USING OF HIGH-TEMPERATURE HYDROCARBONS AS A HEAT TRANSFER AGENT IN INCREASING THE EFFICIENCY OF THE HEAT EXCHANGE PROCESS

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Abstract: *Oil has an important role in the heat exchange process and gas industry. Today, there is an increasing need to optimize the heat exchange process for energy saving and environmentally friendly processes. In the industry, extensive scientific research is being carried out to determine the efficiency of heat exchange equipment during the deep processing of oil and gas raw materials and to improve energy-saving technologies. Industry Analysis of High Temperature Hydrocarbons as Heat Transfer Agents Production, Role in Product Manufacturing and File Composition, Properties, Uses and Mistakes in Ush.*

Key words: *glycerin, naphthalene, ethylene glycol, diphenyl, diphenyl ether, ditolyl-methane, mineral oils, silicon organic liquid, gas condensate, gasoline, kerosene, diesel, fuel oil.*

Introduction. Effective organization of the heat exchange process, improvement of hydrocarbon raw materials driving processes, reduction of energy consumption by controlling the hydrodynamic regimes of hydrocarbon flows in their devices, increasing the efficiency of equipment and creating technologies for deep processing of raw materials, using raw materials in heat exchange devices as a heating agent from high-temperature hydrocarbons, acceleration of heat exchange processes during the heating process, hydrocarbon raw materials and taking into account the physical, chemical and thermophysical properties of its fractions, special attention is paid to priority areas such as the creation of fast, compact technologies of heaters.

The main part. In the industry, extensive scientific research is being carried out to increase the efficiency of heat exchange devices and create energy-saving technologies during the deep processing of oil and gas raw materials. The process of heat exchange refers to the process of heat transfer from a body with a higher temperature to a body with a lower temperature when there is a difference in temperatures. This includes the processes of heating, cooling, evaporation, condensation and artificial cooling. The speed of the process is expressed by the laws of heat transfer depending on the hydrodynamic regime. The driving force of thermal processes is the temperature difference between hot and cold heat carriers [1].

In the oil-gas and chemical industry, heating processes are often carried out using high-temperature heat transfer agents. Superheated water, mineral oils, high-temperature boiling organic liquids and their vapors, liquid salts, mercury and liquid metals are used as high-temperature heat carriers, and they take their heat from flue gases or electric current and transfer it to other materials. . Therefore, such substances are called intermediate heat transfer agents. Moving substances used in heat exchange or to transfer heat from more heated bodies and substances to less heated ones are called heat carriers. According to the direction of movement of heat-carrying mediums, heat exchange devices are straight, opposite, crossed and complex flow [2].

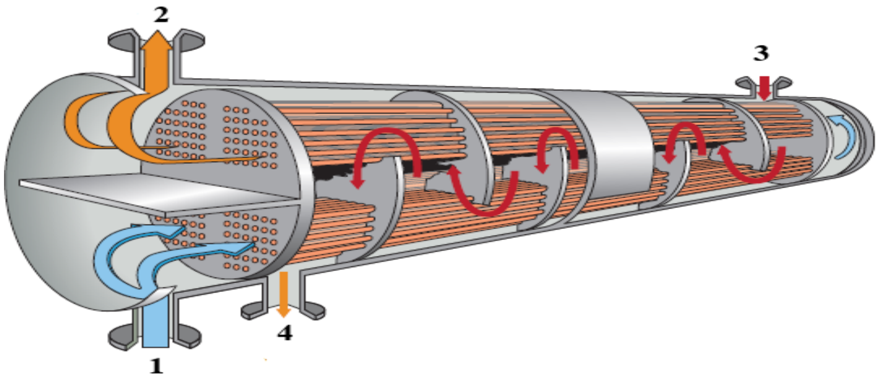

Figure 1. Scheme of movement of heat-carrying high-temperature hydrocarbon, i.e., heating agent and heating agent in a heat exchanger

