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CLASSIFICATION OF RIGID POLYURETHANE FOAM AND PRODUCTS BASED ON THEM ACCORDING TO THE REQUIREMENTS OF THE COMMODITY NOMENCLATURE OF FOREIGN ECONOMIC ACTIVITY

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Annotation
This article presents the study of rigid polyurethane foams based on tertiary amines as catalysts, the results of their production, their classification according to Commodity nomenclature of foreign economic activity (CNF EA) and their assignment of code numbers. The goods obtained as a result of scientific research were assigned commodity codes according to the CNF EA classification and entered into the general register. Rigid polyurethane foams were obtained based on the synthesized products, and samples of the obtained products were selected for further study.

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Introduction. A commodity can be any product that has material value, produced, grown in industries and other areas.

Commodity chemistry is considered the 20th science among young, rapidly developing chemical sciences. It can be said that this science is used in the implementation of scientific innovations made in any field related to chemical sciences, in practice, in various areas of production and economics, in the clear and rapid implementation of import-export processes of goods, in Coding of existing and new goods by their chemical composition based on the HS number occupies a key place in protecting the country's economy and public health.

The first proposals for classification of goods were made by the International Council of Statisticians in 1853, and 60 years later, on December 13, 1913, by the Brussels Convention with the participation of 29 countries, and in 1938 - by the abbreviated nomenclature of goods. Statistics of international trade were declared by 147 sections, 50 groups and 456 commodity items. In connection with the problems in the management of foreign economic activity, a harmonized system was developed in 1981, and since June 4, 1983, an international convention on the harmonized system was adopted, dividing goods into group items, sub-items, assigning them code numbers and developing rules for the classification of goods 2.

The commodity nomenclature of the Republic of Uzbekistan is based on the harmonized system used in world practice. The first versions of the national commodity nomenclature were

developed in 1996 by leading specialists of the Central Laboratory of Customs Expertise and the state administration departments of the Customs Committee [1].

According to the decision of the President of the Republic of Uzbekistan dated December 28, 2022 "On the introduction of the 2022 revision of the Commodity Nomenclature of Foreign Economic Activity of the Republic of Uzbekistan" No. was developed by the committee and the customs practice was put into effect. The latest revision of the nomenclature of goods included in the customs practice includes 21 sections, 1252 commodity items, 5367 commodity sub-items and 11293 commodity sub-sub-items [2].

The formation of classification of goods according to their chemical composition as a new science among chemical sciences is of great practical importance for the younger generation teaching it as a science in higher educational institutions [3].

In accordance with the letter of the Higher Attestation Commission under the Cabinet of Ministers of the Republic of Uzbekistan dated July 9, 1997 No. 01-84 / 0917, the decision of the Scientific and Technical Committee of the Republic of Uzbekistan No. 14 dated July 15, 1997 "Nomenclature of specialties of scientific personnel" in the field of chemical and technical sciences 02.00.22-Classification of goods by chemical composition was introduced certification specialty. Four years later, in 2001, under the guidance of Professor I.R. Askarov, researcher N.Kh. Tokhtaboev proposed 7 new, a total of 22 international code numbers for unrefined and partially refined raw cottonseed oil, 02.00.22 For the first time in the world, candidate dissertations were defended in the specialty classification and certification by composition and awarded by chemical composition recommendations were developed.

Commodity chemistry is a huge school, and the incomparable achievements of the inventor, innovator, doctor of chemical sciences, professor I.R. Askarov, who served Uzbekistan in the successful defense of their scientific works by researchers in the field of chemical and technical sciences. To date, the specialty code 02.00.22 has been changed to 02.00.09-Specialty "Commodity Chemistry", and more than 20 doctors of science, more than 30 candidates of science and doctors of philosophy have successfully defended their scientific research in the field of chemical industry. and technical sciences and received the scientific titles of professor and associate professor.

