

## Project description

### 1. Name of the project

***New method of control of quality and safety of alcohol and alcohol-containing products. Production of standard and control samples of alcohol-containing products.***

### 2. Organization-developer

*Institute for Nuclear Problems of Belarusian State University (INP BSU)*

### 3. The estimated amount of investment (US \$), payback period

*Commercial offer: license costs – from 1 000 \$.*

*Production of standard and control samples of alcohol-containing products.*

*The cost of a set of standard samples – 100 \$.*

*The cost of control sample – \$ 100.*

*The annual demand of enterprises in Belarus is not less than 500 sets of standard samples and 500 control samples.*

### 4. Description of the project, the essence of innovation, project development stage.

***Stage of development of the project – ready for implementation.***

***The new method of quality control and safety of alcoholic beverages*** (Charapitsa S. et al. *Direct Determination of Volatile Compounds in Spirit Drinks by Gas Chromatography. Journal of Agricultural and Food Chemistry, 2013, 61, 2950-2956, DOI:10.1021/jf3044956*):

*the use of ethanol as an internal standard for the quantitative determination of volatile compounds in alcohol and alcohol-containing products directly in milligrams per litre (mg/L) of anhydrous alcohol (Absolute Alcohol – AA) without using the traditional procedure of introducing the internal standard substance in the test sample.*

***The project provides a solution of problems of quality control and safety of alcohol and alcohol-containing products***

*Acetaldehyde, methyl acetate, ethyl acetate, methanol, 2-propanol, 1-propanol, isobutyl alcohol, n-butanol, isoamyl alcohol are main volatile compounds that should be determined in spirit drinks according to the regulations OIV-MA-BS-14-EN and EC2870/2000. Concentrations of these compounds are expressed in mg/L (AA). The quantitative determination of ethanol in all alcohol-containing products entails the payment of taxes to the state budget worldwide.*

#### ***Unsolved problem worldwide:***

- 1. It is impossible to correctly measure the volume content of ethanol in the samples of Brandy / Whisky / Calvados / Cognac, etc. with the required accuracy of at least 0.1% at concentrations of impurities greater than 0.2%. There are methods for determining the volume content of ethanol only in binary (ethanol + water) mixtures. Brandy / Whisky / Calvados/ Cognac are not binary mixtures. Vodka is almost binary mixture.*
- 2. With the current methods of analysis it is not possible to use control samples with a volume of sample of alcohol-containing products less than 250 ml.*

### 5. Competitive Advantages

- direct and correct determination of the volatile compounds, including ethanol in alcohol products;*
- high reliability of the measured data;*
- substantial simplification of the measurement procedure;*
- control the quality of alcoholic beverages in the alcohol market using standard samples of a new type;*
- an internationally recognized level of novelty.*

*The method is applicable for the investigation of alcohol-containing products:*

- *Food products including alcoholic beverages;*
- *Inedible products including:*
  - *Pharmaceutical products,*
  - *Perfumery,*
  - *Waste of alcohol-containing products,*
  - *Bioethanol,*
  - *Ethanol-gasoline blends (car fuel).*

## **6. Results achieved**

*Analysis of obtained results of theoretical and experimental research in specialized testing laboratories of the Investigative Committee of the Republic of Belarus, the Customs Committee of the Republic of Belarus, JSC "Minsk Kristall", Ukrainian State Research and Production Center of Standardization, Metrology, Certification of Consumer Rights Protection (Ukrmetrteststandart) (Ukraine), the National Food and Veterinary Risk Assessment Institute (Lithuania), Rovira i Virgili University (Spain), as well as discussions on relevant international conferences, point to the possibility and the need to include the proposed method of measurement and the method of preparation of standard and test samples of volatiles compounds of alcohol-containing products into international standards.*

*On the basis of the proposed method, on-line AlcoDrinks calculator is developed and placed on the Internet for free access to the addresses: <http://inp.bsu.by/calculator/vcalcr.html> (Russian version) and <http://inp.bsu.by/calculator/vcalc.html> (English version).*

## **7. The market and consumers**

*Testing laboratories with the field of accreditation: quality control and safety of alcohol products.*

## **8. Proposed forms of cooperation**

- *Sale of licenses and information support.*
- *Provide technical support.*

## **9. The project team**

- *Laboratory of Analytical Research of INP BSU – 2 Ph.D., 2 researchers, 2 students.*
- *Belarusian State Technological University (Belarusian State Technological University)*
- *Ukrainian State Research and Production Center of Standardization, Metrology, Certification of Consumer Rights Protection (Ukrmetrteststandart) (Kyiv, Ukraine)*
- *National Food and Veterinary Risk Assessment Institute (Vilnius, Lithuania).*

