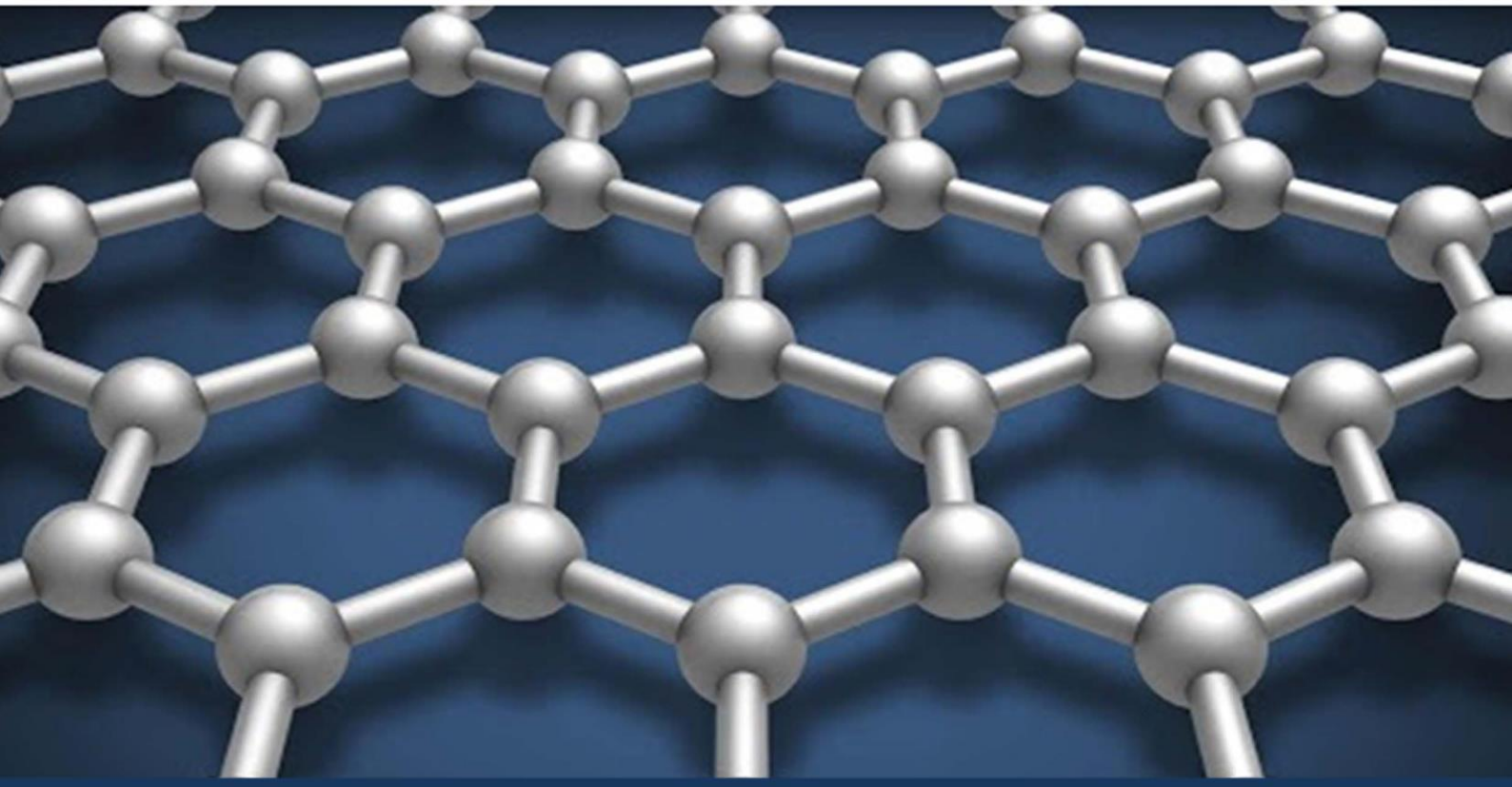
ISSN 2091-5527
№ 4/2024

O‘zbekiston

# Kompozitsion Materiallar

Ilmiy-texnikaviy va amaliy jurnali



Узбекский научно-технический и производственный журнал

# Композиционные материалы

UDC 665.775

# RESEARCH INTO THE GREEN TECHNOLOGY OF PRODUCING ENERGY BASED ON WASTE FROM COAL, OIL AND GAS INDUSTRIES

**Kucharov A.A., Yusupov F.M., Yusupov S.Q.**

*Institute of General and Inorganic Chemistry of the Academy of Sciences*

***Abstract.*** In this article, the development of a waste-free technology of coal-based fuel production and the study of the obtained FA1 fuel were studied. In addition, the composition of coal was scientifically analyzed, and based on it, the scientific results of the dependence of fuel production were presented. Chromatography-mass spectrometer image of fuel obtained from coal and factory waste has been scientifically studied.

