

Factors Affecting the Absorption Drying Process

*Y. Y. Isroilov*¹

Abstract: In this work, the factors affecting the absorption drying process, a schematic diagram of a gas drying device with glycol injection. The fact that the foaming ability of glycols is significantly affected by mechanical impurities and hydrocarbon condensate, as well as control of the operating conditions of fuel injectors in order to exclude local overheating, which causes the decomposition of glycols in the regeneration system and increases the acidity of the solution, is given.

Key words: Glycol, Regeneration, Schematic Diagram, Propane Refrigerator, Three-Phase Separator, Weather Gauge, Thermometer, Cleaning Column, Azeotrope.

INTRODUCTION

In recent years, due to the use of low temperatures in the processing of petroleum gases, the requirements for the degree of gas drying have increased dramatically [1].

The efficiency of the drying process is affected by the following parameters: pressure, temperature, absorbent properties and its concentration.

An increase in pressure reduces the moisture content of the gas and consequently reduces the amount of solution that must be fed to the dryer to obtain a gas with a given dew point [2].

To a large extent, drying depends on the temperature of the effect of the gas-absorbing agent. An increase in the contact temperature increases the partial pressure of the water to absorb the dust, thereby increasing the dew point of the gas to be dried. With a decrease in contact temperature, the opposite effect is observed. Usually, absorption drying is carried out at a temperature of the dried gas not higher than 45-50°C [3].

EG is characterized by the highest volatility (large losses) and TEG is the lowest, so DEG and TEG are used to dry gases at normal temperatures. In low-temperature gas drying, where the drying solution is injected into the cooled gas stream to remove hydrates, EG is often used because it is less soluble in the off-gas hydrocarbon condensate.

The presence of aromatic hydrocarbons in gasoline and condensate increases the solubility of glycols in them and their loss. Diluting glycols with water reduces their solubility in hydrocarbons.

Estimated losses of DEG as a result of ingress with gas are up to 80%, with condensate - 12%, due to leaks in filling containers, etc. - 8% of the total number of losses. Annual losses of DEG in NTS aggregates reach 43 g/1000m³. For good separation of the mixture, it is recommended to include a liquid load of 385 l/h per 1m² of the surface of the phase separator in the design of the phase separator.

RESULT

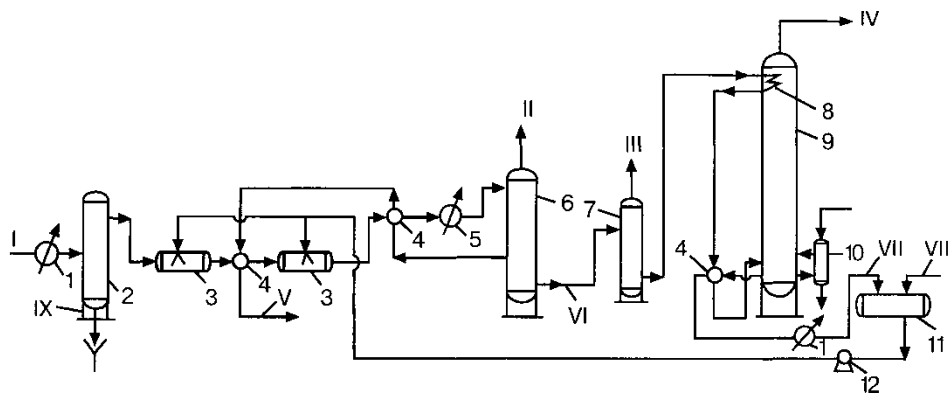
An economically important parameter of the drying process is the absorption ratio, that is, the amount of glycol circulating in the system for 1 kg of moisture. When using TEG, this ratio is 10-35 l/kg of moisture [4].

The role of absorbent concentration is very important. The less water in the absorbent, the lower the dew point of the dried gas. Usually, solutions containing 90-98.5% DEG or 95-99% TEG are used for drying gases with a temperature of 0-40°C [5].

¹ Karshi Engineering-Economics Institute, Student of the group NGK-142-21



Schematic diagram of a gas drying device with a glycol solution:



1 - water cooler; 2 - water separator; 3 - glycol injection device; 4 - heat exchanger; 5 - propane refrigerator; 6 - three-phase separator; 7 - weather gauge; 8 - heat exchanger; 9 - cleaning column; 10 - boiler; 11 - container for glycol; 12 - pump. Streams: I - raw gas; II - dry gas; III - corrosion gases; IV - water vapor; V - hydrocarbon condensate; VI - saturated glycol; VII - regenerated glycol; VIII - new glycol; IX - water.

