The operating efficiency of the stripping section of a catalytic cracking reactor has a considerable effect on the total coking capacity of the regenerator and on the local overheating of the catalyst, since undesorbed hydrocarbons with a high hydrogen content have higher enthalpies and higher combustion rates than undesorbing coke. The elimination of hydrocarbons in the stripping section takes place as a result of the displacement of vapors from the free volume by water vapor, the desorption of hydrocarbons from the surface of the catalyst [1], and calcination with splitting off and desorption of light fragments from the surface.

Consequently, means of increasing the rate of operation of the stripping section must differ, depending on which of the above-mentioned processes can lead to the most complete elimination of the combustible.

In [1,2] a study was made of the effect of various industrial factors on the displacement of vapors from the free volume between the particles; in these articles, however, there are no data characterizing the total effect of the elimination of coke deposits as a result of desorption and calcination.

In the present work, a study was made of the effect of the initial coke content, of the temperature, of the duration of the desorption, and of the mass flow rate of water vapor on the weight loss of the coked catalyst.*

The desorption kinetics were studied in a reactor (Fig. 1) suspended on an analytical balance, which permitted determination of the weight change of the catalyst directly during the course of the process [3]. This method permits determining the removal of deposits due only to desorption and calcination, without taking account of the displacement of vapors from the free volume between particles.

The cracking feedstock was a vacuum gas oil from Arlanskii crude (density $\rho_0^{20}$, 0.9; Conradson coking capacity, 0.09; and sulfur content, 3 wt.%). The catalyst was taken from the 1-A system (specific surface of the catalyst, 176 m$^2$/g; grain size 0.25-0.50 mm; weight 47.5 g).

At three cracking temperatures, 440, 470, and 500°C, as a result of the change in the duration of the process, a coking capacity of the catalyst equal to 1.5 and 2 wt.% was achieved.

After this, desorption of the vapors was carried out using water vapor (feed rate of water, 42 and

*In what follows we shall understand by desorption the total elimination of combustibles due to desorption and calcination.
Stopping the feed of raw material without subsequent stripping leads to a considerable amount of coking of the catalyst (curve 1, Fig. 2). Consequently, insufficient stripping is not only the reason for the breakthrough of petroleum vapors into the regenerator, but can also lead to an increase in coking of the catalyst in the stripping section. An increase of the mass feed rate of water vapor, within the interval studied, has only a slight effect on the weight loss of the catalyst.

It is evident from Fig. 3 that, in the temperature range from 440-550°C and with a desorption time of 30 min, only a very slight amount of hydrocarbons is eliminated from the surface of the catalyst (from 0.04 to 0.20 wt.%, calculated on the catalyst); the greatest weight loss is observed at low temperatures.

At a temperature of 470°C (the closest to the operating conditions of industrial units) the amount of desorption does not exceed 0.04% by weight, calculated on the catalyst.

The limiting amount of vapors (G_{p,v}, % on catalyst) which can be displaced from the free volume between the particles of catalyst and from their pores can be found from the equation

\[ G_{p,v} = 100 \frac{\gamma_{\text{act}} - \gamma_{\text{bed}}}{\gamma_{\text{act}} - \gamma_{\text{p.v.}}} \]  

where \( \gamma_{\text{act}} \), \( \gamma_{\text{bed}} \), \( \gamma_{\text{p.v.}} \) are, respectively, the actual density of the catalyst, the density of the fluidized bed, and the density of the petroleum vapors under desorption conditions.

In units with a fluidized bed of type 1-A catalyst, the coking capacity of the catalyst at the outlet from the stripping zone is approximately 1 wt. % while the value of \( G_{p,v} \) calculated using Eq. (1) for actual operating conditions was found equal to 0.60%. Consequently, in the absence of desorption, the coke load of the generator would increase by 60%. In "thermophore" units, in which the final coking capacity of the catalyst is 3.5%, and \( G_{p,v} \) is equal to 0.25% (as a result of the large density of the bed, \( \gamma_{\text{bed}} \)), the increase in the coke load of a regenerator operating without desorption is only 7%.

It follows from the data presented that the weight loss of a coked catalyst, as a result of the elimination of petroleum vapors from its surface and of calcining of the coke, is 10-15 times less than the weight of the vapors displaced from the volume. Thus, to improve the operation of the stripping section, it is of the utmost importance to set up conditions which will promote the displacement of petroleum vapors from the free volume between the catalyst particles and from its pores. This problem becomes extremely important with a transition to a large number of recirculations.