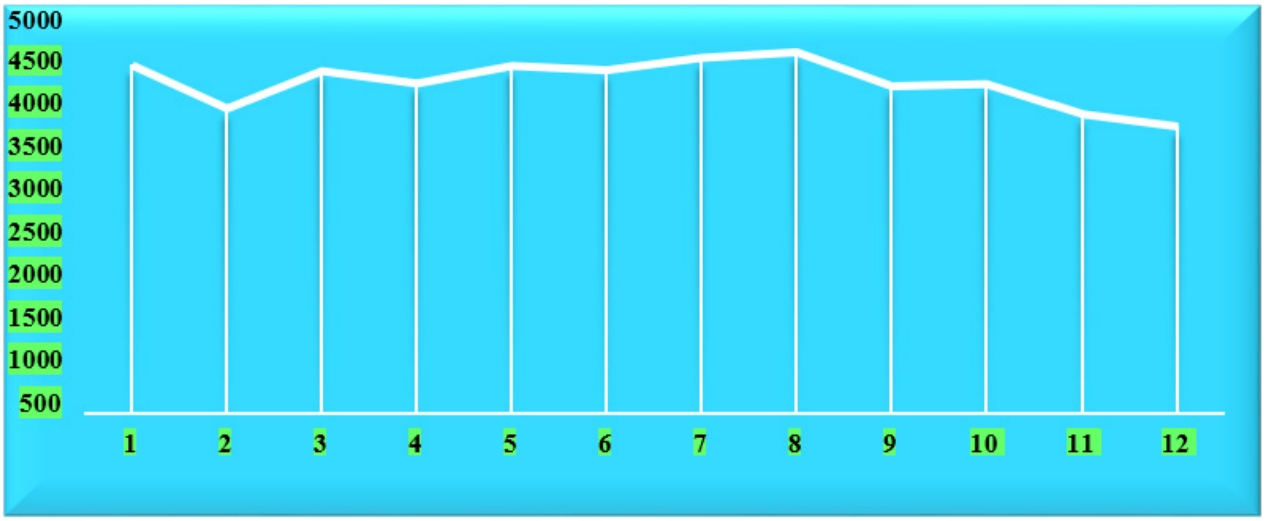

Figure 5. **Monthly oil loss in Kokdumalok field, kg**[4]

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4 Source: Developed by the author.

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2026. № 7

"Muhandislik va iqtisodiyot" jurnali 26.06.2023-yildan
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