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IN SIGHT

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New BASF technologies for gasoline engines with direct injection spark ignition systems

Keywords: gasoline engines with direct fuel injection, tests on engines, fuel performance packages Keropur®.

Abstract. It is described the special aspects of deposit formation on fuel injectors of modern gasoline engines with direct fuel injection (Direct Injection Spark Ignition – DISI). The most effective method to keep injectors clean is to use fuel performance packages. It is listed test results of BASF performance packages on engines with various design. It is showed that using of modern packages Keropur® allows to provide cleaning and preventing deposit formation in direct injection engines with both swirl nozzles and multiple-hole injectors of last generation.

(BASF)

PETROLEUM PRODUCTS: technology, innovation, market

Khairudinov R.I., Dolomatov M.Yu., Sazhina T.I., Khairudinov I.R.

Thermolysis of low-sulfur heavy oil from field "Verblujie"

Keywords: low-sulfur heavy oil, liquid-phase thermal cracking, crude oil thermolysis products, fractional composition, physical and chemical and structural characteristics of oil close cut fractions, of thermolysis product, bottoms > 400°C.

Abstract. The results of the study of the thermolysis process of low-sulfur heavy oil from field "Verblujie" are presented. As a result of determination of fractional composition of original oil and products of its thermolysis, summarization of the results of close cut fractions analyses, the features of formation process of the overhead products boiling in the range of 47-400°C are specified. It is shown that during thermolysis there is significant decrease in bottoms output (from 84.4 to 49.6%) boiling above 400°C, which has higher density and lower sulfur content in comparison with the original oil.

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Use of sulfur as a modifier of oil residues

Keywords: sulfurbitumen, modification of oil residues of sulfur.

Abstract. This work is directed on consideration of relevance of a question of integration of sulfur in the oil remains. Sulfur interaction with the oil remains is studied, the material balance of process is made. The main problems of introduction of sulfur in the oil remains are shown and the directions of development of this subject are presented.

"HAMMEL"
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The applying of adsorption method for obtaining motor oils from baku petroleums

Keywords: T-46 oil distillate, adsorbents, silicagel, bentonite, PMR-spectroscopy, thermo oxidation stability.

Abstract. The results of researches on adsorptive additional cleaning of oil distillate T-46 by application of various adsorbents are observed in this article. Aluminosilicate, silicagel, bentonite, zeolites were studied as adsorbents, and the cleaning conditions of the process were selected.
The quality of obtaining raffinates and oils isolated from the surface of the adsorbent has been studied. Both the amount of aromatic hydrocarbons in the oil and their composition were determined using PMR-spectroscopy. It is shown that naphthalene and phenanthrene hydrocarbons remain on the adsorbent more than others.

The purification of the samples with silicagel, bentonite and zeolite did not show any significant advantages of this or that adsorbent. It is shown that all samples have high thermo oxidation stability.

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MATHEMATICAL SIMULATION

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Analysis of pressure reducing effectiveness in the reforming industrial unit with mathematical modelling method using

Keywords: catalytic naphtha reforming, catalyst, mathematical modelling method, coke formation, catalyst activity.

Abstract. Catalytic naphtha reforming is a very important and effective process for petrochemical industry due to the octane improvement and aromatic feedstocks production. A large number of reactions occur in catalytic reforming, such as dehydrogenation, dehydroisomerization, hydrocracking, isomerization, dehydrocyclization. The catalytic naphtha reforming process yield and its quality depends strongly on the catalytic properties. The catalyst undergoes physiochemical changes during operation what contribute to decrease its activity and selectivity. Coke formation process is the most important catalyst deactivation cause. Coke formation prediction is a quite complex task, because this process depends on operating conditions, oil feed composition, catalyst properties. Operating conditions strongly affect the catalyst. The strategy of reforming technology improving goes hand in hand with a pressure reduction. The aim of this study is analysis of pressure effect on the product yield and its quality in industrial catalytic reforming unit by mathematical modelling method. Industrial catalytic reforming unit with a preliminary hydro-treating in Russia was used as an object. The performance analysis of the reforming catalyst PR-9 and operation prediction on the catalyst PR-81 for production reforming unit have been carried out using a mathematical model. With the computer modelling system using the effect of pressure on the quality of the product has been carried out. It was proved that the work at reduced pressure will increase the product yield by 2% mass, and also will enhance the yield of hydrogen and aromatic hydrocarbons. But, with the pressure reduction the rate of coke formation will increase, so the pressure is not recommended to drop below 1.4 MPa.

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Investigation of the process of obtaining diethylene glycol diester of synthetic oil acids on the mathematical model

Keywords: esterification, diethylene glycol, synthetic oil acids, regression model.

Abstract. The modern level of development of the branches of industrial petrochemical and organic synthesis poses the tasks of rational use of all components, catalysts including a simplified technological process that ensures ecological purity and economic profitability, which is one of the main tasks.

