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Middle Volga Oil Refining Research Institute: stages of the big way_____4-12

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Formation of scientific school on hydrocatalytic processes

Keywords: experimental base, pilot plants, installation of a pilot plant, hydrotreating, hydrocracking, hydroisomerization, conversion, paraffin, raffinate, petrolatum, base oils, low-viscosity hydraulic oils, domestic catalysts

Abstract. The chronology of the development of the scientific school on hydrocatalytic processes, the works of the founders and successors of which are in demand in many industries of the country for decades, and primarily in oil refining and petrochemistry, is shown. The scientific school has found its beginning in the provincial Institute with highly professional staff, introducing large-scale scientific and technical developments. Innovative solutions of the next generations are a worthy continuation of the established traditions and are recognized at the state level.

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System of independent in-depth study of oil resources: problems, solutions, experience_____16-20

Keywords: oil, crude oil, narrow petroleum fraction, in-depth studies, comprehensive physical-chemical research, benchmarking

Abstract. Considered the question of the importance of performing a comprehensive in-depth studies of crude oil with a detailed study of the narrow fractions for the optimized production planning, which requires qualifications and experience of personnel to address the methodological, technical and technological problems. Tabular data with the results of the evaluation of the quality of oils processed in the perimeter of Rosneft Oil Company on the main indicators and the matrix of complex physico-chemical study of individual oil are presented. The instrumental and methodical possibility of obtaining information about the quality of the narrow fractions with the end of boiling up to 600 degrees Celsius actually obtained in laboratory conditions is shown.

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Development of the composition and production technology of the first Russian additives package for HLP hydraulic oils_____21-25

Keywords: additive package, hydraulic oils, industrial equipment, qualification tests, testing in equipment.

Abstract. Currently high-quality oil production is performed with the use of an additive package. Additive packages of foreign companies are used to produce hydraulic oils in Russia. The main aim of this work is to develop colloiddally stable multifunctional additives package that ensures compliance of hydraulic oils with the requirements of an international standard DIN 51524p.2 and equipment manufacture's specifications. To achieve that task there was performed an integrated study of an additives of various functional use and their combinations based on achievements of colloid and nanochemistry on revealing of synergism of their function. There were performed a great number of experiments with the use of the developed size measurement method of micelle additives by PJSC "MidVolgaNIINP" that is based on laser analyzer dynamic light scattering. Obtained results made it possible to produce an optimal composition of additives package that has narrow finely dispersed micelle distribution by volume, which indicates the formation of stable colloid storage system.

The additives package includes zinc dialkyldithiophosphate (ZDDP) with an optimal alkyl structure that in combination with other components provide hydraulic oils with the requirements of an international standard and OEM specifications for essential performance characteristics including watering conditions

such as hydraulic stability, demulsifying properties and filtration with water. It is determined that due to the interaction of the detergent-dispersant additive with ZDDP, the level of OEM requirements for hydrolytic stability of hydraulic oils is achieved. According to the laser analyzer, it is determined that high level of filtration at watering is indicated on samples with finely-dispersed distribution by water volume. The abovementioned allowed developing an optimal composition of additives package, which provides the compliance of hydraulic oils with the requirements of an international standard DIN 51524-2 for this parameter. Due to optimal composition of additives package which also includes anti-oxidation, anti-wear, demulsifying and anticorrosion additives, PH-И-Г-C(п) oils with a developed PH-П-ИГC package meets the requirements of DIN 51524 p.2 standard. As a result the performed research complex allowed developing composition and production technology of the first domestic additives package for hydraulic oils and its components. Based on positive results of qualifications and tests an approval is obtained to use PH-И-Г-C(п) hydraulic oils with the developed PH-П-ИГC additives package in the equipment of an Italian company Danieli. PH-П-ИГC additives package is applied in PJSC “MidVolgaNIINP”.

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Analysis of the effectiveness of the application of the PR-81A catalyst at the reforming facilities of the oil refinery of Rosneft Oil Company **25-28**

Keywords: catalytic reforming, catalyst, octane value, hydrogen concentration, cycle duration.

Abstract. The article performed analysis a work domestic catalyzer reforming PR-81A in first cycle exploitation on reforming plant Rosneft. Was demonstrated that application in manufacturing given catalyst provided possibility receive high octane component with octane value 96-98 by the research method at high product main yield and duration operational cycle two years.

