

APPROVED

HEAD OF GNU VNIITTI

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REPORT

on the results of a comparative analysis of the qualitative characteristics
of samples of coal for hookah

Acting on the basis of Agreement no. 21/10/19, GNU VNIITTI located in the city of Krasnodar received samples of hookah charcoal in original factory packaging for evaluation:

- WUGIL brand charcoal made from walnut shells
- Another popular charcoal made from coconut shells (control group)

Objectives of the research:

- determination of the qualitative characteristics of samples of hookah charcoal (visual assessment, organoleptic assessment, determination of humidity, smell, ignition time, burning duration, dynamics of temperature changes in the bowl and kaloud during the operation of the hookah system, and the carbon monoxide content in the produced aerosol)
- conducting a comparative analysis of the quality characteristics of samples of charcoal for hookah.

1. Research materials and methods

The research was carried out using standard methods adopted in the tobacco industry, as well as the "Method of tasting the mixture for hookah" (M-01-2015) and "Method for determining the content of carbon monoxide in hookah smoke" (M-04-2009) developed by the institution.

2.1. Research materials

During the research, a hookah mixture made according to the recipe and technology developed by the institution was used.

Chart 1. Research Materials

Product name	Country of origin	Weight (g)	Units in package
Charcoal for hookah made from walnut shells	Ukraine	1100	1
Charcoal for hookah made from coconut shells (control)	Indonesia	1000	1

2.2. Research program

The study was conducted according to a program that determines the quality characteristics of samples of charcoal for hookah of various brands, using the following methods:

- the visual inspection that evaluates the appearance of consumer packaging and labels on the packaging
- organoleptic evaluation that determines the consumer characteristics of products
- sensory analysis that determines the effect of the charcoal on the consumer properties of the hookah mix
- determination of individual characteristics, such as humidity, burning duration, speed of ignition, dynamics of temperature changes of the bowl and kaloud during the hookah system operation, and the content of carbon monoxide in the produced aerosol of the hookah mixture

2.3. Equipment

2.3.1. Hookah system:

- DSH hookah (shaft length: 400 mm, diameter: 13 mm, flask volume: 1500 ml)
- Phunnel Bowl
- Alpha Kaloud

2.3.2. Equipment for determination of humidity:

- OHAUS Scout laboratory scales with a weighing error of no more than 0.01 g
- SHS-80-01 SPU drying cabinet
- Weighting bottles according to the regulatory document
- A thermometer according to GOST 28498
- Desiccator according to GOST 25336
- Calcium chloride according to the regulatory document (hardened)

2.3.3. Equipment for determining the content of carbon monoxide in smoke:

- An air vacuum pump that provides a volume gas flow of at least 100 ml/s
- Gas meter, with a division value of no more than 100 ml
- Container with a volume of at least 10 liters (with an output in the lower part)
- 500 ml measuring cylinder
- Carbon monoxide gas analyzer
- OHAUS Scout laboratory scales with a weighing error of no more than 0.01 g

3. The legal framework of the study

The following normative documentation and special literature were used in the research:

1. Federal Law no. 268-FZ of December 22, 2008, on "Technical regulations for tobacco products"
2. Federal Law no. 15-FZ of 23.02.2013 "On protecting citizens' health from exposure to ambient tobacco smoke and the consequences of tobacco use"
3. Federal Law "On amendments to article 19 of the Federal Law "on the protection of citizens' health from exposure to ambient tobacco smoke and the consequences of tobacco use" of 30.12.2015 (456-FZ).
4. Federal Law no. 195-FZ "Code of administrative offenses of the Russian Federation".
5. M-01-2015 "Method of sensory analysis of hookah mix"
6. M-04-2009 "Method for determining the content of carbon monoxide in hookah smoke"

4. Terms and definitions

In accordance with GOST R 52463-2005 "Tobacco and tobacco products. Terms and definitions":

- Hookah tobacco is a type of smoking tobacco product intended for smoking using a hookah and consisting of a mixture of cut or torn raw materials with or without the addition of ingredients.
- The ingredient is a substance (with the exception of tobacco leaf and other parts of tobacco) used in the production of a tobacco product and present in the finished tobacco product, including its modified forms.
- Consumer packaging is packaging intended for sale or primary packaging of products sold to the final consumer.

