TECHNOLOGY, MACHINE-BUILDING, GEODESY

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PROCESS OPTIMIZATION OF LIQUID-LIQUID EXTRACTION REFORMATE FROM SOLVENT TEG AT THE INSTALLATION OF LG-35/8-300B JSC "NAFTAN"

VIACHESLAV KUDRYAVTSEV, SERAFIMA POKROVSKAYA
Polotsk State University, Belarus

Industrial complex for producing aromatic hydrocarbons is a chemical-technological system composed of interconnected industrial catalytic reforming and dearomatisation catalysate. Studying the process of extraction of aromatic hydrocarbons from products of catalytic reforming is an important and actual scientific task. The plant type LG-35 / 8-300B "Naftan" for aromatic hydrocarbons extraction, solvent TEG with a water content of 4-10% by weight is used.

The purpose of this paper is to analyze the structural and parametric optimization of the process of aromatic hydrocarbons extraction to identify ways for better use of the solvent, reducing energy costs, improve quality and increase target products.

The main initial values are the targets that should be in the range studied:

1. The temperature of the solvent entering the extraction column;
2. The water content in the solvent;
3. The multiplicity of circulating solvent: feedstock.

The search for optimal parameters of the extraction process was carried out with the use of modern information technologies according to the method NTRL (Non-Random-Two-Liquids).

Table shows the composition of the group reformate - feedstock extraction plant JSC "Naftan". (CPL data JSC "Naftan").

The group composition of feedstock, according to the Central Laboratory of JSC "Naftan"

hydrcarbons	Wt %
n-alkanes	22,22
i-alkanes	33,31
aromatic	14,59
cycloalkanes	29,88

Due to the limited selectivity for the key pair of the most difficult to separate cycloalkane hydrocarbons C_6 - C_9 arene, the extraction process should be carried out at the lowest possible temperature. It is known that at lower extraction temperatures stability of π-complexes of arenes with polar solvents increases and the selectivity grows up.

Moreover, restrictions to reduce the temperature of the process may increase the viscosity due to the extractant, resulting in reduced efficiency of the extractor practical trays [1].

The selectivity of extraction separation of hydrocarbons increases in the presence of the temperature gradient according to the height of the extractor. Feed at the temperature below the extractant leads to lower temperatures in the bottom section of the extractor and improving arene content in the extract [1].

Figure 1 shows the degree of hydrocarbon recovery temperature of the solvent.

The graph shows that the capacity of TEG slightly increases with increasing temperature.

Extract with the highest aromatic content was obtained in the extraction solvent at temperature of 138-140 ° C, a further increase in temperature besides deterioration of the products obtained may result in increased energy costs. At high temperatures the extraction of non-aromatic hydrocarbons into the extract takes place which adversely affects the quality of commercial benzene, toluene and xylenes

There are several methods for improving the purity of recovered aromatic hydrocarbons. It is possible to increase the purity of the extract by returning aromatic extractor as a recirculator or the use of "antisolvent" (e.g., water), which enhances the selectivity of the solvent and lowers the solubility of the extract of non-aromatic hydrocarbons [2].

Figure 2 shows the degree of extraction of hydrocarbons from the water content in the solvent.

The figure shows that it will be optimal if the water content in the solvent tag is 3-4 wt.%, because at such a ratio more than 90% by weight of all aromatic hydrocarbons with a low content of alkanes and cycloalkanes is derived. By adding 5 and 10% (wt.) of water the recovery rate of aromatics has decreased by 15 and 45% (wt.) respectively (Fig. 2).

TEG has a low solubility with respect to the aromatic hydrocarbons, due to high associating glycols, which entails a high ratio of extractant to feed [3].