***Key words:*** coal, fuel, degree of dispersion, synthesis, liquid fuel, suspension, reactor, mineral, surfactants.

**Introduction.** In order to increase the quality and physical properties of coal for use as fuel in the national economy, it is of great scientific and practical importance to study the geochemical and chemical composition of the products in the existing coal mines and to improve the quality of the products based on the results, as well as to create and implement the technology of its processing methods. is an urgent issue [1]. The superiority of coal reserves as a fuel over other types of organic raw materials makes it the most promising source for the production of synthetic gaseous, liquid and solid fuels, as well as the most important product for obtaining various chemicals and composite materials [2]. The main processing processes that can convert coal into valuable components for the chemical industry include mining, oxidation, semi-coking and coking, gasification, thermal fusion and hydrogenation [3].

It is through beneficiation of coal that the raw material can be turned into a commercial product that can compete with oil and gas. This allows to expand the use of coal, because through enrichment, slag and ash wastes are removed from the fuel composition, the quality of coal is improved, which is effective for the consumer. It also prevents environmental pollution [4].

Reprocessing coal to obtain synthetic fuel for use in the national economy and introducing it into industry is a strategic direction in countries that do not have their own oil. This is explained by the fact that during the energy crisis of the 70s, the largest investments in the development of coal processing processes were made mainly by oil-importing countries.

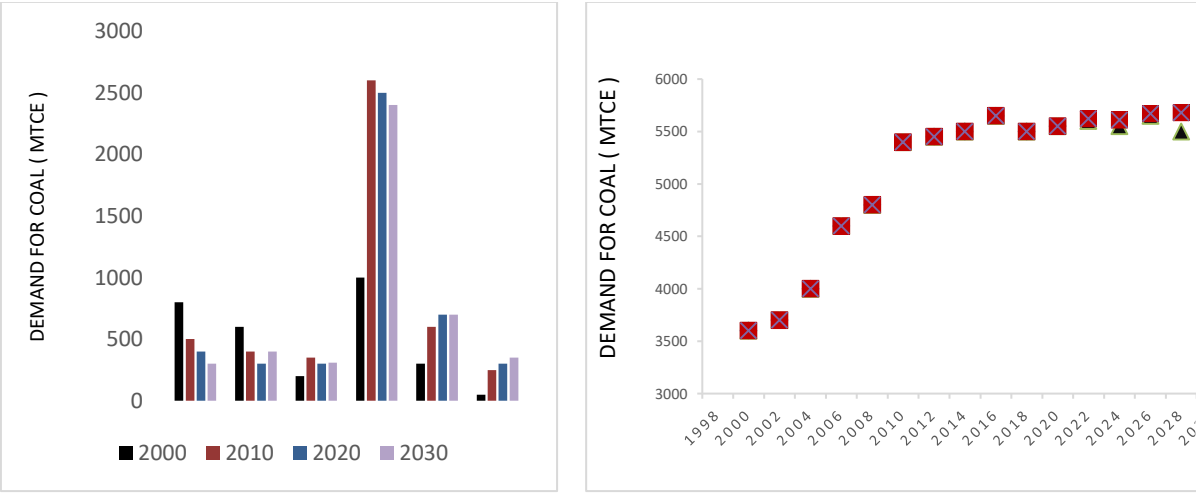



Figure 1. Coal demand volume analysis: 2017 and 2018 based on reports from various countries or regions

The amount of coal consumption worldwide (Figure 1) is projected both globally and separately, which shows that coal consumption will grow steadily over the next 3 years. A large amount of fly ash (coal ash) is produced during coal burning. According to the EIA (International Energy Outlook) organization in the United States of America, even if they are trying to abandon the use of coal for manufacturing or electricity generation, the world's demand for coal will increase from 8 billion tons in 2022 to 40% by 2040, i.e. 11.5 billion It is expected to increase by tons. According to the calculation results, 1 ton of coal ash is produced from every 2 tons of coal in coal-fired power stations [5].

**Material and methods.** Coal samples were taken from the Angren coal mine, which was used in the research work of Uzbekkomir OJSC, and the coal sample was dried and ground to a particle size of 0.2-2 mm in a ball mill. For the research experiments of SFKM-2, aqueous solutions of SFKM-2 were used as media of different density

and coal was gravity enriched with solutions of 1.30, 1.40 and 1.50 gr/cm$^3$ according to GB/T 478-2008. Agilent 5975C Inert MSD/7890A GC Chromatography-Mass in a spectrometer analysis done. Do not interfere structural parts separation Agilent HP - INNOWax quartz capillary column (30 m × 250 μm × 0.25 μm ) 50 ° C (1 min) - 2 ° C / min up to 70 ° was in temperature done increased. C – 20 °C/min up to 240 °C (20 min). Entered of the sample volume 0.2 μl , mobile of the phase flow rate (H2) 1.1 ml/min. EI-MS spectra m / z 10-550 amu between received Components public spectra electron libraries information with comparison based on defined [6].

