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THE INFLUENCE OF THE MAIN TECHNOLOGICAL PARAMETERS ON THE PYROLYSIS PROCESS

Kholikov Kamil Nurmahmatovich
Karshi Engineering Institute of Economics
Department " Physics and electronics " senior teacher.

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Abstract:
Each hydrocarbon, when decomposed, gives only those products that are characteristic of flour, which will also depend on the parameters of the pyrolysis process.

Keywords: Pyrolysis process, pyrolysis products

Each hydrocarbon, when decomposed, gives only those products that are characteristic of flour, which will also depend on the parameters of the pyrolysis process. The output of pyrolysis products in the specified composition of raw materials and the composition of the resulting mixture is a function of three unrelated parameters:
- conversion rate of raw materials-X (or process hardness - S),
- temperature-T, K,
- partial pressure of hydrocarbons Ru, N/m2.

The conversion rate (or process hardness) is a function of the temperature and the time it takes for raw materials to be in the reaction area (interaction time - t) [1].

The parameters of T and Ru determine the selectivity of the pyrolysis process. The degree of selectivity is understood as the ratio of the output of the main products (ethylene), to the output of less significant products (methane, ethane, fraction, etc.).

With an increase in the value of T and a decrease in Ru, the degree of selectivity increases. Hydrocarbons are thermally unstable compounds. In the process of heating, they decompose, forming relatively light compounds, in which the final products of the reaction are carbon and hydrogen [2].

The thermodynamic possibility of obtaining high amounts of olefins during pyrolysis is based on the fact that individual hydrocarbons, in the process of heating to high temperatures, have different thermal stability.

Starting components of raw materials in the range of temperatures up to 650 oS, in the range of 650-900 oS – olefins, acetylene hydrocarbons in the range of 900-1050 oS, at temperatures above 1050 oS – carbon and hydrogen have high stability [3].

Pyrolysis of ethane in the device is carried out in the temperature range of 810-850os. The temperature regime of the process is determined by the raw material that meets the existing pyrolysis. The temperature at which pyrolysis gas exits zmeevik is the determining temperature. The conversion rate of ethane is correctly proportional to the temperature, therefore, by changing the temperature regime, it is possible to regulate the amount of raw materials supplied to the oven (taking into account the ethane that is returned to the cycle).

The conversion (pyrolysis) temperature of 1% of the raw material is the conditional starting temperature of the pyrolysis reaction, which corresponds to 750 oS per ethane, so pyrolysis zmeevikin, performing various tasks, can be divided into several zones.

The distribution of temperatures over the length of the Radiant zmeevik, for the results of pyrolysis, is of great importance. The Shape of the temperature curve is characterized by a profile factor, which is taken as the ratio of the difference in temperatures in the continuation of the final (in the direction of the flow) third of the pyrolysis zone of the reaction to the difference in temperatures in the general pyrolysis zone.For a rectilinear form of a temperature curve, the profile factor is 0.33, for a concave curve it is more than this value, for a Convex curve it will be less than this value (fig.

When other conditions are the same, the bubble shape of the temperature curve contributes to an increase in the output of ethylene and aromatic hydrocarbons, and the concave shape usually contributes to an increase in the output of relatively high molecular olefins – propylene, butylene, butadiene [4].

For vertically located pyrolysis zmeeviks, in order to ensure an even increase in the temperature curve of the pyrolysis and to prevent a sharp change in the reaction mode, the permissible value of the difference in temperatures of the outer surface of the metal between the upper and lower points of one pipe is determined.

