Use of stripping column in methanol production technology based on synthesis gas

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Abstract: It is today's demand to organize and manage the production of products important for the national economy by reprocessing hydrocarbon raw materials based on modern technologies in the enterprises of the organic synthesis industry, as well as to constantly use the achievements of science and technology in practice. The production of chemical products, the development of enterprises is connected with the use of advanced technologies in them. Taking into account the above, the scientific article offers proposals for reducing the number of rectification columns used in the process of methanol production based on synthesis gas by using an evaporation section known as a stripping column.

Keywords: stripping column, rectification, synthesis gas, rectification column, light volatile component, difficult volatile component

Rectification is the separation of components that make up liquid mixtures as a result of partial evaporation and condensation of vapors several times. Usually, only the rectification method provides complete separation of solutions. This process is carried out in tube or plate columns. In the column, the vapor and solution are moved in opposite directions, and in each impinger, the vapor condenses, and the solution partially evaporates due to the heat of condensation of the vapor. Thus, the vapor is enriched with a light volatile component, and the liquid flowing down the column - with a difficult volatile component.

In the chemical industry, at least 2 rectification columns are needed to separate the reaction products during the synthesis of methanol based on synthesis gas. This scientific article proposes to reduce the number of rectification columns by 1 due to the use of a stripping column in the rectification process.

The main stages of methanol production:

- obtaining a mixture of carbon dioxide and hydrogen (synthesis gas);
- getting methyl alcohol as raw material;
- isolation and purification (rectification) of methyl alcohol.

As in the production of ammonia, the synthesis of methanol uses the principle of rotation. Synthesis gas cleaned of sulfur compounds is compressed in a compressor and heated to the required temperature, passing through a heat exchanger. The synthesis gas then enters the synthesis tower containing the catalyst. The reaction mixture heated by the exothermic reaction leaves the synthesis column and is cooled through a heat exchanger. There, it gives heat to the synthesis gas entering the column. The cooled reaction mixture is then transferred to a refrigerator, followed by condensation of methanol. Then it enters the separator. Unreacted synthesis gas is returned to the process. The use of the principle of circulation allows to significantly increase the yield of methanol. (Figure 1)

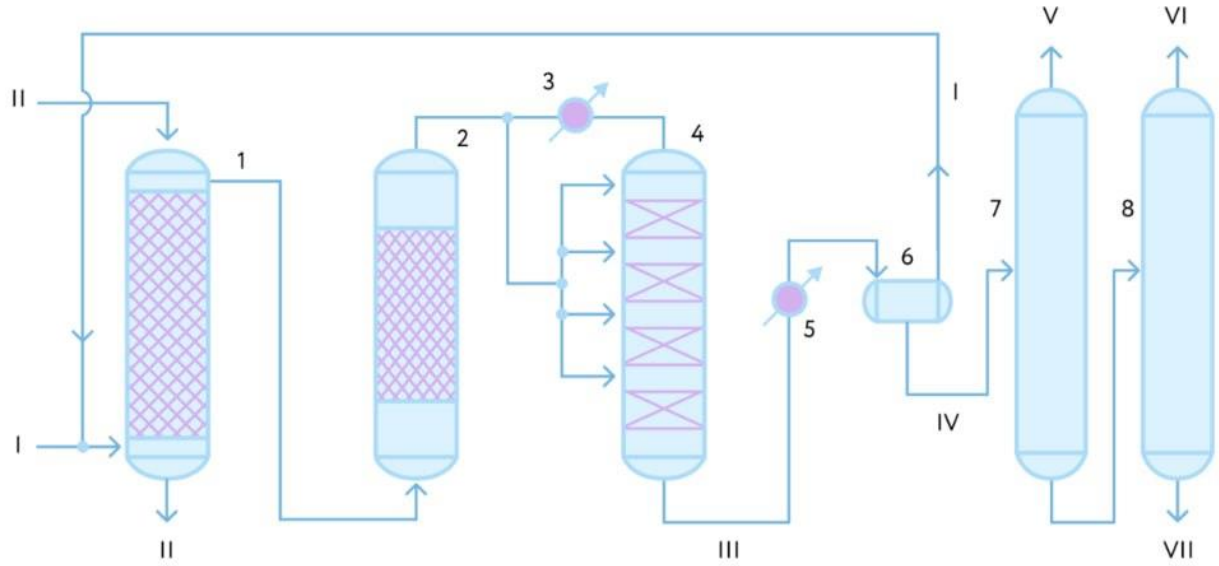

Figure 1. Technology of methanol production process

1-scrubber 2-adsorber 3-heat exchanger 4-synthesis column 5-cooler 6-separator 7.8-rectification column, I-synthesis gas, II-water, III-reaction products, IV-raw methanol, V-dimethyl alcohol, VI - methanol, VII - higher alcohols