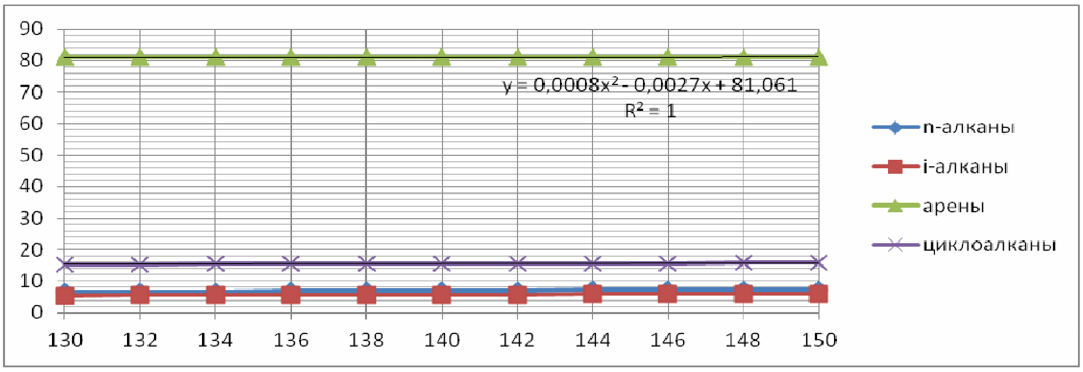

Fig. 1. The recovery of hydrocarbons, depending on the temperature of the solvent

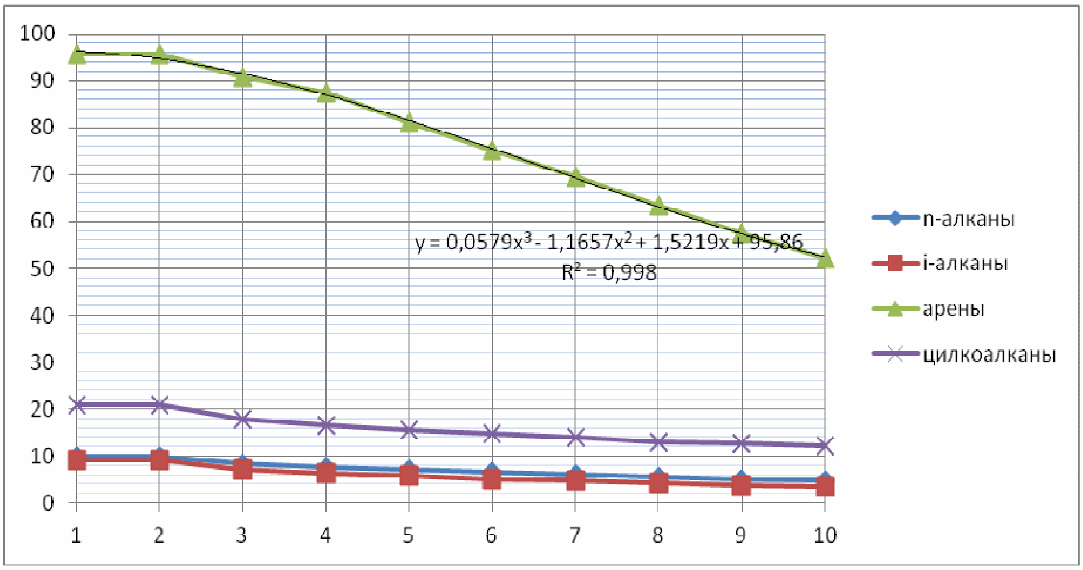

Fig. 2. The recovery of hydrocarbons, depending on the water content in the TEG

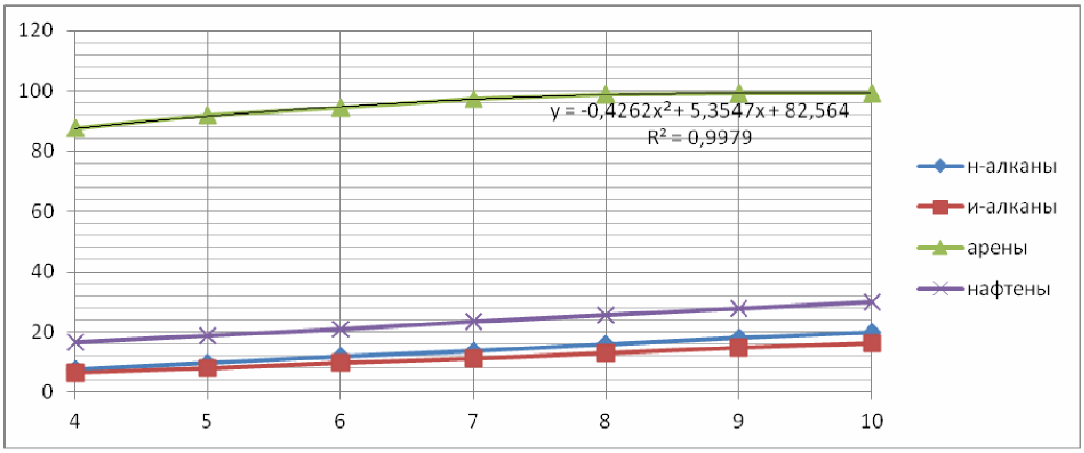

Fig. 3. Dependence of the degree of extraction of hydrocarbons from the multiplicity of circulation solvent: feed

