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INCREASING THE EFFICIENCY OF PROPANE-BUTANE MIXTURE SEPARATION

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Abstract: Gases are widely used in the chemical and petrochemical, metallurgical, pharmaceutical, food, electronic industries
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At present, modern high-tech systems and gas separation units help enterprises to solve problems related to the provision of industrial processes with technical gases. These gases are widely used in the chemical and petrochemical, metallurgical, pharmaceutical, food and electronics industries.

When oil is refined at refineries (refineries), gaseous hydrocarbons of the C_1-C_4 composition are obtained, which partially entrain the C_5 component. Currently, many plants mainly use this mixture as a technical fuel for their own needs and partially sell it as a communal propane-butane mixture. However, against the background of the development of gas separation technologies, this is not entirely advisable. Isobutane (IC_4), which is a part of the gas mixture, is very much in demand on the hydrocarbon market, as its use as a refrigerant in the refrigeration industry, especially for household refrigerators, is growing, since its high refrigerating effect, reduces energy consumption in gas lighters and refueling cylinders. him. Isobutane has found wide application in the production of foams, polyethylene, polypropylene, polystyrene, isoprene and butyl rubber; irreplaceable in the production of aerosols. In addition, isobutane is used as a high-octane component of commercial gasolines, since it has an octane number of 100 points [1].

The technology of separation of gas mixtures using adsorbents has become widespread in cases where it is required to obtain high-purity gas with a large gas flow. Adsorption separation methods are based on the selective extraction of impurities with solid absorbents - adsorbents, which have a high absorption capacity, which makes it possible to process huge volumes of gases with a relatively small amount of sorbent and at the same time achieve a high degree of separation [2]. Therefore, for the separation of a mixture of technical butane, an adsorption method is proposed using a batch unit with a fixed

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bed of adsorbent, which is recommended as a CaA type zeolite.

In fig. 1 shows a schematic flow diagram of a batchwise adsorption unit with a fixed bed of adsorbent, namely CaA type zeolite, for the adsorptive separation of the butane fraction.

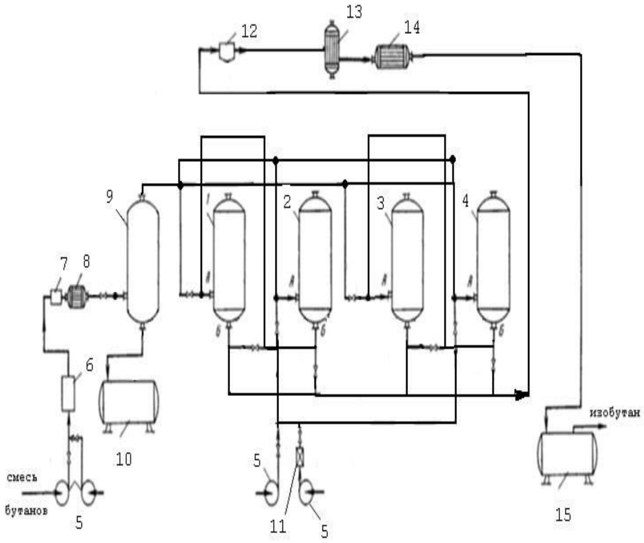

Figure: 1. Basic technological scheme of a batch-type adsorption plant with a fixed bed of adsorbent

The adsorbers 1, 2, 3, 4, each of which is a cylindrical apparatus of the vertical type, are loaded with CaA zeolite. The prepared butane fraction is supposed to be sent initially to the separator 9, which is a vertical cylindrical apparatus with a baffle device, where the dropping liquid will be separated from the gas, which will then be removed from the bottom of the separator and discharged into the drainage tank 10.

From separator 9, butane fraction is sent to adsorbers 1 and 3 by blowers 5 through filter 6, flame arrester 7 with bursting discs and cooler 8. The number of adsorbers is determined in accordance with the unit's operation schedule, made depending on the productivity of one apparatus and the duration of individual phases of the cycle. The above diagram of the adsorption plant includes 4 adsorbers and operates in a three-phase cycle. In a three-phase cycle, adsorption, desorption and cooling of the adsorbent are sequentially carried out. The last two stages represent the process of adsorbent regeneration, that is, restoration of its ability to absorb target components from the initial mixture.

At the end of the adsorption phase, the feed line of the initial mixture (blower, filter, flame arrester, refrigerator) switches to the next two adsorbers 2 and 4, in which the adsorbent regeneration stages (desorption, cooling) have already passed, and desorption begins in adsorbers 1 and 3. the butane fraction is separated into n-butane and isobutane due to the adsorption of n-butane on the CaA zeolite. The separated isobutane leaves the adsorbers through the fittings B and enters through the separator 12 into the condenser 13, the refrigerator 14 and the collector 15. From the collector 15, the gas is directed to the consumer.

The process of desorption of n-butane is carried out by blowing the methane fraction at a temperature of 180-250^{o}C, supplied by the blower 5 through the heater 11 to the adsorbers through the fittings A and removed from the adsorber through the fittings B. At the end of the desorption of n-butane, during which the adsorbent is regenerated simultaneously, the latter is cooled with technical nitrogen, which is supplied by the blower 5 through the fittings A and, which is removed from the adsorbers through the fittings B. Special regeneration of the zeolite is not required due to the combination of the processes of desorption of n-butane and regeneration. This is where the cycle ends, and the adsorbers switch to the adsorption stage [3, 4].

