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AUTHOR(S)	Natela Khetsuriani, Madlena Chkhaidze, Georgi AbramiShvili, Jumbler Iosebidze
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PRODUCTION AND STUDY OF BIO GAZOLINES

*Doctor, **Natela Khetsuriani,** Head of the Petroleum Chemistry laboratory, Chief Research Worker, TSU, Petre Melikishvili Institute of Physical and Organic Chemistry, Laboratory of Petroleum Chemistry, Tbilisi, Georgia*
*MS **Madlena Chkhaidze** Scientific worker, TSU, Petre Melikishvili Institute of Physical and Organic Chemistry, Laboratory of Petroleum Chemistry, Tbilisi, Georgia*
*Doctor **Georgi AbramiShvili,** Georgian Technical University, Tbilisi, Georgia*
*Doctor **Jumbler Iosebidze,** Georgian Technical University, Tbilisi, Georgia*

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ABSTRACT

Combustible ethanol was obtained from agricultural waste. Test samplesE0 (petrolgazoline) and E5, E10 and E20 (epanpl/gazoline blend) were prepared and their physical, chemical and technical characteristics were studied. The effect of bioethanol on the ecological compatibility of the automobile engine has been studied. The objects of research were Regular, Premium and Super of Petrol gasoline Samples, as well as a of 10%, 20% and 30%. bioethanol/gazoline blends. The study of the ecological properties of the test additive was carried out at the stand of automobile engines SAK-670 (Germany), on which the engine of a BMW-316 car with coupling sleeve and a transmission assembly is installed. The stand is equipped with brakes and torque sensors, as well as with crankshaft speed and fuel consumption measuring instruments. The test mixtures during an idle running of engine cause a decrease in the CO content in the exhaust gases by 10-16%, and this taking into account their low cost, indicate the prospect of expanding the use of fuel ethanol.

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Introduction. The reduction of oil reserves, development of energy-saving technologies, tightening of standards for exhausted gases, pollution of the environment is forcing the world to find and develop new, renewable energy sources. One of the mechanisms for improving the ecological situation is exactly the use of renewable energy sources. These trends are strongly reflected in programs for development of the energetic of the United States, the European Union and other developed countries, which show that by 2040 the share of renewable energy sources in global primary energy consumption is supposed to grow up to 30%, and the greenhouse gas emissions will be shorten by 50%. The use of renewable energy sources leads to transition to low-carbon mixtures, which gives us a positive effect from both an economic and environmental point of view. Today bioenergy is considered to be the main tendency of development of the fuel market, which will retain its preference in the development of energy supply of the world for the next 30-40 years.

Change of climate in the present-day world, being one of the most serious environmental problems, is associated with the "greenhouse effect", caused by a drastic increase in the concentration of carbon dioxide (CO_2) in the atmosphere. This is contrary to the regulations of the Kyoto Protocol and the Rio de Janeiro Climate Convention, which declare significant reductions in greenhouse gas emissions in the 21st century.

The main task of environmental requirements in the sphere of road transport is to reduce radically the CO_2 content in the exhaust gases. Leading countries such as the US, China and the EU are tightening up CO_2 emission standards for all types of vehicles every year, stipulating for significant growth of their efficiency and the need to produce new, ecologically clean fuels. For example, to obtain gasoline with high antiknock rating, oxygenates (the oxygen-containing components) are used, the most common of which is bioethanol, obtained from renewable biological wastes. Its use is accompanied by a decrease in the CO_2 content in the atmosphere, and its combustion in the engine significantly reduces harmful compounds as compared with the petroleum gasoline. The production of alternative, renewable, environmentally friendly fuels is very important for Georgia, which is almost entirely dependent on imported petroleum products. Researches show that transport accounts for 74% of harmful emissions into atmosphere in the whole country and 79% in Tbilisi. The number of respiratory and oncological diseases in Georgia has increased by 20% over the past 10 years. Therefore, it is important for our country to produce environmentally friendly biofuels from renewable energy sources and especially from the wastes. Biogasolines can successfully replace petroleum gasolines in vehicles with internal combustion engines that are present in Georgia. The mechanism for improving the ecological state of the country and the development of energy-saving technologies for energy carriers is the use of renewable energy sources [1-6].

Results and discussions.

The physical and chemical characteristics of the test samples and base gasoline have been studied. The parameters of the test sample were found to meet the requirements of EN228 and EN15376: 2014 standards. The group composition of motor gasoline (E0) and of biofuels E5, E10 and E20 was also determined using the infrared spectrometer ("PerkinElmer Spectrum, Version 10.4.2"). The fuels have been analyzed according to the EN228 [7] and EN15376 standards [8]. The results of analyses and the chemical and physical characteristics are given in the Table 1.