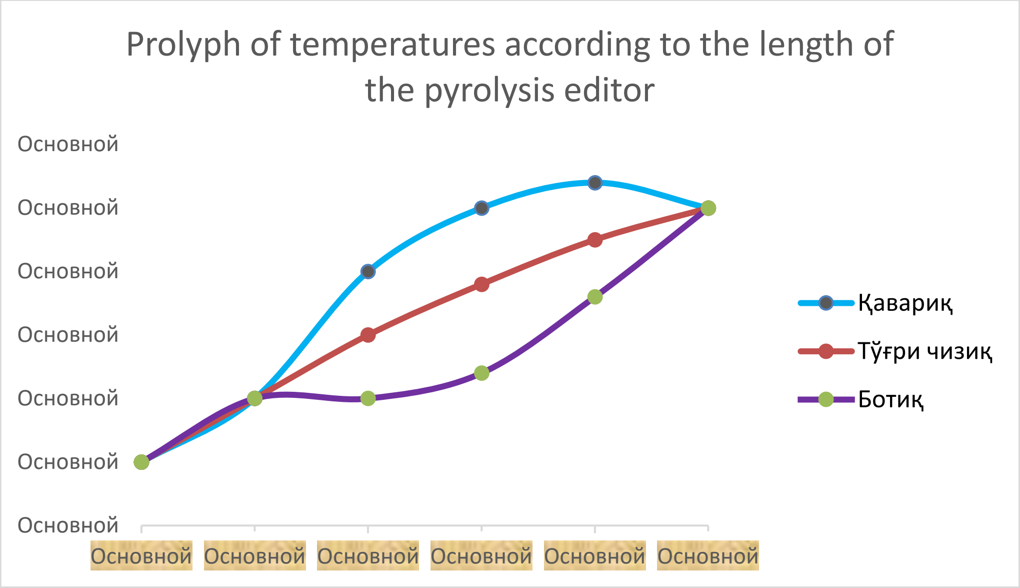


Figure 1. Temperature profile for the length of the pyrolysis reactor: 1 - convex, 2 - straight linear, 3 – concave

The time of presence in the reaction zone of hydrocarbons undergoing pyrolysis is another important parameter of the pyrolysis process. The time of being in the reaction zone is understood as the time of the flow of the reacting substance, at temperatures where the pyrolysis reaction goes at high speeds, being in the reaction zmeevig [5].

The output curves of the final products, depending on the time of their stay in the reaction zone, go through the maximum values for each temperature. The rate of primary reactions in which olefins are formed as a result of the reaction increases to a greater value than the rate of secondary reactions, and for each lower olefins there is an optimal (temperature-dependent) value of the time of the raw material being in the reaction zone (the output of olefin has a maximum value), while with an increase in Thus, an increase in the temperature of the pyrolysis reaction, with a reduction in the time of being in the reaction zone at the same time, leads to a relatively high output of the main products. Therefore, to determine the conditions of the process, a parameter known as the degree of hardness or hardness of the pyrolysis process is used, which simultaneously takes into account the change in temperature and the time of being in the reaction zone.

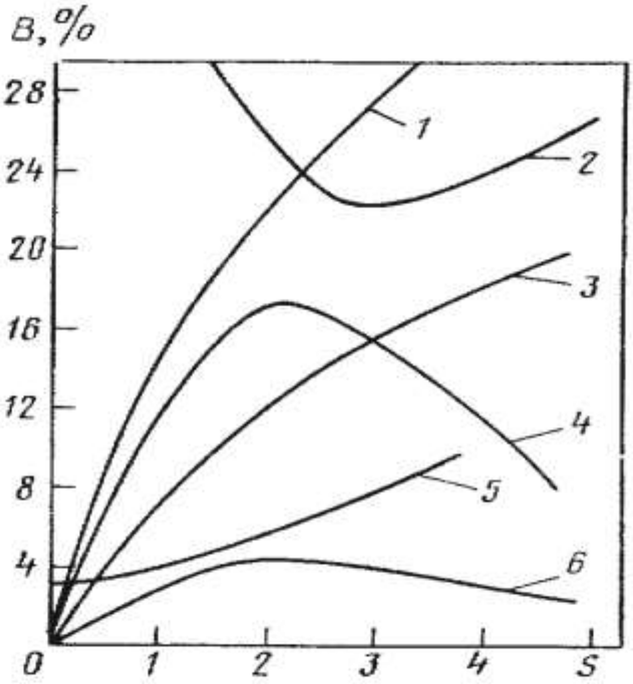
With an increase in the hardness of the pyrolysis process, the output of hydrogen and methane constantly increases, the output of ethylene does not increase, even slightly decreases.

