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RESOURCESAVING TECHNOLOGY WITH THE COLLECTION, PREPARATION AND STORAGE HYDROCARBON RAW MATERIAL

In petroleum and gas industry with the collection and preparation of petroleum, condensate and gas one of the basic problems is the reduction of technological losses of hydrocarbon raw material and reagents. With technological losses cause not only economic, but also ecological damage.

The analysis of the situation with technological losses shows, that in the world more than 15 billions cubic metres burnt of gas are annually, and more than 2,0 millions tons liquid hydrocarbon are burnt with gas. Especially it is necessary to note the ecological problem. It is known, that 75 % of the total volume of losses comes into atmospheric air, 20 % - in water, 5 % in soils [1, 2]. As a result there are processes of degradation of flora and fauna.

The analysis of technological expenses on preparation of natural gas shows, that more than 90 % are necessary on the expenses connected with the supply of hydrateformation inhibitors and absorbent [3]. An ablation of methanol and glycols with the drained gas gives the greatest losses. With the collection of natural gas the reduction of expenses is connected with the reduction of the outlay of methanol.

The basic parameter of the efficiency of the performance of the process equipment engaged in the collection and preparation of a condensate are the general losses of C_{3+B}, C_{5+B} with separation gas, which is injected into a gas pipeline.

The general losses of a condensate are summerized of losses of a condensate in the drip state and losses in a steam phase.

Losses of a condensate in the steam phase depend on:

- structure of hydrocarbon raw material;
- thermodynamic mode of operations of a low temperature separator (LTS);
- destribution of gas on a technological line;
- integrity of a tubular beam in heat exchangers.

In case of infringement of tightness of a tubular beam the "greasy" gas flows in a main gas pipeline omitting LTS.

Losses of a condensate in the drip state depend on:

- the state of a mesh layer and the integrity of a separation plate;
- the outlay, pressure and temperature of a gas (its speed in a low temperature separator).

The results of the analysis of separation gases, general losses of C_{3+B}, C_{5+B} with separation gases for the conditions of Urengoy deposit are given on fig. 1 and fig.2.