Table 1. Physical and chemical specifications of bio fuels and its blends

PROPERTY	Gasoline E0	Bio fuels			Standards
		E5	E10	E20	
density at 15 °C, kg/m^3	749,1	752.0	757,0	762.0	ASTM D287 -12
Density at 20°C, kg/m^3	745,0	747,7	753,0	758.0	ASTM D287 -12
Density °API Gravity	57,41	56.6	55,42	54,19	ГОСТ Р. 51069-97
Research octane number, RON	93	95	96	98	ASTM D2699 19e1
Motor octane number, MON	83	85	86	88	ASTM D2700 -19e1
Viscosity at 40°C, mm^2/c	0,5052	0,5364	0,5564	0,6188	ASTM D445
Acid number, mg KOH/g	0,016	0.015	0,008	0,004	ASTM D664 - 18e2
Determination of gum content by jet evaporation method	3	2.8	2,5	2,0	ИСО6246-95
Vapour pressure, kPa	50	55	60	70	EN ISO 7536
Copper strip Corrosion, (3 hours at 50°C)	1b	1b	1b	1b	ИСО 2160-85
Benzene content, %	1,1	1,0	0,9	0,8	ЕН 12177-2008
Total Aromatics content, %	32,5	32.0	30,0	28,5	EN 15553
Sulfur content, mg/kg	0,05	0.047	0,045	0,04	ASTM D 3227-92
Gasoline Distillation, °C					
Beginning Boiling Point, °C	35	38	40	40	ASTM D - 86-93
10%	55 °C	50 °C	51 °C	52 °C	„
50%	85 °C	80 °C	75 °C	70 °C	„
90%	150 °C	155 °C	150 °C	150 °C	„
Final Boiling Point, °C	170 °C	172 °C	175 °C	180 °C	„

The purpose of this Article thesis is to obtain fuel ethanol from agricultural wastes and the production of bio gasoline's, which is important for the revival of the bioethanol industry and the development of agriculture. Over the past century the ethanol production in the world has increased 8 times. Experts predict that by 2040 at least 20% of motor fuel will be produced from biomass. A technology for production of bio gasoline from renewable energy sources and secondary raw materials has been developed. Bio Ethanol is an environmentally friendly high-octane gasoline additive that is widely used in fossil gasoline's without modification of car engine.

We have obtained 10 liters of ethanol fuel from corn and other agricultural wastes in the laboratory conditions. Physical and chemical properties of bio ethanol have been studied in accordance with the requirements of ASTM D-4806-20. Test samples of bio gasoline's – E5 (5% ethanol + 95% gasoline), E10 (10% ethanol + 90% gasoline) and E20 (20% ethanol + 80% gasoline) were prepared on the basis of Romero's Premium grade gasoline. The functional groups of the compounds of bio gasoline were analyzed using *PerkinElmer SPECTRUM Version 10.4.2.*

The Fig.1 shows the spectrum of E5, E10, E20, and E0, i.e. petroleum-based gasoline fuel, where compounds have been identified. The figure 2 Chromatograms of the test Samples.

