INVESTIGATOIN OF THE INFLUENCE OF FEEDSTOCK CONSUMPTION ON THE PROCESS OF CATALYTIC DEWAXING AND OPTIMIZATION OF THE TECHNOLOGICAL MODE

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The aim of the work is to study the process of catalytic dewaxing using a mathematical model. The urgency of the work lies in the growing demand for low-hardening products [4]. The raw material of the dewaxing process is a mixture of a straight-run diesel fraction and atmospheric gas oil. Process products include stable gasoline, components of diesel fuels: fraction 180-240 ºC, fraction 240-340 ºC; fraction> 340 ºC. Using the mathematical model [1,2], the influence of consumption on the process of catalytic dewaxing, as well as on the content of normal paraffins in the product, the CFPP (cold filter plugging point) and the yield of the product were investigated. Initial data for calculation was feedstock compositions and ratios of the mixed feedstock flows at two options of the industrial dewaxing unit operation. Table 1 shows the ratios of fractions in the mixed feedstock of the dewaxing process for two options of the industrial unit operation.

Table 1

Ratios of fractions in the mixed feedstock of the dewaxing process

Fraction	Options of the industrial dewaxing operation	
	Option 1	Option 2
	%	
Diesel fraction	75	0
Atmospheric gas oil	21	93
Visbreacking gasoline	4	7

The range of variation of flow rate is selected in the range of 280-320 m3/ h in increments of 10. Process temperature is 350 °C, flow rate of hydrogen-containing gas is 15.000 m3/h, pressure is 6.9 MPa.

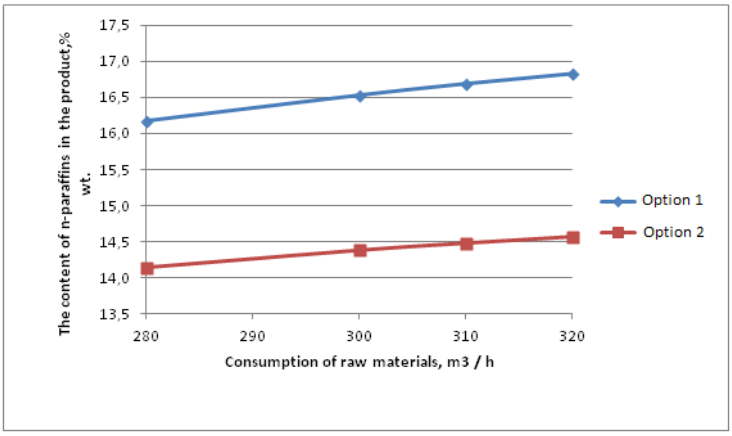

Fig. 1. Dependence of the content of n-paraffins in the product on the consumption of raw materials

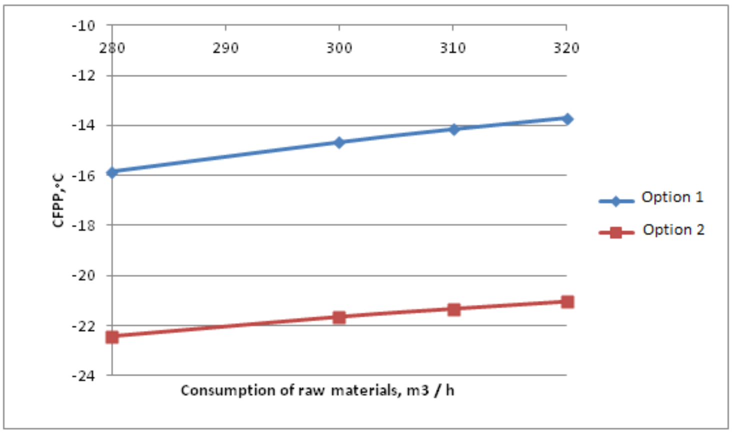

Fig. 2. Dependence of the product CFPP on the consumption of raw materials

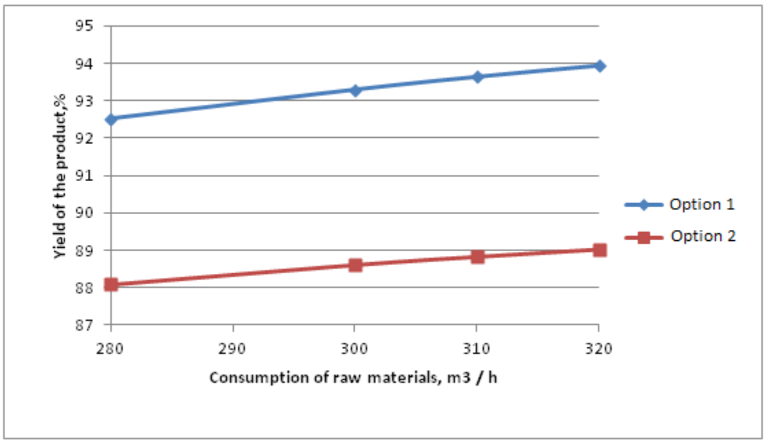

Fig. 3. Dependence of product yield on raw material consumption

With an increase in the flow rate from 280 to 320 m3/h, the content of n-paraffins in the product increases by 0.6%wt. for the first variant of the plant operation and for 0.5%wt. for the second option. With increasing raw material consumption, CFPP of the product increases, this is due to directly proportional dependence of the content of n-paraffins and the maximum filterability of the product. With the increase in raw material consumption, the yield of diesel fuel increases, this is due to lower contact time and thus the conversion of n-paraffins of diesel range. In this work technological mode of the dewaxing process was optimized for the feedstock consumption 280 and 300 m3/h. For the second option of the dewaxing unit operation the reaction temperature was selected in such a way that CFPP=-20 oC [3]. The calculation was carried out for reaction temperature higher and lower than optimum temperature by 5 oC. The results of optimization are shown in Table 2.

Table 2

Optimization results for the composition of raw materials during the operation of the catalytic dewaxing plant according to "Option 2" in the production of diesel fuel in winter

Consumption of raw materials, m3/h	Optimum temperature, ºC	The content of n-paraffins in the product,% wt.	CFPP of the product, ºC	Yield of diesel fuel,%
280	330	15.10	-19	90
	335	14.85	-20	89
	340	14.59	-21	88
300	333	15.10	-19	90
	338	14.88	-20	89
	343	14.64	-21	88

Based on the optimization results, the following conclusions can be drawn:

1) With increasing raw material consumption in the dewaxing process, maintaining the optimal temperature in the reactor allows to obtain components of diesel fuels with the required low-temperature properties (CFPP -15 ° C and -20 ° C for inter-season diesel fuel and winter diesel fuel), while maintaining a high yield (93% and 89%).

2) In the raw material consumption range of 280-300 m3/h, the optimal temperature in the dewaxing reactor is in the range of 347-357 ºC for raw materials consisting of a mixture of diesel fraction, atmospheric gas oil and visbreaking gasoline (Variant-1) with a high content of n-paraffins C10 -C27 (16.7%wt.) and 335-342 ° C for raw materials consisting of a mixture of atmospheric gas oil and visbreaking gasoline (variant-2), with a low content of n-paraffins C10-C27 (14.9%wt.).

References

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