Currently, most countries in the world have a harmonized system of description and coding of goods, which significantly simplifies the movement of goods across customs borders and increases the volume of international trade.

Classification of goods is considered a type of activity carried out for customs purposes.

The customs classification of goods performs three main functions:

- use in determining the amount of customs duties to be collected, based on the duty rate;
- correct execution of permitting documents in a notarial manner;
- used to summarize information about goods when maintaining state statistics and customs statistics.

In the CNF EA, product codes play an important role in maintaining foreign trade statistics, state statistics, are associated with import customs duty rates, prohibitions and restrictions, and have a very important characteristic when monitoring customs value.

The specialty "Commodity Chemistry" is a relevant area in the system of chemical sciences, this specialty is recognized as an independent scientific direction, and significant work is being done in this area. The code number assigned to each product allows us to draw conclusions about its chemical composition, source of raw materials, production method, quality, environmental safety and correct price. That is why today commodity chemistry is acquiring important practical significance throughout the world [4].

According to the State Customs Committee of the Republic of Uzbekistan, as a result of the introduction of commodity chemistry science into customs practice, the state as a whole managed to save 100 billion soums for the period from 2010 to 2018. sums, in 2020 83 billion soums. reached.

These indicators indicate the importance of this discipline in the large-scale development of the economy of our country [5].

Today, much scientific research is being conducted in this area in developed countries such as Uzbekistan, the USA, China, Korea, Japan and Russia [6].

Isakov Kh. and Akhmadaliev M.A. in their doctoral dissertations developed a technology for industrial production of composite commercial products with special properties, classified them according to CNFEAand developed commodity codes based on their chemical composition [7].

Abdulloev Sh.Kh., Tulakov N.K., Abdugapparov F.S., M.Kh. Mamarakhmonov, K.K. Otakhonov M.M. Khodzhimatov, O.Sh. Abdulloev, M.M. Mominzhonov and a number of other scientists in their scientific research created new products based on ferrocene and its derivatives, developed various product codes for them based on their chemical composition according to the HS and recommended them for practical use. They also developed new modern methods using infrared spectroscopy, mass spectrometry and chromatograph mass spectrometry for the accurate determination of product codes [8-10].

L. Pulatova, D. T. Khasanova, B. N. Sattarova, M. Yo. Imomova, S. A. Rustamov, Sh. K. Kushnazarova, D. B. Karimova and a number of other scientists made a great contribution to the development of the science of commodity chemistry with their scientific research [7-10].

Under the supervision of I.R. Askarov, 23 doctors of science, about 50 candidates of science, doctors of philosophical sciences in the specialty "Commodity chemistry" were trained. This is, first of all, the scientific basis for protecting the economic interests of states, consumers and producers.

Rigid polyurethane foams (RPPU) are a rapidly developing industry. Polyurethane foam was first obtained in 1937 by a small group of scientists led by Otto Bayer. It is used as insulation in the construction of buildings and structures, as well as in the manufacture of refrigerators and coolers. This is due to its very low thermal conductivity (0.019 - 0.03 W / (m * K)), low vapor permeability and waterproofing characteristics. Rigid polyurethane foams with a closed cell structure are used almost everywhere and are used in work on:

- thermal insulation of roofs and attics,
- insulation and acoustic insulation of walls both from inside the premises and outside the building,
- waterproofing and insulation of foundations.

Rigid polyurethane foam is not subject to rotting and mold, as well as exposure to chemicals: paints, oils, gasoline, solvents.

High adhesion coefficients make this material very versatile, it can be applied with equal success to paper, metal, wood, plaster, brick, roofing felt, tiles and much more. The ability to produce and apply polyurethane foam directly on the construction site significantly reduces associated costs and makes the applied heat-insulating layer completely monolithic - which guarantees the absence of cold bridges. Single-component compositions, hardened by air moisture (mounting foam), have also found their application and are often used in everyday life for minor noise insulation and heat insulation household work, as well as where filling of voids is required (for example, when installing plastic windows and doorways).

