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ANALYSIS OF THE PROTECTIVE PROPERTIES OF FABRICS FOR SPECIAL CLOTHING OF OIL AND GAS EXTRACTION FIELD WORKERS AT HIGH TEMPERATURES

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Abstract: The article studies the protective properties of fabrics intended for special clothing for workers in the oil and gas industry in Uzbekistan. Based on the conditions for the production of special clothing fabrics, the requirements for them are formed based on the norms specified in individual state standards.

Keywords: Hydrocarbons, oil and gas production, drilling, technical requirements, overalls, desert areas, workers, requirements, leading countries, catalogs, oil fields, climate parameters, sun exposure

Introduction. Different types of foreign and domestic fabrics for special clothes are sold in the world textile market every year. These fabrics have a special characteristic structure and protective coatings against various dangerous and harmful production factors. depending on the production conditions of the fabrics of special clothes, certain state standards are used based on the norms specified in Rostneft [1].

Method. The appearance on the market of special clothes made of modern fabrics with new features requires a different approach to the package of materials. The biological capabilities of the human thermoregulatory system are limited when working in open air and hot climates.

Special protective clothing should be prepared taking into account the hygienic requirements (fabrics and clothing construction necessary for human performance and health) [2]. It is mentioned in the sources that such requirements for clothes are aimed at ensuring the heat exchange of the human body with the environment, the level of body temperature, skin moisture and skin breathing [3,4].

The analysis of the fabrics used in the models of special clothing manufacturing companies of different countries showed that mainly mixed and cotton fabrics use oil-water-oil-repellent coatings. Usually it is not absorbed in all the details of oilmen's special clothes, only in separate parts, for example; front part, knees and elbows, pockets, the lower part of the clothes [5,6,7]. these parts of special clothing protect workers' bodies through protective coverings.

Special clothing designed to protect against oil and oil products is divided into 4 protective classes: Ns-crude oil, Nl-light oil and oil products, Nm-oil oils and heavy oil and oil products, Nj-vegetable and animal fats GOST 12.4. 103-80 [8] (Table 1).

At the same time, special clothes provide short-term protection of the parts of the body that are not covered by protective coatings of oil workers.There are areas of the surface where oil splashes on it and changes the initial physical-mechanical, hygienic and other properties of the fabric.

This requires a rational formulation of the material package and the use of its additional functional modification [9].

Table 1

Classes of protection of work clothes depending on the type of oil products [GOST 12.4. 103-80]

Class	Special clothes	sign	Types of oil products
1	Protection from light petroleum products	Nl	Gasoline, kerosene, diesel fuel, condensate
2	Protection from heavy petroleum products and petroleum oils	Nm	Fuel oil (mazut), lubricating oils, bitumen
3	Protection from crude oil	Ns	Crude oil
4	Protection from vegetable and animal fats	Нж	Vegetable and animal fats

According to an analysis of the oilmen's special clothing reference, special oil-water-repellent protective fabrics are in the high price category and therefore are not used in ready-to-wear suits. Therefore, the task of changing the properties of existing fabrics from local raw materials with improved protective properties becomes more urgent.

The Russian state company "Rosneft" has developed a set of requirements for special summer clothing

and fabrics for its production [1]. These are the standards of moisture permeability, air permeability, hygroscopicity, oil and water permeability, crude oil protection, antistatic properties, as well as oil and fire resistance, acid resistance [5,10].

Flame retardant textile fabrics are essential for the production of special protective clothing for oil and gas drillers and miners. Here, a person comes into direct contact with combustibles, oil and gas. Fires in the oil and gas industry account for 12% of all accidents [10].

Proban® and Pyrovatex® are specialty fabrics with flame retardant protective coatings for cotton fabrics. Their distinguishing feature is in the chemical composition and coating technology: the first coating is applied to the surface of the fabric, and the second one has fire-resistant properties due to the formation of molecular bonds in the fiber [11].

Fabrics treated with Proban® technology are flame retardant due to the polymer fixed to the fabric for the life of the product. Proban® fire coating is a chemical and technological process to give fire resistant properties to cotton fabrics, which is carried out at the last stage of the fabric weaving process.

There are also Pyrovatex fire-resistant coatings used for fabrics made of cotton or its blends to achieve a permanent fire protection effect [12].

Dale Antiflame Triple ("Triple") is a flame retardant fabric impregnated with special fireproof Pyrovatex fabrics. The three-layer fabrics of this group are strong enough (tear strength is not less than 1000N/700N) and are intended for wearing in cold weather. Dale Tes-uses Teflon to create a strong barrier against water, oil and pollution [13].

Dale AS cotton and blended fabrics are made from long staple cotton weighing between 180 and 420 g/m2 [14]. Protection of the fabric from rain and oil products is provided by an oil-waterproof coating based on the "fluorocarbon" drug [15].

A known set of flame retardant fabrics with Kevlar aramid fiber. This fiber has a number of unique properties. Therefore, flame-resistant textile fabrics for special protective clothing are made from it [16]. The fire resistance of these fabrics is provided by chemical fibers. They do not burn and do not melt. The basis of these fibers is synthetic paraaramid "Kevlar" [17].

Fabrics from such fibers are produced by foreign and domestic manufacturers: Nomex (Nomex)® fibers - "Dupont" production company, "Arimid", "Pion", "Tvim", yarns - "Lirsot", LLC, "Rusar", SVM-"Kamenskvolokno" OJSC. Fabrics made of these fibers (Terlon, SVM) have a heat flux of 40.0kW/m for at least five seconds, resistance to open flame-at least 15s, thermal conductivity at a temperature of 50-150°C, at least 0.06W/m.

