

## PRODUCTION OF OLEFIN AND AROMATIC HYDROCARBONS BY PYROLYSIS OF GAS CONDENSATE

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In Algeria, gas condensates occupy second place after crude with respect to volume of recovery. They are exported to France, Belgium, countries of South America, and certain other countries, and are also used to produce the 85-180°C cut and diesel fuel. The 85-180°C cut is directed into a reformer for the production of high-octane reformat.

Algerian gas condensates contain mixtures of paraffins and naphthenes, and also a small amount of aromatic hydrocarbons. Since these condensates have a paraffin-naphthene base, it is possible to use them as pyrolysis feedstock for the production of olefins and aromatic condensates [1, 2]. The olefin hydrocarbons serve as feedstock for the production of polymers, and the aromatic hydrocarbons as feedstock for pyrolysis – high-octane additives to premium-grade commercial gasolines

At the present time, low-octane gasoline cuts are subjected to pyrolysis, as a result of which the volume of the 85-180°C cut – reformer feedstock, is reduced. The purpose of this paper is to investigate laws governing pyrolysis of the 36-279°C cut of gas condensate, and ascertain optimal conditions for the production of ethylene and propylene. Physico-chemical characteristics of this cut are presented below:

Density, kg/m <sup>3</sup> .....	721.6
Refractive index at 20°C .....	1.4105
Molecular mass .....	118.7
Aniline point, °C .....	64
Group hydrocarbon composition, wt. %:	
paraffin .....	65.05
naphthene .....	26.13
aromatic .....	8.82

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Distillation curve, °C:

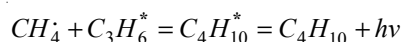
IBP .....	36
5% .....	51
10% .....	62
20% .....	73
30% .....	85
40% .....	96
50% .....	111
60% .....	134
70% .....	157
80% .....	182
90% .....	227
95% .....	271
EP .....	279

The pyrolysis was conducted in a straight-through unit, which includes a heating section, a reactor with two connected tanks – for delivery of feedstock, and water for its dilution to a ratio of 1:0.5, and a section for cooling and receiving of the pyrolysis products.

The reactor was placed in a cylindrical heating furnace. After heating to the assigned temperature – 720-840°C – the condensate and water were delivered into the furnace at a certain rate. During the pyrolysis, the temperature was maintained constant by regulating the voltage in the metallic winding of the furnace with an autotransformer. The gas and liquid products obtained were passed through a cooler into a gasometer and tank, respectively. Samples of these products were analyzed by the chromatographic method.

The hydrocarbon composition of the gas is presented in Table 1. As is apparent, the composition of the gas varies considerably with increasing temperature of the process. The methane yield is maximum at 800°C, and then diminishes with increasing temperature. This law reflects the possibility of methane interacting with higher-molecular hydrocarbons. The ethylene yield increases continuously with increasing temperature; this characterizes the thermal stability of this hydrocarbon. Consequently, the ethylene molecules do not participate in subsequent conversions, since increased energy outlays are required for their excitation.

Like the methane yield, the yield of propylene is maximum at 800°C; this reflects the possibility of subsequent interaction of the propylene molecules with excited methane molecules via the circuit



in accordance with notions of the generalized quantum-chemical principle [3]. Radiation of light energy  $hv$  by

Table 1

Pyrolysis temperature, °C	Composition of pyrolysis gas, vol. %			
	methane	ethylene	propylene	other hydrocarbons
720	29.30	20.01	12.00	38.69
760	31.45	27.08	12.43	29.01
800	40.95	30.40	13.49	15.16
840	38.58	33.80	12.75	14.87

Table 2

Pyrolysis temperature, °C	Composition of liquid pyrolysis product, wt. %			
	benzene	toluol	xylyls	other hydrocarbons
720	4.80	10.50	8.14	76.56
760	6.00	11.85	10.96	71.19
800	13.43	17.04	11.63	56.90
840	12.51	18.40	13.20	55.89

excited butane molecules reflects the exothermic mechanism of the individual stages of the thermal conversion of hydrocarbons. Professor Ya. M. Paushkin intuitively indicated this mechanism as early as the 1960s, placing his colleagues in a quandary.

Higher-molecular paraffin and olefin hydrocarbons are implied for the other hydrocarbons. Their content in the pyrolysis gas decreases with increasing process temperature owing to an increase in the percentage of their conversion to aromatic hydrocarbons.

The composition of the liquid pyrolysis product, which is an aromatic concentrate obtained at various temperatures, is presented in Table 2.

As is apparent, the benzene content in the aromatic concentrate decreases at pyrolysis temperatures above 800°C. This is most likely associated with alkylation of the molecules of excited benzene with excited ethylene molecules. Participation of the latter in the destructive alkylation of benzene with the formation of toluol and xylyls is possible. Actually, the content of toluol and xylyls in the liquid product increases continuously with increasing pyrolysis temperature.

Based on the data in Table 2, it is possible to point out that the aromatic concentrate may serve as a valuable feedstock for petrochemical synthesis, or as a high-octane additive to commercial gasolines after removal of the benzene.

## REFERENCES

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