5. Research results

5.1. Visual inspection of consumer packaging of coal for hookah of various brands.

According to the results of visual inspection of consumer packaging of samples of coal for hookah of various brands, the following results were established:

- Samples of WUGIL charcoal for hookah are provided in consumer packaging, which is a cardboard box weighing 1.1 kg, which contains two inserts, i.e. two packages of coal in a plastic film of 0.55 kg each (Fig. 1). The actual weight corresponds to the manufacturer's stated weight. Each packaging has a total amount of 40 cubes of charcoal (25x25x25mm, black color).

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- Samples of charcoal for hookah made from coconut shells (control) are provided in a consumer packaging, which is a cardboard box weighing 1.0 kg, with an additional packaging of coal in a plastic film inside. The actual weight of the product corresponds to the manufacturer's stated weight. The inner packaging has a total amount of 72 cubes of charcoal (25x25x25mm, bright black color).

Experimental and control samples of coal are regular cubes with sides of 25x25x25 mm.

The appearance of the studied samples of WUGIL brand charcoal is shown in figure 1.



Figure 1. Samples of WUGIL brand charcoal. The surface of the consumer packaging of WUGIL brand contains some information for the consumer. The information is summarized in Chart 2.

Chart 2. Information on the packaging

WUGIL charcoal for hookah
Face
WUGIL Exclusive product
Sides
WUGIL 80 Walnut charcoal for hookah Charcoal for hookah from walnut Advertising and marketing statements (organic, low ash content, extended burning duration, odorless, ignition time, ecology)
Back
Safety measures Manufacturer: OOO "Ukrainskiye Energeticheskiye Resehniya" 03061, Ukraine, Kyiv, Otradny Ave., 95-G +38 097 77781 72 Importer: OOO "Atrium" Russia, 123112, Moscow, Presnenskaya embankment, 10-2, Office 119 + 7 915 470 35 55 The shelf life is not limited /Barcode/

5.2 Qualitative characteristics of samples of charcoal for hookah of various brands.

During the research, the qualitative characteristics of samples of charcoal for hookah of two brands were determined.

5.2.1 Dynamics of changes in the temperature of the bowl and kaloud during the operation of the hookah system using charcoal of various brands.

The results of determining changes in the temperature of the bowl and kaloud during the operation of the hookah system using charcoal of various brands are shown in figures 2 and 3. The smoking session lasted for 80 minutes. The experiments were carried three times.

Figure 2 shows the curves of the average values of changes in the temperature of the Phunnel bowl.

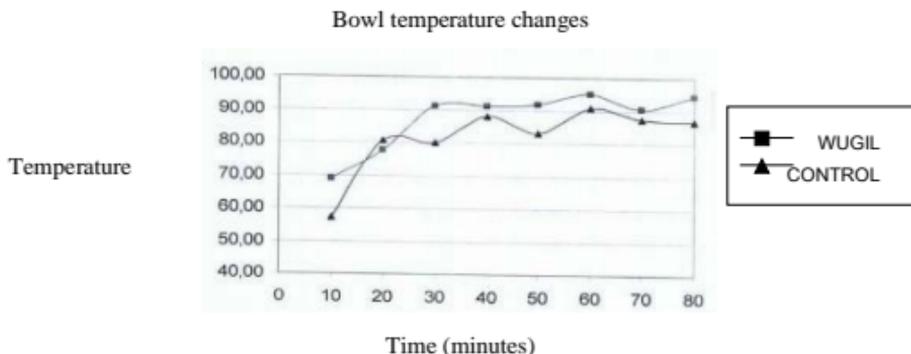


Fig. 2. Change in the temperature of the Phunnel bowl during the operation of the DSH hookah system with the charcoal of various brands.

Figure 3 shows the curves of the average values of the Alpha kaloud alpha temperature change.

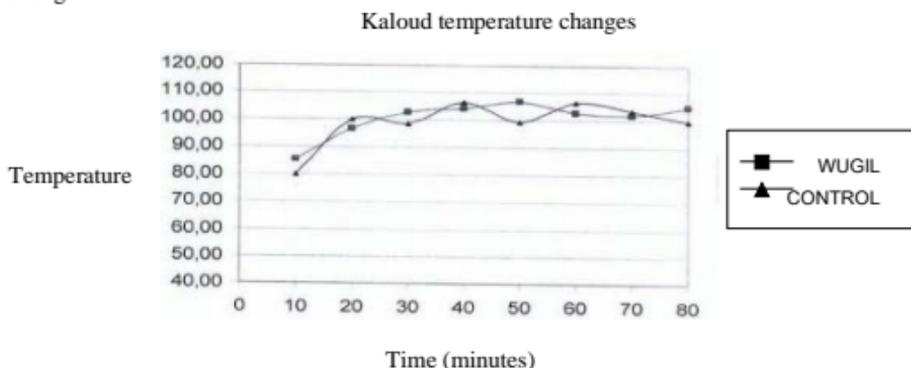


Fig. 2. Change in the temperature of the Alpha kaloud during the operation of the DSH hookah system with the charcoal of various brands.