Rigid polyurethane foams are obtained by the action of two components A and B. Component A may contain polyether polyol, surfactants, freon, catalyst. Component B includes an isocyanate-containing substance. Catalysts based on tertiary amines are important and necessary components in the production of polyurethane materials.

In order to obtain a cheap and import-substituting product for the production of rigid polyurethane foams, rigid polyurethane foams based on diethanolamine and benzaldehyde in a 1:1 mol/mol ratio were obtained in laboratory conditions and the products of the reaction of benzaldehyde with diethanolamine were studied [11]. However, the high cost of the benzaldehyde used affects the cost of the finished product. Therefore, we conducted a study to select an alternative substance with a large supply of raw materials for the rational use of secondary products of local manufacturing

enterprises. We chose furfural as such a product due to its valuable properties. This choice is explained by the fact that furfural can be obtained from local secondary products (sunflower stalks, straw, bran, etc.) and is an alternative renewable product. The choice of furfural as the main raw material for the synthesis of rigid polyurethane foams is explained by its easy availability (obtained by hydrolysis of pentose-containing substances - sawdust, sunflower seed husks, cabbage stalks, etc.) and cost.

Based on the products of the interaction of furfural with diethanolamine, the physicochemical properties of the hydroxylase-containing compound were studied using IR spectroscopy [12]. Continuing the research work and conducting further studies, we studied the patterns of reactions of the formation of hydroxylase-containing products from diethanolamine and furfural [13].

Based on the synthesized product, composites of rigid polyurethane foams of several samples were obtained. Of the samples obtained, a composite with physicomechanical properties similar to Laprol-294 was selected. Sample No. 2 with a component composition consisting of 70.0 mass parts Laprol-307 was selected as the optimal composition; 20.0 parts by weight – Lapramola-294; synthesized product – 10.0 parts by weight; surfactant (KEP – 2a) – 1.0 parts by weight; and water 1.5 parts by weight [14].

Based on the synthesized products and the above formulation, samples of rigid polyurethane foams were obtained in laboratory conditions and their physical and mechanical properties were studied [15].

Continuing our research activities aimed at introducing the synthesized product into industrial production, we compared the samples of rigid polyurethane foams we obtained with a standard sample of rigid polyurethane foam grade PUF-307 and compared them. The physical and mechanical properties of the above rigid polyurethane foams are given in the following table 1.

Table 1

Physical and mechanical properties of rigid polyurethane foam samples

№	Name	Sample – 1*	Sample – 2*
1.	Start time, sec	13	11
2.	Gel time, sec	26	21
3.	Rise time, sec	53	51
4.	Apparent density, kg/m^3	90	91
5.	Compressive strength, MPa	0,82	0,45
6.	Impact toughness, kJ/m	0,23	0,24
7.	Water absorption, kg/m^2	0,41	0,42
8.	Combustibility (fire tube) mass loss, %.	47,6	53,7

Note: Sample No. 1 - Formula of rigid polyurethane foam developed in the laboratory; Sample No. 2 - Standard formula of rigid polyurethane foam grade PUF-307*

As can be seen from the above table 1, the start time of the rigid polyurethane foam we obtained is 13 sec., while the start time of the rigid polyurethane foam of the standard sample grade PUF-307 is 11 sec. The gelation time of our sample was 21 sec. for the standard sample. The rise time of our sample was 53 sec., while for the standard sample it was 51 sec. The apparent density of all 2 samples was 90 and 91 kg/m^3, respectively. The compressive strength of our sample was 0.82, while for the standard sample grade PUF-307 it was 0.45 MPa. The impact strength of the obtained sample was 0.23, and for the standard sample this indicator is 0.21 kJ/m. The water absorption indicators of the samples were 0.41 and 0.42 kg/m^2, respectively. The flammability indicators of all 2 samples were 47.6 and 53.7%, respectively.

