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RATIONAL FOR CHOOSING PHASE CHANGE MATERIALS FOR THE PRODUCTION OF THERMOREGULATION TEXTILE MATERIAL

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Abstract. The article deals with the concept of "phase change material", defined the principle of their action. Designated substances which have thermoregulation properties which can be used in the manufacture of textile materials intended for making clothes. Noted that as thermoregulation materials are optimal paraffin's. Maximum specific heat capacity and optimum temperature of the phase transition material have octadecane (C18H38) and nonadecan that can provide the most comfortable settings space under clothing. To preserve the thermoregulation properties of the materials used microencapsulation technology.

Phase change materials (PCM) - a substance that can change phase (aggregate) state in a specific temperature range. Latent heat energy released (absorbed) in the phase transition between the liquid and solid states is about 200 times more than during the heating (cooling) of the same material by weight.

When heated PCM absorbs a small amount of heat, and the temperature is constantly increasing. When the melting temperature of the phase transition occurs and further there is the absorption and conservation of latent heat. This PCM and the environment temperature remains constant. When PCM cooling and crystallization, heat is released and moves into the environment. This PCM and environment temperature also remains constant.

The ability to absorb or release such a large amount of latent heat without temperature change makes PCM attractive for use as a means of storing heat [1].

There are about 500 kinds of substances that can change phase state of a change in temperature and absorb heat, but not all maybe used in practice.

So, today, widely used phase change materials for the production of a new generation of textile and clothing, providing a comfortable climate under clothing in all weather conditions. Great development such materials have been in the European Union and the United States of America.

Now, an important task is to find and study the properties of materials with changes phase state for use in the textile and clothing industry.

It is known that it is necessary for its production, a thermoregulatory phase change material in the human body thermo physiological range of 27-35^0 C for thermal stabilization under clothing space.

It was established experimentally that for use in textile materials intended for the manufacture of clothing most suitable heat storage material with a phase transition temperature in thermo physiological human body temperature range are hydrocarbons having from 18 to 20 carbon atoms (paraffin's): octadecane ($C_{18}H_{38}$) nonadecan ($C_{19}H_{40}$) eicosane ($C_{20}H_{42}$). This oil distillation products, it is cheap, nontoxic, hydrophobic, have a melting point state for the practice of crystallization and high latent heat. Also suitable thermal parameters are contains inorganic salts [2].

As a result of experimental studies by Russian scientists, the basic main indicators of thermal heat storage materials (table 1).

Table 1 – Basic thermal performance materials with change phase state

Thermoregulation material	Solidness, kg/m^3	Phase change temperature, ^{0}C			Specific heat of fusion, J/g		Specific heat, J/g, ^{0}C	
		Method TA	Method DSC	informational	experimental	informational	experimental	informational
Octadecane	778	27,6	27,6	28,2	306	303	2,1	-
Nonadecane	777	31,2	31,2	32,2	289	-	1,9	-
Eicosane	778	35,0	35,0	36,6	309	284	1,9	-
Glauber's salt (Na_2SO_4*$10H_2O$)	11490	332,0	332,0	332,4	258	250	1,9	1,9

Source: [1].

Many experimental studies established instability of Glauber's salt (sodium sulfate dehydrate). Although Glauber's salt is a safe substance, as a result of its expansion in humans of an allergic reaction may occur. Therefore, as the heat storage materials for use in textile materials intended for the production of clothing, recommended paraffins.

Maximum specific heat capacity and optimum temperature of the phase transition material have octadecane ($C_{18}H_{38}$) and nonadecan that can provide the most comfortable settings under clothing space.

Since for melting these substances melt, the problems of fixation of the textile material. To solve this problem, using microencapsulation technology. Microencapsulation - a process to incorporation of small particles in the thin shell material film-forming material. As a result, microencapsulation product obtained in the form of individual microcapsules ranging in size from submicron's to hundreds of microns. Substance inside the capsule called the contents of the microcapsules, the active or basic substance, forms the core of the microcapsules, and the encapsulating material is a material of shells [3].

Size of the microcapsules is 1-20 micrometers (the same as the size of the pigment particles). Wall material - an elastic polymer (acrylates, melamine derivatives), the wall is approximately 20% by weight of the capsule. It is important to note, that the encapsulation reduces the amount of latent heat [2].

PCM microcapsules can be incorporated into the spinning polymer of manufactured (e.g., acrylic, viscose), incorporated into the structure of foams and these foams applied to fabric in a lamination process, or embedded in a coating compound and coated onto fabrics. Filling hollow fibers is another method to incorporate PCM in textile material [4].

Textile materials with phase change materials are one example of Active Smart Textile. Textiles containing PCM are considered smart, because they react to changes in environmental temperature, absorbing and releasing latent heat and provide a thermoregulation effect.

Thus, it can be concluded that the present PCM list is not too wide. Paraffin's (octadecane and nonadecan) is the preferred kind of PCM for textile application, because the melting point of paraffin is very close to the temperature of the body. PCM microcapsules can be incorporated in the textile material in different ways.

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