1-Introduction of heated raw materials to the device; 2-Removing the heated product from the device; 3-Heat-carrying high-temperature hydrocarbon, i.e., heating agent entering the device; 4-Releasing the heating agent from the device

Figure 1 shows the movement diagram of the heat-carrying high-temperature hydrocarbon, i.e., the heating agent, and the heating agent in the heat exchanger. Heat exchange devices are as follows according to the type of heat carriers [3]: liquid-liquid; vapor - liquid; steam-steam, steam-gas and gas-gas. Depending on the change of the aggregate state of the heat carriers, heat exchange devices are as follows: non-variable aggregate state; the aggregate state of one heat carrier is variable; the aggregate state of both heat carriers is variable. According to the description of the movement of heat carriers, the heat transfer surface of the heat exchanger is divided into three types, i.e. natural circulation; forced circulation; is divided into the movement of the liquid under the influence of gravity. Superheated water, mineral oils, high-temperature boiling organic liquids and their vapors, liquid salts, mercury and liquid metals are used as high-temperature heat carriers, and they take their heat from flue gases or electric current and transfer it to other materials. . Therefore, such substances are called intermediate heat transfer agents [4].

One of the high-temperature hydrocarbons used as a heat transfer agent is heating with mineral oils. This method is simpler and cheaper than heating with superheated water. In addition, it is not necessary to use high pressure in the system. With the help of mineral oils, it is possible to heat materials up to a maximum temperature of 250-300 °C. Mineral oils are the cheapest organic liquids. But they also have a number of disadvantages: the heat transfer coefficient is small, contamination appears on the heat exchange surface, there is a possibility of oil oxidation at high temperatures. For the heating device to work well enough, the difference between the temperature of the oil and the heated product must be at least 15-20 °C. Therefore, heating with mineral oils is rarely used nowadays. Heating with high temperature organic liquids. Such heat transfer agents can be used in both liquid and vapor states and are used for heating up to about 400 °C. These include glycerin, naphthalene, ethylene glycol, diphenyl, diphenyl ether, ditolyl-methane, mineral oils, silicon organic liquids, and others. Diphenyl mixture consisting of 26.5% diphenyl and 73.5% diphenyl ether is widely used in the chemical industry. This mixture can have the following parameters. For example, when t_e=258 °C, P=0.1 MPa, r=285 kJ//kg; r=220 kJ/kg when t_{ev}=380 °C, P=0.8 MPa. The main advantage of the diphenyl mixture is that it is possible to obtain a high temperature with a small pressure using this heat transfer agent. For example, at a temperature of 300 °C, the pressure of saturated water vapor is equal to 8.8 MPa, while the pressure of the vapor of a diphenyl mixture is only 0.24 MPa. For this reason, for heating to high temperature with the help of diphenyl mixture, it is possible to use heat exchangers with ordinary foam instead of high-pressure heat exchangers. The diphenyl mixture, like other organic heat transfer agents, has some disadvantages: the heat of vaporization of the mixture is low, the mixture is flammable. It can be heated up to 380 °C using a diphenyl vapor mixture. At an even higher temperature, decomposition occurs in the diphenyl mixture [5].

Table 1

Characteristics of some types of high-temperature hydrocarbons

Name	**Color**	**Composition**	**Heating temperature, °C**	**Usage**

Gas condensate	Colorless, clear	Aliphatic, acyclic, alicyclic	200-300	heating agent, benzene, toluene, xylene, lacquer paint system solvents, special composite liquids, fuel, important raw materials for organic and petrochemical syntheses, as a semi-finished product in the national economy
Gasoline	Colorless	There are alkane, alkene, cycloalkane, cycloalkene, aromatic compounds with various structures, the number of C in the molecule is from 5 to 9	40-200 If other hydrocarbons are added, this temperature will change	Mainly as a fuel, solvent, washing liquid for internal combustion engines
Kerosene	Colorless, yellow	the number of C atoms in the molecule is from 9 to 16, 1% saturated, 23-60% aliphatic, 24-58% naphthenic, 6-15% aromatic hydrocarbons	150-250	Mainly lighting and miscellaneous detergent for fuels, machine parts, rubber and pharmaceutical products; industrial solvents, ink thinners, organic chemical cracking materials; glass-ceramic industry, aluminum sheet rolling, jet engines and as household fuel