Like ethyl alcohol, methanol also forms azeotropic mixtures with water and some organic solvents (for example, acetone, benzene, dichloroethane). This means that the boiling point of the mixture is lower than the boiling point of the individual substances. This makes it difficult to separate the substances using the rectification process.

To reduce energy costs, the following should be done:

1) cover the rectifier columns with good thermal insulation

2) conduct the process with optimal phlegm;

3) use of secondary heat flows to meet production needs;

4) use sharp steam to evaporate the liquid in the cube of the device under possible conditions;

5) use of a heat pump;

6) in some conditions, for example, during the rectification of azeotropic mixtures, the use of two (or more) column devices operating at different pressures.

Using ordinary columns, the mixture can be separated into only two fractions. In oil refineries, the mixture is usually separated into several fractions. For example, as a result of drilling oil, gasoline, ligroin, kerosene, diesel oil and fuel oil are extracted from it. To make such a separation, several simple columns located in a row are required. The number of columns should be less than the number of separated components. Organization of the process in this way causes many inconveniences and causes an increase in metal consumption. Therefore, separation of methanol production technology products based on synthesis gas into 3 or more fractions is carried out according to a single-column system. Such a column is a complex column consisting of several simple columns assembled in one body and located on top of each other. (Figure 2)

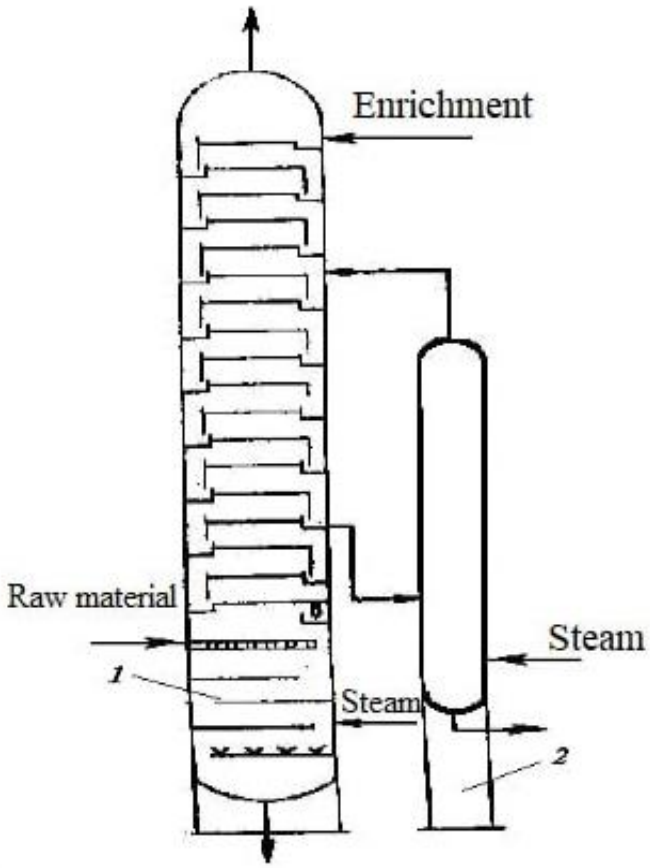

Figure 2. Complex column principle scheme
1-main column; 2-stripping column

Figure 2 shows a complex plate column that separates the proposed multicomponent mixture into three fractions. The advantage of such a column is that it occupies less production space compared to ordinary columns located separately, saturation is carried out only through the uppermost plate.

The column has a separate evaporation section known as the stripping column, which is placed in the common body. The stripping column is equipped with several plates.

The stripping column is equipped with several plates. The use of a stripping column will save the costs of metal constructions.

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