Gas drying from moisture depends on the concentration of glycol at the inlet of the absorber, i.e. thermal desorption of water in terms of glycol recovery does not allow to achieve a concentration higher than 97% because glycols begin to decompose at temperatures of 164°C (DEG) and 206°C (TEG). The maximum rate of regeneration under these conditions is 96.7% for diethylene glycol and 98.1% for triethylene glycol. When the concentration of glycol is 96-97%, the dew point of the gas after drying does not exceed 30 °C (this is dew point depression). If the concentration of glycol at the inlet of the absorber is 99%, then the dew point rises to 40 °C. Such depression of the dew point is not enough in some cases (low-temperature gas processing), and therefore vacuum desorption of moisture from glycol is used to deepen gas drying (at a pressure and temperature of 0.06-0.08 MPa), approximately 200°C). In this case, the regenerated glycol concentration increases to 99.5% and the dew point depression increases to 50-70°C.

Glycol desorption schemes have become widespread with the introduction of a cleaning agent into the desorber. As such agent, dried gas in the upper part of the absorber is usually used, heated to 180 - 200°C and fed through the liquid to the lower part of the desorber. The introduction of this agent allows to reduce the partial pressure of water vapor in the desorber, that is, to provide a vacuum effect, and thus to increase the glycol concentration to 99.3-99.6%.

The maximum possible temperature of the gas dew point (80-90°C) can be achieved with the help of two-stage drying. In this case, the installation has two absorption and desorption systems. In the first stage, the gas is dried with glycol with a concentration of approximately 96-97%, then it enters the absorber of the second stage, where it is thoroughly dried with glycol with a concentration of 99.5-99.6%. Accordingly, in the desorber of the first stage, moisture is desorbed at close to atmospheric pressure, and in the second stage under vacuum or by introducing a cleaning agent into the desorber.

In addition, it is possible to regenerate glycol under reduced pressure, add hygroscopic salts (calcium chlorides, zinc chlorides, etc.) to glycol, use azeotropic regeneration, and remove water with heated gas (purified and dried natural). Gas or any inert gas, for example: nitrogen, etc.). The use of these methods allows obtaining glycol with a regeneration rate of 99% and higher.

When using azeotropic distillation, low-boiling substances are introduced as azeotropic substances that form azeotropic mixtures with water: benzene, toluene, xylene, etc. They are introduced through a perforated pipe in an amount of not more than 10% by weight of the absorbent, at the level of a hot glycol solution. The boiling point of the obtained azeotrope is lower than the boiling point of water, which allows to increase the mass fraction of regenerated glycol to 99.9% and to reach the dew point of the dried gas at minus 75°C.



The efficiency of drying devices depends on the loss of glycols, which are mainly due to decomposition and oxidation during the regeneration process, evaporation in the flow of dried and boiling gases, condensation of water and its steam escaping from the top. Desorber and discharged to sewer or atmosphere. In NTS plants, glycol is also lost due to its dissolution in hydrocarbon condensate.

DISCUSSION

The foamability of glycols is significantly affected by mechanical impurities and hydrocarbon condensate. Antifoam agents (trialkyl phosphate, octyl alcohol, silicones) are sometimes used to reduce DEG losses with dry gas due to mechanical drag.

In the regeneration system, it is necessary to control the operating conditions of the fuel injectors in order to exclude local overheating, which leads to the decomposition of glycols and increases the acidity of the solution during fire heating. Acidity should be maintained at pH 7.3 by adding sodium tetraborate, mercaptobenzothiazole, or MEA. Due to the excess addition of these reagents, pH above 8-8.5 leads to foaming of the solution and increased losses.

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CONCLUSION

Factors and factors affecting the absorption drying process were examined in detail, the effect of the following parameters on the efficiency of the drying process was studied: pressure, exposure temperature, absorption properties and its concentration, and gas with glycol injection. a schematic diagram of the drying device was created, mechanical admixtures and hydrocarbon condensate were significantly affected by the foamability of glycols.

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