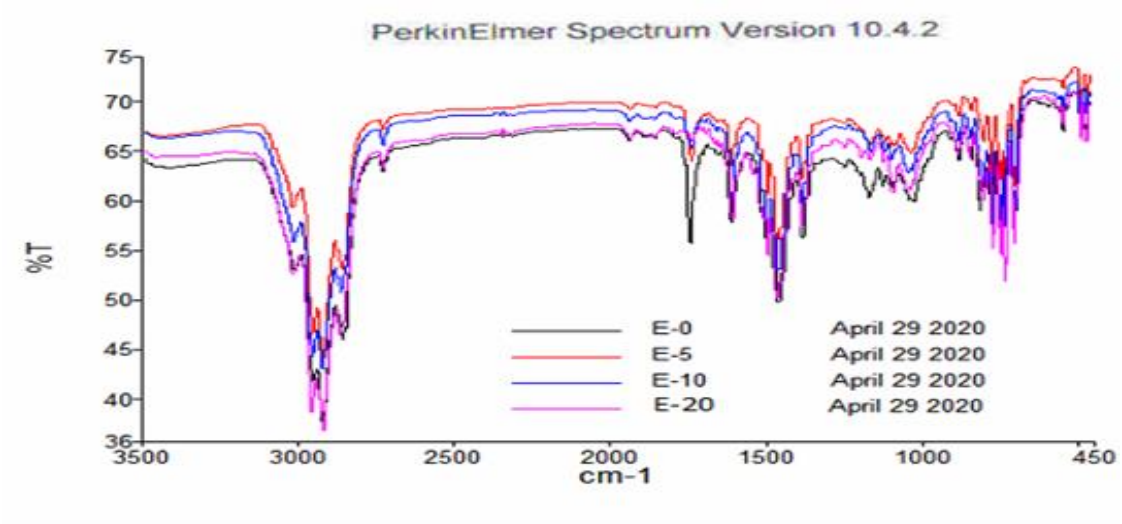

Fig. 1. Petrolfuels and blends fuels Infrared spectra

Experiments were performed on the Crystallux-4000M gas chromatograph with NetChrom v2 software to determine the individual hydrocarbon networks in the test samples E0, E5, E10 and E20. Duration of analysis 30 minutes. The study was conducted in accordance to the requirements of ASTM D 7096. Figure 2 shows the chromatograms of the test specimens.

Results and discussions.

Studies to determine individual hydrocarbons in samples under investigation – E0, E5, E10 and E20 were carried out using the gas chromatograph Crystallux-4000M with NetChrom, v2 software. Certain hydrocarbons contained in the research objects have been studied and identified. The obtained results meet the requirements of the ASTM D7096 standard. Comparative characterization of fuels was carried out [9].

The effect of bio ethanol on the ecological compatibility of the automobile engine has been studied. The objects of research were Regular, Premium and Super brands of petrol gasoline, as well as a bio ethanol test additive, which was added to gasoline in the amount of 10%, 20% and 30%.

The study of the ecological properties of the test additive was carried out at the stand of automobile engines SAK-670 (Germany), on which the engine of a BMW-316 car with coupling sleeve and a transmission assembly is installed. The stand is equipped with brakes and torque sensors, as well as with crankshaft speed and fuel consumption measuring instruments. The research has shown that bioethanol develops relatively more efficiency than low-octane gasoline. As a sample for testing was chosen the "Regular" brand of Rompetrol gasoline, to which fuel ethanol was added in the amount of 10, 20 and 30% [10]. The test mixtures during an idle running of engine cause a decrease in the CO content in the exhaust gases by 10-16%, and this taking into account their low cost, indicate the prospect of expanding the use of fuel ethanol.