diesel (gasoil)	Clear, yellow, sometimes red or even green	about 75% from aliphatic hydrocarbons ($C_{10}H_{20}$–$C_{15}H_{28}$) and about 25% from aromatic hydrocarbons (eg, benzene, styrene); about 86% C, 14% H and a small fraction of S	180-350	Cars, tractors, ships, locomotives, construction and military vehicles, power plants (diesel power plant)
Fuel oil	Close-up	the number of C atoms in the molecule is higher than 16, a mixture of asphaltene, carbene, carbide and metals (Ni, Fe, V, Na, Ca)	250-400	Diesel oils (fuel for engines), various lubricating oils (for lubricating machine mechanisms), petroleum jelly, alkane

High-temperature organic liquids also include gas condensate, gasoline, kerosene, gas oil, fuel oil, glycerin, naphthalene, ethylene glycol, diphenyl, diphenyl ether, ditolylmethane, mineral oils, silicon organic liquids, and others. Some types of high-temperature materials used as heat carriers in the oil and gas industry are listed in Table 1. The advantages of using high-temperature hydrocarbons in heating processes in the oil-gas industry are as follows: both liquids and vapors of high-temperature hydrocarbons can be used as heat transfer agents in the heating process; the heating process can be carried out to a temperature of about 400 °C and higher; the heating process can be increased to a high temperature with a small pressure; the density of the heat-carrying agent is high, it is resistant to the effects of high temperatures, has good thermal conductivity, high heat transfer coefficient; low electricity and energy consumption is beneficial from an economic point of view; high-temperature hydrocarbons often emit fewer pollutants and cause less damage to the environment; these substances can be adapted for different processes, which allows to optimize production processes; these substances allow for quick and efficient heating, which causes acceleration of the heat exchange process; these hydrocarbons help to store thermal energy efficiently and also the use of high-temperature hydrocarbons as heating agents allows for new innovations that lead to industry renewal [6, 7].

Figure 2. Failure of tubes of a shell-and-tube heat exchanger due to heat-carrying high-temperature hydrocarbons

The disadvantages of using high-temperature hydrocarbons are as follows: production and use of high-temperature hydrocarbons are relatively expensive; substances of this type evaporate faster in pipes due to the low heat of steam generation; high temperatures in such substances create dangerous conditions and pose a danger to workers in the industry due to the property of burning; because high-temperature hydrocarbons are contained in devices under high temperatures, these devices require more maintenance; high temperatures can quickly wear or degrade some materials (Figure 2), and high-temperature equipment and equipment used for high-temperature hydrocarbons as heating agents are expensive [8]. Also, high-temperature hydrocarbons are the reason for the quality of the product obtained from the device. If it is necessary to obtain a high-temperature product, the temperature of the heat transfer agent is increased, and as a result, the raw material heated inside the device heats up and causes steam to appear in the internal environment. As the area occupied by steam in the pipes expands, the heat transfer from the heating agent to the heated agent decreases. As a result, the consumption of gas and electricity to heat the product at the required temperature increases, costs increase, and also causes various accidents due to the heating of heat-carrying hydrocarbons at high temperatures in the devices. To prevent this situation, make compact changes to the design of shell-and-tube heat exchange devices. it is necessary to isolate the steam in the pipes.

Conclusion. In the oil and gas industry, high-temperature hydrocarbons are mainly used as heat carriers. It is necessary to reduce the effect of high-temperature hydrocarbons in heat exchange devices and to change the design of the device when increasing the temperature of the product. As a result of reducing the space occupied by steam in the internal pipes of the heat exchanger, the product temperature can be sufficiently increased, the pipe accidents will be relatively reduced, and the gas and electricity consumption for heating the heat carrier high-temperature hydrocarbons will lead to higher energy savings and economic stability.

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