**Results and discussions.** In order to improve the quality of unusable 2BR-B2 and 2BOMSSh-B2 lignite mined from the Angren coal mine in Uzbekistan, their quality indicators were determined and their results were analyzed (Table 1).

**Table 1**

**Preliminary chemical analysis results of Angren coals**

| Type of analysis | Indicator name | 2BR-B2 | 2BOMSSh-B2 |
|---|---|---|---|
| Technical analysis | Humidity,% | 11.5 | 14.2 |
| | Total degree, A˚,% | 48.09 | 52.44 |
| | High heat of combustion kcal/kg | 1610-2450 | 1540-2380 |
| Element composition; % | Carbon | 63-77 | 60-75 |
| | Oxygen | 16-28 | 17-34 |
| | Hydrogen | 4.0-6.3 | 4.2-5.8 |
| | Nitrogen | 0.7-1.4 | 0.5-1.5 |
| | Sulfur gold | 0.1-1.8 | 0.1-1.6 |
| Coal ash mineral composition ; % | $SiO_2$ | 58.1 | 66.9 |
| | $Fe_2O_3$ | 2.1 | 1.6 |
| | $Al_2O_3$ | 27.6 | 18.2 |
| | CaO | 8.4 | 7.9 |
| | MgO | 1.8 | 2.3 |
| | $Na_2O$ | 0.6 | 0.9 |
| | $K_2O$ | 1.2 | 0.7 |

There is produced at JV "Uz-Kor Gas Chemical" and is considered a secondary product and is released as waste. Its composition is mainly a mixture of heavy hydrocarbons , its density at 20 ˚C is 1,050 g/cm $^3$ is Dark brown solid substance with specific smell product is considered. The process is given an autothermal direction (Figure 2).

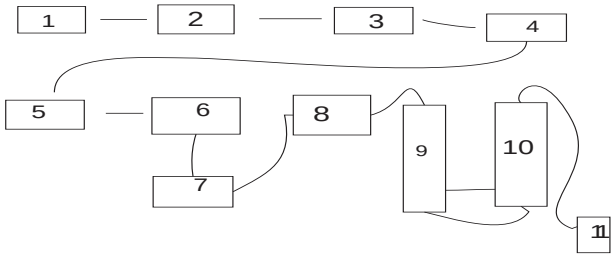



**Figure 2. Technological scheme of obtaining liquid fuel.**

1. Coal waste 2. vibrosieve 3. crusher 4. Gravity drum 5. Flotation reactor 6. dryer 7. tarry waste 8. ball mill 9. pyrolysis unit 10. cooler 11. liquid fuel tank

Coal waste and tar are crushed in a ball mill (0.3-0.5 mm) and fed to the pyrolyzer. The process lasts 1.5 hours up to 500 $^{0}$ C. Liquid fuel and gas flows from the bottom of the pyrolysis device into the collection tank. Liquid fuel efficiency is calculated based on the test results.

The joint venture of Uz-Kor Gas Chemical Limited Liability Company, located in Ustyurt region , is one of the largest producers of polymer products in Central Asia based on natural gas processing. The total annual production capacity of the complex is 387,000 tons of polyethylene and 83,000 tons of polypropylene. Pyrolysis distillate, pyrolysis oil and TAR product are not recycled and waste without is stored . Pyrolysis distillate and pyrolysis oil are secondary raw materials for obtaining naphthalene, aromatic hydrocarbons, indene, phthalic anhydride and other valuable chemical products needed for industry. Pyrocondensate, depending on the raw material of pyrolysis, makes up 2-5% of the mass. In turn, pyrocondensate is divided into three components: pyrolysis distillate up to 180 $^{0}$C , pyrolysis oil up to 260-280 $^{0}$C and residual tar products above 280 $^{0}$C are formed. Processing of these fractions at JV "Uz-Kor Gas Chemical" LLC is not provided for in the plant project, so it remains a waste product. At the same time, heavy fractions of liquid pyrolysis products are raw materials with an impressive potential for further use, because modern technologies require the production of valuable products that are much more expensive than fuel

FA1-1 fuel samples obtained from coal based on the developed technology were analyzed in a gas chromatograph using an Agilent 5977A mass selective detector for preliminary determination of their qualitative and quantitative composition. The results of the analysis are presented in Figure 3.