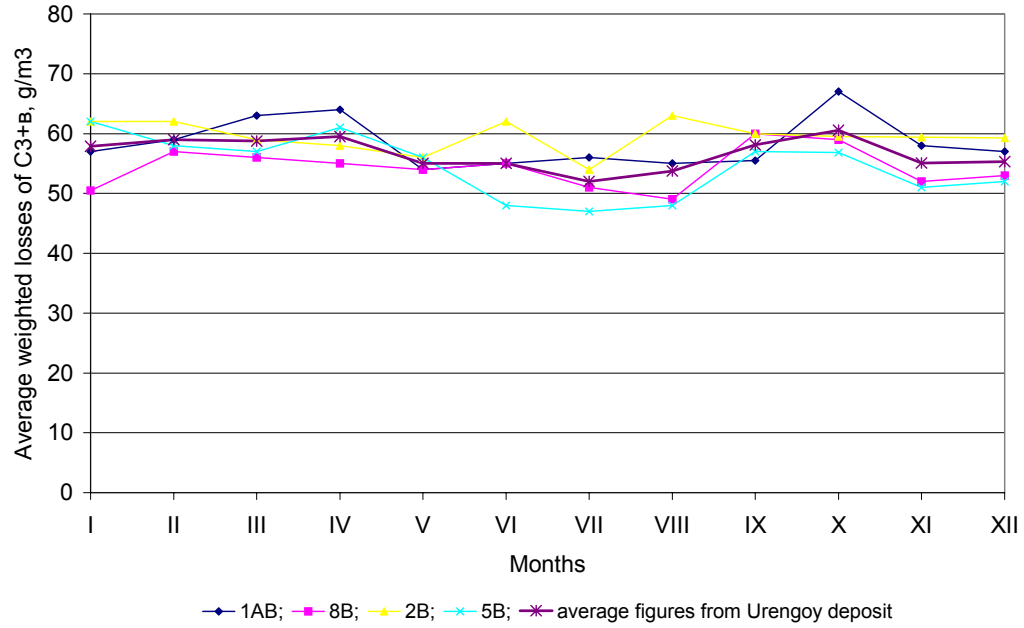

Fig.1. Total losses of C_{3+B} with separation gases

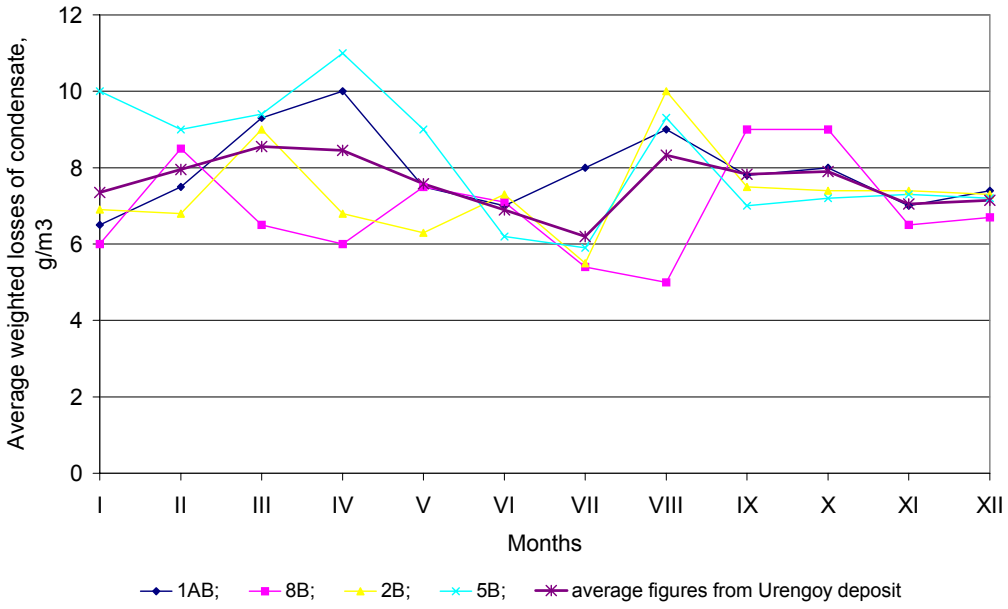

Fig.2. Total losses of C_{5+B} with separation gases

Recoding to they results of researches the loss of a condensate in the drip state amounts to:

- 1,0 g/m^3 of C_{5+B} and to 2,0-2,2 g/m^3 of C_{3+B} in normal conditions of a mesh layer in a separator;

- 4,0 g/m^3 of C_{5+B} in the drip state in the case of infringement of a mesh layer.

The results of gaugings of losses of C_{5+B} in the drip state in complex installation

of preparation of a gas (CIPG) of Valangin's deposits are given on fig. 3.