Considering all these problems, this article is devoted to the investigation of the reaction of esterification the synthetic petroleum acids (SPA) with diethylene glycol (DEG), in the presence of a heterogeneous catalyst (micro-TiO_2).

The aim of the work was to compile a regression model based on statistical processing of the experimental data of the DEG esterification reaction, followed by an investigation of the optimum values of the regime parameters, as well as the development of recommendations on possible effects on the course of the reaction.

For establish quantitative relationships that reflect the influence of the main factors of the technological regime, among which are the temperature of the experiment– x_1, °C; quantity of catalyst – x_2, % wt.; molar ratio of SPA to alcohol – x_3; duration of experience – x_4, hr; ether output – y_1, %, number acidity value – y_2, mg KOH/g; was used the method of active planning of the type 2^4 experiment with subsequent mathematical and statistical processing of the experimental data.

The mathematical expression the dependence of the optimization parameter on the input independent variables is presented in the form of a regression equation.

For determine the coefficients of the equation was used the program S-plus 2000 Professinal, developed by company Mathworks for automated mathematical processing of experimentally obtained data, i.e. of the statistical analysis of calculation data for regression coefficients.
The processing of the experimental data made it possible to determine the values of the coefficients of the regression equation.
From the values of linear coefficients, one can judge the degree of influence of individual factors on the value of the optimization criterion.
Evaluation of the significance of the regression coefficients was determined using the Student's test.
The calculations showed that the coefficient a_{12} and also the coefficients b_2, b_{12}, b_{24} is insignificant.
The model adequacy hypothesis was tested by the Fisher criterion.
Comparing the found values of the Fp criterion with the table values in the chosen confidence probability of 95% and the degrees of freedom f_1=6, f_2=2, we see that the calculated values of Fp are less than the table values Ft=19.3.
This indicates that the regression equations adequately describe the response surface.
Consequently, they can serve as a statistical model of the regularities in the change in process parameters and their can be used to solve the problem of optimization and also in the study of the reaction in a wide range of variation of the input variables.
Using the developed regression model, calculations were carried out on the PC to study the influence of each input factor on the output parameters.
The developed mathematical model in the form of a regression polynomial, adequately describing the experimental data, allowed to find the optimal values of the input reaction variables: the temperature of the experiment – 140°C , quantity of catalyst – 1% wt., (with respect to SPA), molar ratio of SPA to DEG = 2:1,4, duration of experience – 4,5 hr, at which the maximum yield of the ether was 93% of the theory, and the value acid number was 0.48 mg KOH/g.

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Timofeeva N.A., Kapustin V.M., Reutova O.A., Demin A.M., Khadzhiev S.N.

Investigation of energy efficiency of the hydroconversion process at the stage of design

Keywords: energy efficiency, power consumption, pinch-analysis, hydroconversion, unit revamp, heat recovery, heat exchangers, heavy petroleum residues.

Abstract. Nowadays a variety of complex oil processing technologies are under investigation of their energy efficiency. The crude distillation unit offers a good potential to examine heat integration, but the heavy oil or heavy residue destructive technologies are even more comprehensive as a research topic. The key point is that technologies such as hydrocracking and hydroconversion not only include separation and fractionation units like in the crude distillation, but additionally complex reactive units have to be considered for these technologies.
The research is devoted to investigation of energy efficiency of the heavy oil hydroconversion process. As the first stage, a mathematical model of the fractionation unit in Aspen Hysys® was constructed and an option of its optimization was proposed. As the second stage, a potential of the heat integration and exchanger network optimization are considered.
Process heat integration analysis consists of numerous techniques that allow engineers to evaluate entire processes or sites. It includes hierarchical design methods like the Pinch Analysis, which uses thermodynamic concepts and heuristics, as well as mathematical programming such as linear, non-linear, mixed integer linear or non-linear programming. In this research work the Pinch Analysis will be the primer source of evaluation. This method is widely used in oil refinery to evaluate the network of heat exchangers and to find solutions of increasing heat recovery between process flows.
In our case, the minimum temperature difference between hot and cold streams of the process has been found by analyzing operational and capital costs. As a result, an option to improve the energy efficiency of the process by maximizing the use of the heat of boundary flows is proposed.

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EQUIPMENT and DEVICES

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Ways to reduce level of water comsuption in oil treatment processing

Abstract. The report presents results of the experimental-industrial trails of mixer used for reducing washing water consumption in desalting and dehydration processing.

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INDUSTRIAL SAFETY

Syroedov N.E., Konstantinov V.E., Sharykin F.E., Kalashnikov V.G.

Improving the efficiency of evaluation processes electrical supply

Keywords: electrification of liquid petroleum products, dielectric materials, fire and explosion safety, electrostatic charge.

Abstract. The article presents materials on the development and substantiation of the application of the device for evaluating the electrification of liquid petroleum products, which allows to evaluate integrally the influence of various materials and also operation conditions, on the accumulation of charges, and the subsequent increase in the efficiency of assessing the electrical safety of petroleum products supply processes.

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