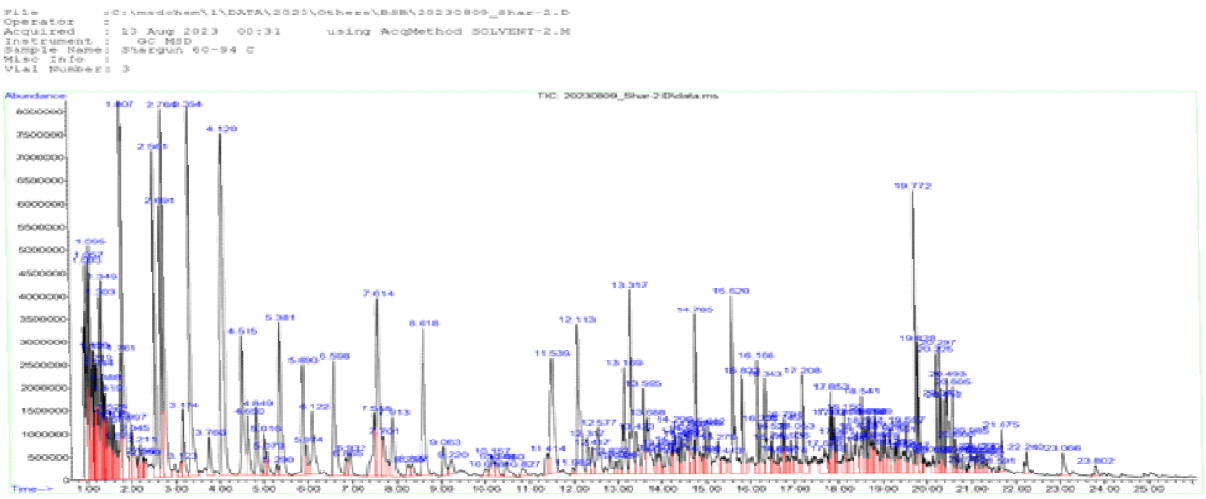


**Figure 3. Chromatography-mass spectrometer result image of FA1 sample**

It can be seen from the image of the result of chromatography-mass spectrometer of the liquid fuel obtained from coal and factory waste that it can be concluded that the obtained sample is suitable for use due to the high content of light fraction hydrocarbons and the low content of other toxic gases when used for burning.

**Conclusions:** The results of the initial chemical analysis of Angren coals were scientifically interpreted, and based on them, the scientific basis of obtaining gas and liquid fuel was developed. Based on the developed modern waste-free technology, for the first time, the results of the mass spectrum analysis of fuel obtained on the basis of coal and technological waste were analyzed, and the abundance of light hydrocarbons was scientifically determined.

## REFERENCES:

1. Atakhanov, A., Turdikulov, I., Mamadiyorov, B., Abdullaeva, N., Nurgaliev, I., Khaydar, Y., & Rashidova, S. (2019). Isolation of nanocellulose from cotton cellulose and computer modeling of its structure. Open Journal of Polymer Chemistry, 9(04), 117-129.

2. Yusupov, F., Kucharov, A., Baymatova, G., Shukurullayev, B., & Yuldashev, R. (2023, August). Development and study of adsorption properties of a new sulfur polyvinyl chloride cation exchanger for water treatment. In IOP Conference Series: Earth and Environmental Science (Vol. 1231, No. 1, p. 012027). IOP Publishing.

3. Xursandov, Bobomurod, et al. "Study of changes in the physical and mechanical properties of sulfur asphalt concrete mixture based on polymer sulfur." AIP Conference Proceedings. Vol. 3045. No. 1. AIP Publishing, 2024.

4. Kucharov, Azizbek, et al. "Development of technology for water concentration of brown coal without use and use of red waste in this process as a raw material for colored glass in the glass industry." E3S Web of Conferences. Vol. 264. EDP Sciences, 2021.

5. Ergasheva , D. A., Kholmirzaev , F. S. U., & Mamanazarov , M. M. U. (2020). Methods for producing B2O3/Al2O3 granules and its properties. Universum : technical sciences , (5-2 (74)), 79-82.

6. Qurbonov, Azizjon, Azizbek Kucharov, and Farxod Yusupov. "Development of a technology for obtaining an anti-corrosion coating for gas pipelines." AIP Conference Proceedings. Vol. 3102. No. 1. AIP Publishing, 2024

**Kucharov Azizbek Alisher ugli** -*PhD*, Doctoral student (DSc) of the Institute of General and Inorganic Chemistry of the Academy of Sciences

**Yusupov Farkhod Mahkamovich** -Doctor of technical sciences, professor, Institute of General and Inorganic Chemistry of the Academy of Sciences

**Yusupov Suxrob Qahramonovich** -*PhD*, Doctoral student (DSc) of the Institute of General and Inorganic Chemistry of the Academy of Sciences