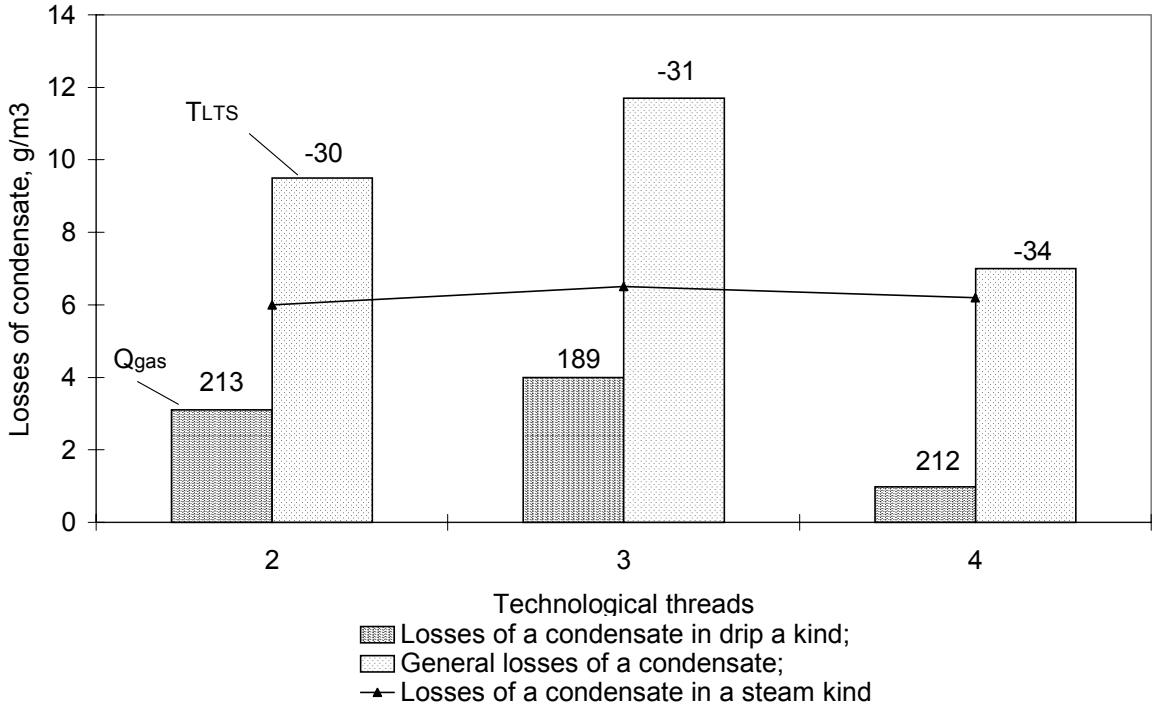

Fig.3. Losses of condensate C_{5+B} wih separation gases at CIPG-5

As it is visible from the results of the researches expressed on the diagram that the ablation of a drip liquid from design devices on technological threads number 2, 3, 4 CIPG-2B, number 3, 5, 6, 8 CIPG-1AB and number 4 CIPG - 5B amount up to 0,1 g/m^3 of a separation gas. These threads are "normal" for a designed construction (a mesh layer). Technological threads number 2, 3 CIPG-5B with ablation 3 - 4 g/m^3 are evidently with the broken mesh layers.

From results of the researches expressed on fig. 3, it is visible, that the losses in the steam phase determined as a difference of general losses and losses in the drip state, and compose 6- 7 g/m^3.

With reference to petroleum deposits the task of reduction of technological losses can be solved partially by various circuits and devices allowing to use a pipeline as a step of separation.These are devices of preliminary selection of a gas, equalisers - depulsators, technological systems with recirculation of gases at the different steps of separation, condensers installed on an exit line of greasy gas and various low temperature processes.

In USPTU the technology of stabilization of petroleum is developed by momentary absorption in a mixing pipeline, in which an absorbent is injected in the flow of a gas, mixed up, then cooled in the pipeline and divided in division pits into a drained gas and a sated absorbent. The sated absorbent (petroleum) is added to the basic flow of petroleum. In

the technology adiabatic mode of operations is used. The mass outlay of absorbent is maintained at 2-3 % of initial astable petroleum, the cooling of the mix of a gas with the absorbent at 20 and more degrees lower than the temperature of petroleum separation, the pressure of the process is limited by the amount of the pressure of sated steams of stable petroleum. Various variants of technology with recirculation of gas of steps of separation and sated absorbent have been developed, and they are applicable for catching petrol fractions from a separation gas in low pressure devices and tanks [4, 5]. The introduction of this technology at the Mamontov deposit has allowed to reduce technological losses from 0,67 to 0,15 % mass. and to receive about 30 thousand tons of petroleum in addition at insignificant capital and operational expenses. And its recoupment period is half a year.

At gas deposits for reduction of the outlay of methanol the following technologies are offered:

- the use of the exhaust methanol solution for preliminary processing of gas in loops and feeding on a mouth of a chink;
- the use of the exhaust methanol solution in separators with its consequent flowing by natural gas (desorbtion);
- optimization of the system of methanol distribution with its recirculation along the on technological threads depending on thermobarical modes of operation of the systems of production, collection and preparation of a natural gas.

With LTS at a gas condensate deposit (GCD) injection of methanol by concentration not less than 90 % mass. is done before heat exchangers. Received in low temperature separators, intermediate separators and dilatable chambers water-methanol mixture (WMM) is injected into a separator with the help of a pump , equipped with contact separated elements, where a blowdown from WMM to a gas phase is made by a warm gas of methanol. From the gas phase methanol, in the process of decreasing of temperature, passes the liquid phase accoding to the technological chain and inhibites the process in LTS. WMM of concentration of 20-50 % mass. is not thrown out into industrialy drainage but "is blown out " in a separator to the concentration of 6-12 % mass.

In the connection with the fact that many large gas deposits of Russian Federation are at the stage of compressor production in athe technological chain the introduction of completing compressor station (CCS) before CIPG,is supposed,but such a system circuit has a number of drawbacks [5, c. 161-166]:

1. The incomplete clearing of crude gas from bed water and mechanical admixtures results in their receipt to the forcers of CCS and deterioration of responsible details of the working group, accumulation of salts on highly revolution details and their disbalance, periodic cork emission of bed water on the forcers, influencing the operation of monitoring systems, protection and creation of an emergency on CCS.

2. The moisture present in a compressed gas after the ambassador , in a cold period of a year causes formation of hydrates in bottom tubes of the devices of air cooling of gas (ACG), therefore it fails to cool rather deeply acompressed gas and to provide required conditions for drainage of gas on CIPG in winter time.