This installation uses vertical cylindrical adsorbers with a vertical adsorbent bed. The disadvantages of the vertical arrangement of the adsorbent is the unevenness of the layer in height, which is formed during loading, as well as during operation due to uneven shrinkage from abrasion, carryover and other reasons. The unevenness of the adsorbent layer increases with an increase in the section of the apparatus. Therefore, the throughput capacity of adsorbers with a vertical bed of adsorbent usually does not exceed 1-1.5 m^3 / s.

To eliminate this drawback, it is proposed to use an improved design of the adsorber, the diagram of which is shown in Fig 2.

The device of a vertical adsorber is illustrated by its diagram, Fig. 2.

The vertical adsorber has a cylindrical body 1 with a conical cover 2 and a bottom 3. A loading hatch 4 is mounted in the cover 2, a nozzle 5 for supplying the initial mixture - butane fraction and cooling gas - nitrogen through the distribution grid 6, nozzle 7 for removing n-butane during desorption and a branch pipe 8 for the safety valve. In the middle part of the body, beams 9 are installed with supports 10, supporting the grate 11, on which two layers of stainless steel 12 mesh are laid. The adsorbent layer 13 - zeolite in the form of granules with a diameter of 3 mm is located between two layers of 12 stainless steel mesh (instead of a layer gravel) and a grid 14, on which weights 15 are located to prevent the carryover of the adsorbent 13 during desorption. The unloading of the spent adsorbent 13 is carried out through the unloading hatch 16 installed in the housing. In the bottom 3, an inspection hatch 17 is mounted with a branch pipe 18 for condensate drainage, a branch pipe 19 for supplying the methane fraction during desorption and a branch pipe 20 for removing isobutane during adsorption and exhaust gas - nitrogen during cooling. The adsorber is mounted on a support using a support ring 21. An electromagnet 23 with a core 24 is connected to the grate 11 with the help of bearings 22. A spring 25 is attached to the electromagnet 23 on the other side, resting on a fixed support 26.

The adsorber works as follows. The butane fraction for separation is fed to the upper part of the apparatus through the branch pipe 5 for feeding the initial mixture through the distribution grid 6. Isobutane, separated from n-butane, is removed from the adsorber through the branch pipe 20. Adsorbent 13 - zeolite in the form of granules with a diameter of 3 mm is loaded through the loading hatch 4, and the spent adsorbent is removed through the unloading hatch 16. Desorption is carried out by feeding the methane fraction through the pipe 19. The branch pipe 7 is designed to remove n-butane during desorption, and a safety valve is installed in the branch pipe 8 for trouble-free process flow.

The proposed design of the adsorber makes it possible to increase the uniformity of the adsorbent distribution along the height of the adsorber by attaching the electromagnet 23 to the grate 11 with the help of bearings 22. To the electromagnet 23, on the other hand, a

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spring 25 is attached, resting on a fixed support 26. The core of the electromagnet 24 forms a magnetic field that attracts grate 11, while the electromagnet 23 abuts against the spring 25, causing it to be compressed. Upon reaching the maximum compression, the spring 25 begins to expand, returning the electromagnet 23 to its original position, thereby causing horizontal vibrations of the grate 11. As a result of vibrations entering the adsorber through the loading hatch 4, the adsorbent is evenly distributed over the grate, forming a uniform layer along the height.

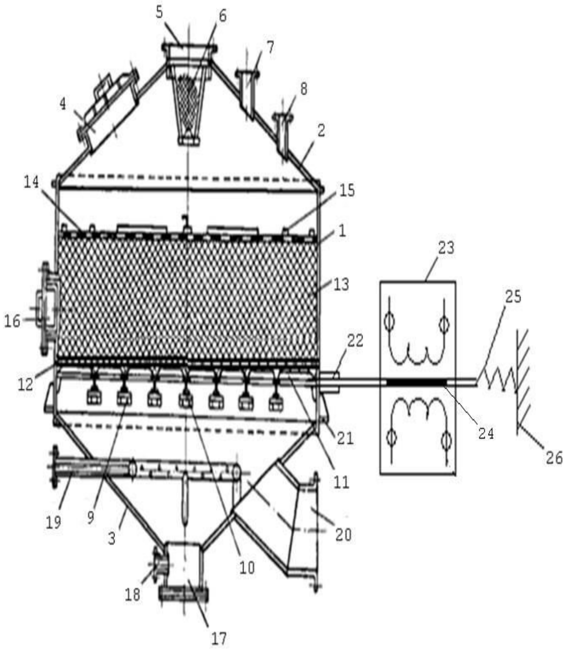

Figure: 2.
Advanceddesignoftheverticaladsorber

Thus, the increase in the efficiency of the process of adsorption separation of a mixture of technical butane is based on the use of a new design of the main technological apparatus, an adsorber. In contrast to analogs, the proposed useful model improves the quality of separation of the butane fraction by uniformly distributing the adsorbent along the height due to horizontal vibrations of the adsorber lattice.

Literature

1.СУГ – ООО «Новотек-Трейдинг»: НОМЕНКЛАТУРА ПРОДУКЦИИ URL: http://ntrading.ru/business/products/?id=57

2.Шумяцкий Ю.И. Адсорбционные процессы. - Российский химико-технологический университет им. Д.И. Менделеева, 2005. – 153с.

3.Ветошкин А.Г. Процессы и аппараты газоочистки: Учебное пособие. – Пенза: ПГУ, 2006. – 201с.