TYPES OF LIQUID SORBENTS USED IN GAS DRYING AND THEIR MAIN PHYSICAL AND CHEMICAL PROPERTIES

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To remove moisture from natural gas, various dryers with the following properties can be used [1-2]:

• high absorption capacity in large ranges of process pressure and temperature;

• low saturated vapor pressure, this property is one of the main indicators for reducing the loss of absorbents during regeneration;

• the difference of the boiling temperature from the boiling temperature of water in large intervals. The higher the boiling temperatures, the easier it is to separate the absorbent and water using simple methods;

• that the density of the absorbent differs from the density of liquid hydrocarbons found in natural gas. This makes it easier to separate the absorbent and the condensate;

• low viscosity in operating conditions to ensure better contact with gas from the absorber, heat exchanger and other mass exchange equipment;

• property of high selectivity to gas components, i.e. low interaction index with the substances contained in the gas;

• property of neutrality of the absorbent, that is, it does not react chemically with various inhibitors used in gas production;

• low corrosion activity;

• high strength against thermal decomposition and oxidation;

• cheapness;

• low ability to form foam when in contact with a gas mixture;

• non-toxic, etc.

To a certain extent, the above requirements for drying these gases are met by ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, and various combinations of glycols with ethers [3].

Aqueous solutions of ethylene glycol, compared to aqueous solutions of diethylene glycol and ethylene glycol, have a much lower solidification temperature, a higher level of hydrate formation at the same concentrations, a lower viscosity during drying, and lower solubility with hydrocarbon condensates, so their loss is much less. EG also has environmental advantages over other glycols: for example, its aqueous solution decomposes quickly in the external environment, which is not characteristic of other glycols.

The main disadvantage of EG is its low saturated vapor index. For example, this indicator of 99% EG solution at 20oC is 2.5 times higher than this indicator of DEG and 7 times higher than this indicator of UEG [4]. Therefore, EG in gas dryers. They are not widely used due to their outgassing and loss due to this. It is preferable to use only EG solutions as inhibitors in low-temperature separation devices.

Today, high concentration DEG and UEG solutions are widely used as absorbents for gas drying in industry. Other glycols, in particular EG and PG mixtures, are used as inhibitors that prevent hydrate formation in gas separation processes at low temperatures. Table 1.4 lists the main physical and chemical properties of DEG and UEG .

Table 1.4

The main physical and chemical properties of DEG and UEG

№	Properties of glycols	UEG	DEG
1	Chemical formula	$C_6H_{14}O_4$	$C_8H_{10}O_5$
2	Density at 20°C, g/cm³	1,1255	1,1185
3	Relative molecular mass	150,18	106,11
4	Heat of vaporization under a pressure of 0.1 MPa, kDj/kg	416	629
5	20°C heat capacity, kDj/kg*K	2,98	2,08
6	Temperature indicators, °C • flammable in air • start of decomposition • flash in an open crucible • hardening	 206,6 174 165,5 -7,5	 164,5 151 143,2 -8,9
7	Boiling temperature, °C	278,3	245
8	20°C refractive index in	1,4560	1,4472
9	Surface tension, 10⁻³ m	45,1	48,5
10	Critical pressure, MPa	3,70	5,1
11	Critical temperature, °C	440	410
12	90°C heat of fusion of water in glycols at temp, kDj/kg	210	135

Aqueous solutions of UEG have many advantages over solutions of EG and DEG. The saturation vapor pressure of UEG is lower than that of DEG, and the loss of UEG by itself due to outgassing and regeneration is much lower. When drying natural gas at a higher level, UEG shows a gas drying index with a lower dew point temperature compared to DEG. In addition, the decomposition temperature of UEG is lower than that of DEG, and when glycol is used in drying, their decomposition products are much less when UEG is used.

The difference between the initial costs of drying equipment with UEG and the costs resulting from losses is very small. However, low-viscosity DEG can also be used in cold regions at low temperatures.

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