The degree of equal hardness of the process, when adding together at different values of temperature and time of being in the reaction zone, corresponds to the degree of penetration of the same reaction, but in this the composition of the resulting pyrolysis products varies.

The degree of hardness of the pyrolysis process, based on the economic aspect, is selected taking into account many factors, but the following dependencies of the process are observed (depending on the degree of hardness).

The output of ethylene and decay relatively heavy products passes through the maximum value. The release of hydrogen and methane rises evenly. The amount of liquid products decreases rapidly at the beginning of the reaction, passes through the minimum value and begins to rise. By the degree of reaction penetration, the process can be conditionally divided into 4 zones (fig) .

Picture – 2



Zone 1 (degree of hardness up to S=1) is characterized by the predominance of primary reactions of decomposition of saturated components in the composition of raw materials, an increase in the flow of main components and a decrease in the output of liquid products of pyrolysis. The output of secondary products is relatively low. In the device, pyrolysis mode at temperatures 780 – 810 oS is suitable for this zone.

Zone 2 (S=1 to 2-2.5) is characterized by an increase in the rates of primary reactions of decay,which is visible from a decrease in the output of liquid products, but an increase in the predominance of secondary reactions begins. The increase in the release of hydrogen, methane, ethylene and butadiene will continue. The rate of decomposition of propylene and butanes is equal to the rate of their formation, then increases from it, and the output of these products passes through the maximum value. In the device, pyrolysis mode at temperatures 810 – 830 oS is suitable for this zone.

Zone 3 (s = 2-2,from 5 to 5-6) is characterized by the actual cessation of primary reactions. Secondary reactions predominate. The increase in the output of methane and hydrogen, the decrease in the output of propylene and butylenes will continue. The output of ethylene and butadiene passes through the maximum value. The curve of the output of liquid products passes through the minimum value and begins to increase as a result of the formation of stable aromatic compounds. Pyrolysis mode at temperatures 830 – 850 oS is suitable for this zone.

In Zone 4 (S>5-6), pyrolysis gas contains practically no raw material components (except aromatic compounds). The release of hydrogen, methane, aromatic compounds (mainly benzene and toluene) increases. The output of all other products is reduced. For the production of olefins, this zone does not matter.

The partial pressure of hydrocarbons in the reaction zone, in addition to the two factors indicated, also depends on the difference in pressures in the flow over the length of the reactor, which in turn will depend on the consumption of raw materials and its physical properties, the dimensions and construction of the zmeevik.

Dilution (saturation) of hydrocarbon raw materials with water vapor is an important and relatively light modifiable factor that determines the partial pressure of hydrocarbons. With an increase in the level of vapor dilution of raw materials (a decrease in the partial pressure of hydrocarbons), the output of ethylene, Divinyl and butane increases, but the output of aromatic hydrocarbons and methane decreases, that is, the selectivity of the pyrolysis process increases.

The effect of partial pressure of hydrocarbons on the release of propylene is less pronounced than nibatan. Perhaps this factor has little effect on its output. This is also caused by the fact that in pyrolysis zmeevigi propylene is formed by relatively heavier products (this is allowed by the high parsial pressure of hydrocarbons) not only in the direction, but also reacts with atomic hydrogen to form ethylene (this reaction is allowed by the low parsial pressure of hydrocarbons) [6].

With an increase in the degree of dilution of hydrocarbons with water vapor, the formation of Coke in zmeevik decreases, since the rate of reactions at the second and relatively high kinetic levels, which leads to the formation of high molecular compounds, decreases. Since water vapor giving reduces the rate at which a Coke layer is formed on the inner surface of pyrolysis pipes, the pressure difference and the rate of increase in the temperature of the surface of the pipes during the working cycle are reduced, while its period from Coke cleaning of pipes is prolonged. Thus, due to the dilution (saturation) of raw materials with steam, it is possible to increase the degree of hardness of pyrolysis and, accordingly, the release of ethylene, without reducing the selectivity of the process.

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