3. Because of high humidity of crude gas and high temperature of contact the required depth drainage of commodity gas is not always reached. So, for glycol CIPG with the temperature of gas after ACG more than 23 ^{0}C and pressure of 7,0 MPa the point of dew of commodity gas is not reached in summer at minus10 ^{0}C, and in winter period, if

after ACG the temperature of a flow of gas is more than 18 ^{0}C and pressure equals to 7,0 MPa, then it fails to ensure a point of dew at minus 20 ^{0}C.

The analysis shows, that the temperature of a gas at the exit from a CCS reaches 40 – 50 ^{0}C. The losses of absorbent are increased on the order by realization of the process of drainage at the given temperature. The increase of its outlay is inefficient because of the fact, that the installations of regeneration sated diethyleneglycol (SDEG) on CIPG are not designed for processing of its necessary volume. The use of ACG in a cold period for obtaining required temperature is also impossible. For protection the bottom tubes ACG whole volume of gas is inhibited, however, it results in substantial growth of operational expenses and increase of losses of methanol. For the solution of this problem USPTU together with the scientific technological centre of Nadivgazprom has developed devices of new generation and technology, the essence of which consists in recirculation of a warm gas through bottom tubes [2, c. 152 – 155].

Other possible ways of the solution of the problem of preparation of a gas at compressor period of operation of gas deposits are the use of three-ethylenglycol instead of DEG, the use of the modernized technological system of gas preparation, allowing to carry out the process drainage without compressing if before the CIPG, and a two-steps gas drainage process with preliminary absorption by sated or regenerated DEG in a gas pipeline and with the consequent drainage on absorber [6, 7]. In the technological system the gas pipeline is used as the technological device, in which the special device allowing to increase the efficiency of mass-transfer process and to allocate sated absorbent after the contact with a natural gas is mounted. Its required point of dew before the injection into a main gas pipeline in this case is reached. At the same time previously drained gas allows to use potential ACG in a cold season without the danger of hydrateformation in tubing beams.

On GCD the reduction of losses of a condensate in the steam phase is reached by introduction of absorbing of technologies (injection of heavy hydrocarbons, low temperature absorption etc.), in the case of the drip state - by increasing the overall performance of a LTS. In particular, at Urengoi GCD for the solution of the problems of decrease reduction of general losses of a condensate the reconstruction of the separator of the second step of a LTS has beenis carried out, the re-equipment of this line has been done for the maintenance of the condensate supply from the first step separator to the separator of the second step, and new centrifugal separation elements with recirculation of gas have been installed instead of coagulating nozzles. A separator works as follows. A gas-liquid flow reaches a unit of entrance, where the preliminary clearing of a gas is fulfiled. Previously cleared gas comes to a coagulator, where there is integration of fine drops of a liquid and then it comes to the device in a tangency direction. Because of rotation in the cavity of the device a part of the drops of a liquid is gathered on the walls of the device and flows down into the liquid collector. The separated in the centrifugal elements condensate is removed by means of draining pipes.

The introduction of a separator has shown the following features:

- The maximal effective productivity of a separator meets to the outlay of gas 260000 m^3/h at the pressure 5,8 MPa with carrying-out of C_{5+} no more than 0,03 g/m^3;

- Injection of a condensate in the pipeline before the separator does not reduce this amount of productivity.

For the reduction of losses of a condensate in the steam phase absorbing processes of extraction of a condensate are the most effective. For the increase of extraction of a condensate at CIPG Valangin deposits the technology providing injection of a part of an unstable condensate, dropping out in a separator of the first step, into the gas flow before the LTS has been introduced.. Accoding to the results of the resuarches the optimum amount of an injected condensate equals 14-20 m^3/h,and thus the additional amount of obtained reaches the amount of 3,2-3,5 g/m^3. The further increase of the amount of an injected condensate results in the increase of the temperature of a LTS and the contents of C_{5+} in a separation gas. The supply of a condensate in a flow of a gas before a separator of the second step in the amount of 20 m^3/h allows to reduce the losses of C_{5+} up to 0,05-0,1 g/m^3.

Thus, to increase the efficiency of the processes of preparation of hydrocarbon raw materials dew to the development and introduction of technologies is based on the processes of momentary absorption.

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ABSTRACT

Herein the problems of reduction of technological losses hydrocarbon of raw materials and reagent at oil producing the enterprises are considered. The new technologies applied to the solution of this problem are analyzed. As the basic idea the technologies based on the processes momentary adsorbtion and disorbtion are offered, and it is offered to use pipelines as technological devices for absorption of petrol fractions from petroleum and natural gas, preliminary drainage of natural gas in dilatable chambers and gas pipelines, disorbtion of a sated watermethanol solution by a warm gas.