Figure 3 shows the dependence of the degree of extraction of hydrocarbons on the weight ratio of solvent to feed. The extract, containing more than 90% (wt.) of aromatic hydrocarbons is obtained in a weight ratio of solvent to feedstock of 5:1 to 7:1.

The maximum separation of aromatics is achieved at a multiplicity of circulation 8:1. Further increasing of the solvent feed has no effect on the number of extracted aromatics, but reduces the quality of the extract by an additional content of non-aromatic hydrocarbons. The deterioration of economic performance of the process by increasing the costs of pumping the solvent and increasing the water fed to the stripping of the extract is significant.

We have obtained regression equations describing the process of reformate extraction:

1) $y = 0{,}0008x^2 - 0{,}0027x + 81{,}061$ $R^2 = 1$ (1)
2) $y = 0{,}0579x^3 - 1{,}1657x^2 + 1{,}5219x + 95{,}86$ $R^2 = 0{,}9989$ (2)
3) $y = -0{,}4262x^2 + 5{,}3547x + 82{,}564$ $R^2 = 0{,}9979$ (3)

$$R_{cp} = \frac{\sum R_n}{n} = \frac{1+0{,}9989+0{,}9979}{3} = 0{,}9989 \quad (4)$$

The coefficient of correlation between the degree of extraction of aromatic hydrocarbons and their content in the extract is equal to 0.9989, which means that there is a close connection between the selected optimization parameters.

In accordance with the obtained regression equation, conditions for the extraction of aromatic hydrocarbons from reformate have been selected:

1) solvent temperature 138-140 ° C;
2) the water content in the solvent, 4% wt .;
3) the weight ratio of solvent to feed - 6: 1

The degree of extraction of aromatic hydrocarbons in these conditions is more than 90% by weight to feed, which is 30% more than the actual performance at the operating enterprise JSC "Naftan" at lower multiplicity of solvent to raw materials and process temperature.

Conclusion: statistical model, which allows increasing the degree of extraction of aromatic hydrocarbons from reformate and significantly reduces energy costs of the process, has been proposed and validated.

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MOTIVATIONAL INFLUENCE ON PROFESSIONAL WORK IN HAZARDOUS WORKING CONDITIONS – AN INDICATOR OF SAFETY CULTURE

YULIYA BULAUKA
Polotsk State University, Belarus

The results of the analysis of motivational influences attracting workers in hazardous occupations and influencing the formation of safety culture are presented.

It is well known that one of the most effective ways to achieve life safety is the development and formation of personal safety culture through the educational process. However, at the present stage of social development in the formation of spontaneous search system of youth values, orienting professional choice of young people, there is a problem of inefficiency of the Institute of Education. Consequently, it results in the emergence of personal dissatisfaction in the course of work in the area of specialization, which is reflected in the outcome of labor and the security level generated by the process.

In addition, the problem of formation of valuable attitude to health at work is being exacerbated. In Belarus, about 30% of the total number of workers are forced to work in harsh environments, including chemical and petrochemical industry - 53%, ferrous metallurgy - 51%, electricity - 49%, forestry - 47%, textiles - 43% [1, p.17]. Poor working conditions are the cause of the high level of temporary disability of employees. Workers, engaged in work in harmful and (or) dangerous working conditions, are entitled to a retirement pension for work in special working conditions, salaries at a higher rate, free provision of therapeutic and preventive nutrition, milk or equivalent foodstuffs, paid breaks on working conditions, shorter working hours, additional leave and other compensations. Not surprisingly, the current system of compensation for work in harmful and (or) dangerous conditions stimulates the excessive length of work in such conditions and disregard of the principle of the protection of employees' time, which exacerbates the problem of preserving and strengthening the health of workers.