## **10. 2-3 pictures**

*It was obtained the Certificate of certification procedure (method) No253.0169/01.00258/2013 by Federal Agency for Technical Regulation and Metrology of the Russian Federation (Rosstandart) "Method of measurement of the mass concentration of volatile compounds in alcohol drinks by gas chromatography".*



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Federal Agency  
for Technical Regulation and Metrology  
(Rosstandart)  
The Federal State Unitary Enterprise  
"Ural Scientific-Research Institute of Metrology"  
(Federal State Unitary Enterprise "UNIM")  
State Scientific Institute of Metrology

**CERTIFICATE**  
**of certification procedure (method)**

№ 253,0169/01.00258/2013

Method of measurement of the mass concentration of volatile compounds in alcohol drinks

name of method, including the name of the measured values and, if appropriate, measurement object,  
by Gas Chromatographyadditional parameters and implemented method for measuring  
designed for measuring of the mass concentration of volatile components in alcohol drinks by  
are of use

gas chromatography in the Laboratory of Analytical Research of INP BSU.

developed by the Research Institute "Institute of Nuclear Problems" of Belarusian State University (INP BSU)  
name and address of the organization (enterprise) developed the method

220030 Belarus, city of Minsk, Bobruiskaya Str., 11

and contained in the document "Determination of volatile compounds in alcohol drinks by gas chromatography"  
designation and name of the document containing the method, year of approval, number of pagesMethod is certified in accordance with the Federal Law № 102 "On ensuring the uniformity of measurements"  
and GOST R 8.563-2009.Certification carried out on the results of metrological examination of theoretical and experimental materials  
development of measurement techniques and/or experimental studiesAs a result of evaluation of the measurement procedure is established that the method meets the  
legal document in the area of traceability (if available) and GOST R 8.563  
requirements of GOST R 8.563-2009.

Performance measurement accuracy are given in Appendix on 2 pages.

Deputy Director



Yu.S.Bessonov

Head of Laboratory

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Date of issue

12.07.2013

Recommended for revision of the measurement procedure

12.07.2018

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On-line calculator AlcoDrinks: <http://inp.bsu.by/calculator/vcalc.html>

## On-line calculator AlcoDrinks on correct determination of volatile compounds, including ethanol, in alcohol products

Using this calculator, you can perform a quantitative determination of the content of volatile compounds, using ethanol as internal standard.

You should only specify the value of the area under the peaks of the analyzed compound and ethanol. As a result, you will immediately receive the concentration of analyzed compound in mg per liter of absolute alcohol (AA). Given values RRF are approximate. For more accurate results, you should enter the improved values for the calculation of RRF, corresponding to your gas chromatography.

### Name of the sample:

Sample - CRN LGCS100 Whisky-Congeners

Compound	Density*, mg/L	RRF		Area, arb. units	Concentration, mg/L (AA) <input type="text"/>
		Average**	Custom		
acetaldehyde	783400	1.337	1.337	31.216	75.844
isobutyraldehyde	793800	1.109	1.109	0	0
ethylformate	916800	1.321	1.321	0	0
acetone	784500	1.300	1.300	0	0
methyl acetate	934200	1.387	1.387	3.481	8.774
ethyl acetate	900300	1.117	1.117	121.388	246.401
methanol	786600	1.223	1.223	23.757	52.800
2-butanone	805000	0.900	0.900	0	0
2-propanol	785000	0.969	0.969	0.917	1.615
ethanol	789300	1.000	1.000	434338	789300 (39.90 v/v %)
diacetyl	990000	2.019	2.019	0	0
2-butanol	806300	0.853	0.853	0	0
1-propanol	805300	0.679	0.679	471.362	581.619
isobutanol	801800	0.581	0.581	585.582	618.270
isoamyl acetate	876000	0.707	0.707	0	0
1-butanol	809800	0.648	0.648	4.443	5.232
isoamylol	813000	0.632	0.632	775.877	891.095
hexanol	815300	0.600	0.600	0	0
ethyl lactate	1032800	1.908	1.908	0	0
cyclohexanol	962400	0.556	0.556	0	0
benzyl alcohol	1041900	0.909	0.909	0	0
phenylethanol	1013000	0.730	0.730	0	0
sample	948060				

Print the results

\*Densities are given according to TOXNET - Toxicology Data Network, U.S. National Library of Medicine <http://toxnet.nlm.nih.gov/>.

\*\*Average coefficients RRF are calculated on results obtained on gas chromatographs Crystal (JSC SDB Chromatec, Yoshkar-Ola, Russia).

## **11. Directions**

*Food industry, pharmacy and biotechnology.*

## **12. Contacts**

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