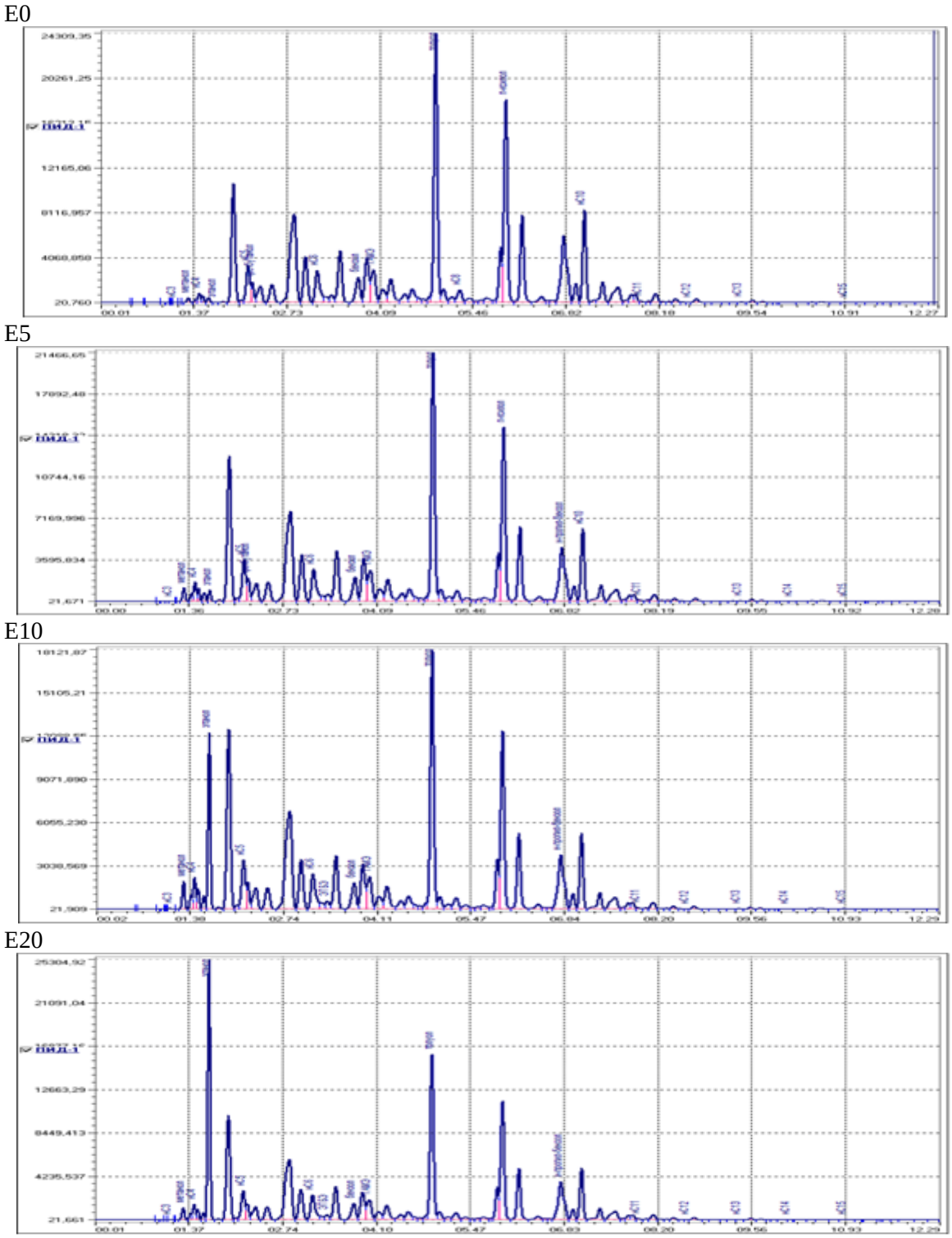

Fig. 2. Chromatograms of Test samples

During the experiment, the fuel consumption of the engine was estimated at idle running and at maximum power. The fuel consumption, as well as the amount of carbon dioxide and hydrocarbons in the exhaust gases, was determined. The engine runs on a test biogasoline without failures, the mechanisms and systems of the engine are working normally, no need for their modification has been identified. Average fuel consumption decreased by 3.2% compared to gasoline (E0). The content of CO and low-boiling organic carbohydrates in the exhaust gases also reduced by 12% and 35%, respectively.

Studies have been carried out to determine the shelf life of the test fuels. The test samples were kept in the laboratory in closed chemical vessels at room temperature. During the year, we

periodically (monthly) carried out spectral analysis of the samples under study using an infrared spectrometer and using a gas chromatograph. It was found that the group and individual composition of hydrocarbons in the studied samples did not change during storage.

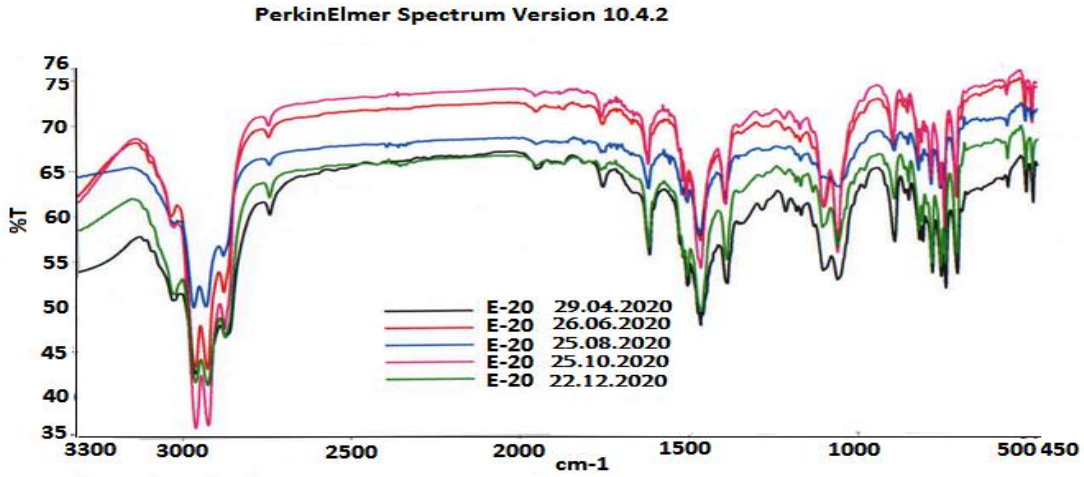

Fig. 3. IR Spectra E20 Bio gasolines

To improve the storage period of bio gasoline E20, test sample has been stored in the lab, under the normal, in a glass conical flask and covered with conventional cap, under the temperature 20-25°C. In order to determine the sustainability of the sample the parameters and the group composition of the fuel have been regularly (every month or monthly bases) checked using IR spectrometer and the gas chromatographer. The results, which are given in the *Fig. 3*, show that the composition of the functional groups did not change during these bio gasoline fully maintained the group composition, the bio gasoline maintained all its best characteristics.

Conclusions. In Georgia the biofuel has been obtained for the first time and it can be used in vehicles with internal combustion engines. For production of bio ethanol the corn and other agricultural wastes are used which ensures rational waste management, the development of energy-saving technologies and an improvement in the ecological state of the environment.

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