It has self-extinguishing properties: it does not burn, does not generate smoke and does not melt. This fiber is unmatched in terms of heat stability. When exposed to high temperature, its specific heat level is up to 500 degrees [18].

Experimental work. Material. Gore-Tex is a high-tech membrane fabric with an oleophobic coating (Figure 1 and Figure 2). The analysis of the fabrics used in the models of various MK manufacturers showed that fire-fighting and anti-static properties can be given locally without processing all clothes, but only to its individual parts (for example, protective covers, cuffs, front part) [53].

At the same time, in addition to vinyl artificial leather, elasto leather, film coating and a series of fabrics with oil and waterproof coating are used as protective coatings against oil.

Figure 1. Gore-Tex 2.5. Fabric structure

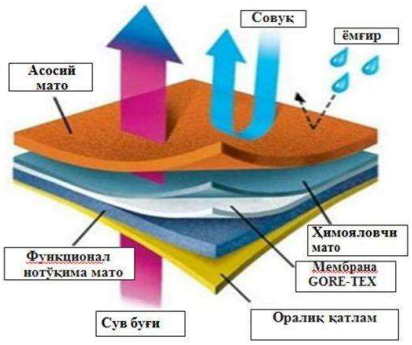

Figure 2. The structure of Gore-Tex fabric

The scientific work of many scientists of Uzbekistan is devoted to the issue of developing methods of improving the flame-resistant-oleophobic properties of fabrics intended for special clothing of workers of various industries. A PVC composition containing polyvinyl chloride and plasticizer is known [19]. However, the composition is not sufficiently resistant to the effects of hydrocarbons.

Result and discussion. Also, the composition is known for obtaining protective coatings by melting into a solution containing PVC, dioctylphthalate, mineral filler, stabilizer, polyethylsiloxane liquid and pigment, or applying it to a fabric base [20].

However, this composition has a low viscosity, which indicates that the starting ingredients do not interact sufficiently.

The disadvantage of this composition is that it has a high level of viscosity and does not provide sufficient protective properties of the coating when applied to the fabric by the freezing method, has low oil resistance during operation, does not retain the necessary components that provide stability to the impact of hydrocarbons, oils and fats on textile fabrics [21].

In addition, this composition does not contain the necessary components that provide stability to the impact of hydrocarbons, oils and fats on textile fabrics.

The work of oil workers is associated with a high risk of sparks from static electricity, which causes fires and explosions. Therefore, labor protection specialists in oil and gas production enterprises pay special attention to the selection of antistatic clothing for such workers. One of the main requirements for such MK is the antistatic surface of the produced fabrics.

Antistatic fabric for specialty clothing is required to protect workers in industries such as oil and gas production and processing, energy, mechanical engineering, metallurgy, electronics, and pharmaceuticals. Antistatic fabric is a reliable protection of a person from the formation of static electricity. The composition of antistatic fabric is composed of cotton and antistatic thread or other composite.

Flame retardant fabrics with antistatic yarn can be made of cotton or blends: for example: cotton and polyester or cotton and nylon. This approach to the composition of raw materials is primarily related to the need to increase the strength properties of finished products subjected to various mechanical damages during the work process.

Antistatic protection is achieved by inserting Belltron carbon threads into the fabric [22], the antistatic properties are permanently preserved during the production process of the fabric, and it reliably performs the function of dispersing static sparks. electric current falling on the surface of special clothing, which in turn can cause a flash of fire.

Antistatic fiber cloth, made of special metal threads. They guarantee protection of workers from harmful static electricity (Fig. 3).

XM FireLine has developed a line of fire-resistant fabrics that, in addition to being flame-resistant, also have anti-static properties, which is especially important in situations where static electricity generated in low humidity can cause injury and other unpleasant consequences. Such fabrics are very important when it is necessary to comply with the conditions of antistatic properties, for example, when welding pipes (Fig. 4,5) [23,24].

Dale Antiflame Triple, Windbloc membrane fabrics and Windstopper-membrane fleece fabrics with excellent wind protection while maintaining the unique ability to "breathe" are recommended in order to improve the special clothing of oil and gas production workers with hydrophobic features. In these membrane fabrics, comfort and unique properties are combined with an important quality - fire resistance.

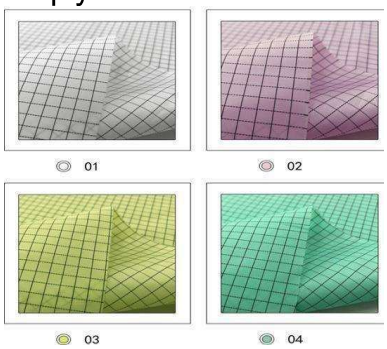

Figure 3. Antistatic fabrics from Belltron

Figure 4. Flame retardant and antistatic fabrics from XM FireLine

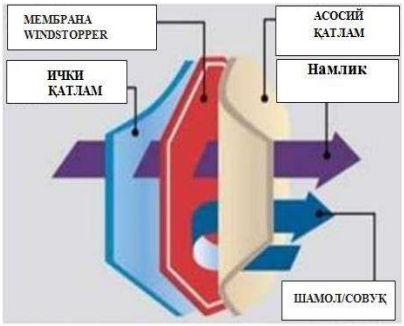

Figure 5. Windstopper fabric structure

Conclusion. Design of the Windstopper membrane material package for the oil repellent suit shown in Figure 5 [25] (Figure 5).The identified raw materials indicate that it is necessary to carry out research in order to improve the protective properties of confectionary packages of special clothing fabrics under the influence of oil.

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