Analyzing the results obtained, we can conclude that the temperatures at the measured points for the WUGIL brand charcoal and the control sample have similar values. --- As a result, the institution claims that the calorific value of the WUGIL charcoal and the control sample are identical.

Similar results were obtained when measuring the Kaloud temperature (Fig. 3).

5.2.2 Organoleptic evaluation of charcoal for hookahs of various brands.

The qualitative characteristics of the studied samples of coal for hookah are shown in Chart 3.

Chart 3. Qualitative characteristics of the studied samples of charcoal for hookah

Sample	Organoleptic evaluation		
	Smell	Color	Humidity, %
WUGIL charcoal for hookah made from walnut shells	Light, almost nonexistent	Gray and black	7.64
Charcoal for hookah made from coconut shells (control)	Specific, clear, distinct	Black	7.80

The results contained in Chart 3 clearly show that the humidity of the experimental and control samples have similar values, and the discrepancies are within the limits of the experiment error. The color of the samples is black. The smell of WUGIL brand charcoal is light, in contrast to the characteristic smell of the control sample of coal. The duration of the burning of the studied samples is the same and lasts around 80 minutes.

5.3. Consumer characteristics of the studied coal samples and sensory analysis of the hookah mixture when smoking.

During the study, the ignition time and the content of carbon monoxide (CO) in the produced aerosol were determined.

The content of carbon monoxide in the hookah system with the studied coal samples was determined in accordance with the "Methodology for determining the content of carbon monoxide in hookah smoke" (M-04-2009). The data is shown in Chart 4.

Chart 4. Consumer characteristics of the studied samples of charcoal for hookah

Name	Consumer properties		Coal cube weight		
	Ignition duration, seconds	Content of CO, %	Average value,	Standard deviation	Coefficient of variation
WUGIL charcoal for hookah from shells of walnut	394.6	0.0858	13.443	0.47232	3.513494
Coal for hookah from shells of coconut (control)	495.6	0.1075	14.165	0.33588	2.371282

Analyzing the results presented in Chart 4, we can conclude:

- the duration of WUGIL brand charcoal ignition is 394.6 seconds on average, which is 25.6% less than that of the control sample
- the coefficients of variation of the mass of one cube of coal of the studied samples are comparable.

Since the data on the CO content in the gas phase of the experimental (WUGIL) and control samples are heterogeneous, one-factor analysis of the results obtained was performed.

The results of a one-way analysis of variance of the carbon monoxide content in the gas phase during the operation of the hookah system with the studied coal samples are presented in Chart 5.

Chart 5. One-way analysis of variance of carbon monoxide content in aerosol

	Number	Amount	Average	Dispersion
Coal for hookah from shells of coconut (control)	12	1.29	0.1075	3.86E-05
WUGIL charcoal for hookah made from walnut shells	12	1.03	0.0858	9.92E-05

Dispersion analysis

Source variation	SS	df	MS	F	P value	F critical
Between groups	0.002817	1	0.002817	40.85714	1.97E-06	4.300940
Within the group	0.001517	22	6.89E-05			
Total	0.004333	23				

As a result of a one-way analysis of variance, it was found that the differences in the content of carbon monoxide (CO) in the aerosol, using WUGIL walnut shell charcoal and coconut shell charcoal (control), are not accidental.

In an aerosol made using WUGIL brand charcoal, the carbon monoxide content is 20% less than when burning a control sample of coal.

5.4. Sensory analysis of the hookah mixture when smoking the studied coal samples.

As a result of the sensory analysis, no significant influence of the experimental and control samples of coal on the taste and aroma of the hookah mixture was found.

Conclusions

As a result of the conducted research, the following things were established:

- when using the WUGIL charcoal made from walnut shells, the carbon monoxide content in the aerosol is 20% less than for the control sample of charcoal from coconut shell
- the duration of WUGIL charcoal ignition is 25.6% less than of the control sample
- the duration of the burning of WUGIL charcoal and the control sample are the same
- the calorific value of WUGIL charcoal and the coconut shell control coal is identical
- when using WUGIL charcoal there's almost no smell in comparison with the control sample

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