Such close physical and mechanical values of the apparent density, impact strength, and water absorption indicators are explained by the same content of Laprol-373 in the formulation in the amount of 70.0 mass parts.

Thus, based on the above, we can conclude that the product we developed, obtained with a diethanolamine:furfural ratio of 2:1, can replace the currently used standard rigid polyurethane foam grade PPU-307. And based on this, we can add that the product synthesized by us has been introduced into the recipe for obtaining rigid polyurethane foams and positive, satisfactory results have been obtained.

As a result of the conducted research work, it was recommended to assign commodity codes according to the CNF EA to the new products obtained based on the reaction products of diethanolamine and furfural in a ratio of 2:1 to obtain rigid polyurethane foams.

Experiments and discussion. Our research has shown that in the nomenclature of goods of foreign economic activity, the code of the goods is - VII section 39 group (the term "plastics" means materials of headings 3901 - 3914, which are capable, during polymerization or at some subsequent stage, of taking a given shape under the influence of external action (usually temperature and pressure, and, if necessary, using a solvent or plasticizer) and retaining it after the removal of the external action, such as pressing, casting, extruding, calendering or other), the content is presented in heading 3909, divided into subheadings with nine-digit commodity codes. The following table 2 shows the classification of plastics and plastic products in the Nomenclature of Goods for Foreign Economic Activity of the Republic of Uzbekistan, 2022 edition.

Table 2.

Classification of rigid polyurethane foam products by commodity codes according to CNF EA

№	Code numbers	Description
1.	3909	liquid synthetic polyolefins, less than 60 vol.% of which is distilled at a temperature of 300 ºC and a pressure of 1013 mbar when distillation under reduced pressure is used (headings 3901 and 3902); low polymerisation resins of the coumarone-indene type (heading 3911); other synthetic polymers containing on average at least 5 monomer units; silicones (heading 3910); resols (heading 3909) and other prepolymers.
2.	3909 10 000 0	- urea and thiocarbamide resins
3.	3909 20 000 0	- melamine resins
4.	3909 30 000 0	- other amino-aldehyde resins
5.	3909 40 000 0	- phenolic resins
6.	3909 50	- polyurethanes:

7.	3909 50 100 0	- - polyurethane, copolymer 2,2 '-(tert-butylimino) diethanol and 4,4 '-methylenedicyclohexyl diiso cyanate, in the form of a solution in N,N -dimethylacetamide with a polymer content of 50 wt.% or more
8.	3909 50 900 0	- - other

Results. As can be seen from the table, in the 2022 edition of the HS, products of the chemical and related industries are listed in only 3 commodity items, namely 3909 50 000 - polyurethanes; 3909 50 100 0 - polyurethane, a copolymer of 2,2- '(tert-butylimino)diethanol and 4,4- 'methylene dicyclohexyl diisocyanate, in the form of a solution in N,N-dimethylacetamide with a polymer content of 50 wt.% or more; 3909 50 900 0 – other.

As a result of the conducted research, it was revealed that the synthesized product is not allocated a separate commodity code according to the CNF EA. As is known, rigid polyurethane foam consists of two components - component A and component B. Component A consists of several products, one of which is tertiary amines, which are part of the synthesized product.

Conclusion. Based on the above, it can be added that rigid polyurethane foams are classified under CNF EA with commodity code 3909 50 - polyurethanes. Also, goods with code 3909 50 900 0 other. Based on the above, rigid polyurethane foams (obtained on the basis of reaction products of diethanolamine and furfural, including products made from them) are classified under CNF EAwith product code 3909 50 900 1 .

As a result of the conducted research, it was established that polyurethane foam products used in industry and everyday life are not allocated a separate commodity code according to the requirements of the CNF EA.

In order to replace the rigid polyurethane foam grade PUF-307 Lapramol-294 used in the standard recipe with a product synthesized by us, we selected an optimal recipe that met our requirements and, based on the recipe we developed, we obtained samples of rigid polyurethane foams.

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