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Receiving additives to motor fuels on the basis of alkylsalicylic acids **29-34**

Keywords: the technical alkylsalicylic acids, anticorrosive additives, antistatic additive, antiwear additive, washing additives, motor fuels

Abstract. In PJSC “MidVolgaNIINP” on the basis of technical alkylsalicylic acids (TASK) developed are: anticorrosive and washing additives to gasolines, antiwear additive to low-sulphurous diesel fuel and antistatic additive for light oil products and hydrocarbonic solvents. It is established that existence in structure of the developed additives of an aromatic ring and big alkil radicals promotes improvement of functional properties. It is shown that additives on a basis the TASK show high functional efficiency. Thus the TASK are of considerable interest as an important component at synthesis of additives not only to oils, but also to motor fuels.

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Developments of PJSC «MidVolgaNIINP» in the field of road bitumen according to interstate standard GOST 33133-2014 **34-38**

Keywords: road bitumen; the residue oxidation; viscosity, ductility, aging and diluent of bitumen, compounding of raw materials for bitumen production.

Abstract. The article describes the main problems encountered in the transition of industrial plants from the production of road bitumen according to GOST 22245-90 towards GOST 33133-2014. PJSC “MidVolgaNIINP”, within the framework of scientific and technical support, conducted research to

determine the causes of emerging deviations in the quality of the resulting bitumen, as well as finding ways to eliminate them.

The studies were based on the actual data coming from Rosneft's industrial bitumen plants and were aimed at solving the problems faced by each specific production. The results of the research formed the basis for recommendations on the adjustment of technological processes and are worked out in the course of pilot runs.

One of the most difficult tasks was to achieve the requirements of GOST 33133-2014 in terms of "ductility at 0°C" for road bitumen brand BND 50/70. Narrow enough penetration range (51-70 ×0.1 mm) in combination with a high value of the softening temperature (51°C) in many cases led to the fact that the tar with a nominal viscosity at 80°C at 60 c and higher achievement of low-temperature performance has proven to be difficult. Studies were conducted to determine the optimal quality of raw materials with the selection of its composition, in relation to the conditions of each plant.

In addition, the influence of the oxidation process temperature on the quality of bitumen obtained in accordance with GOST 33133-2014 is considered.

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About modern approaches to the solution of problems of increase of deformability of road bitumen

39-43

Keywords: road bitumen, oxidation of the tar oil, vacuum gas oil, extract of selective purification of oils, viscosity, group composition of petroleum products.

Abstract. The article deals with the influence of the raw material composition modifiers on the deformative properties of viscous road bitumen in accordance with the requirements of GOST 33133-2014, obtained by the oxidation technology of high-viscosity tar vacuum fuel oil distillation from heavy oils of Arlano-Chekmagushevsky and medium West Siberian oil fields. For modification of raw materials widely available products of oil processing on oil refineries such as: heavy vacuum gasoil, 4 and 5 distillate fractions from VDU installations and Extracts of selective cleaning of oils were used. The studies found that group composition and the viscosity modifier has a selective effect on the deformation quality road bitumen. Therefore, their use allows to regulate quality of road bitumen purposefully.

Determined that in terms of tars from crude oils of the West Siberian and Arlano-Chekmagushevskogo deposits it is preferred to use as a modifier of 4 and 5 distillate fractions of VDU, as well as the introduction in the raw material of the oxidation of additional quantities of aromatic hydrocarbons in the composition of the modifier ESCO leads to deterioration of the deformation characteristics of oxidized bitumen.

The research results were used to develop recommendations for optimization of industrial bitumen production technology at Rosneft oil refinery.

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Analytical service of the Institute: methodological and instrumentation plus creative team

44-47

Keywords: accreditation, standardized methods, measurement methods, comparative tests, analytical control, metrological support and standardization.

Abstract. The development of the analytical service of the Institute is shown. Designated area of activity and the importance of work performed by the team, which brings together a number of independent units, but implementing a common strategy: an accurate and traceable verification of the provided test results, the expansion of the information content of the methods implementation in laboratory practice of modern quality analyzers for the solution of scientific and production tasks of the Institute and Company.

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Receiving and properties magnesium-containing alkylsalicylate additive with lowered ash-content to oils

48-51

Keywords: alkylsalicylate additive, magnesium oxide, calcium hydroxide, technical alkylsalicylic acids, neutral alkylsalicylates of magnesium, high-alkaline additive, ash-content.

Abstract. Magnesium-containing detergent additives having a low-ash content than those containing calcium or barium are of considerable interest. The complex of the experiments directed on receiving neutral salts of magnesium alkyl(C₁₆-C₁₈)salicylic acids with the subsequent carrying out a stage of a karbonatation in the presence of oxide of magnesium or hydroxide of calcium under the influence of CO₂ in the presence of various pro-motors has been conducted. Synthesis conditions were chosen and a sample of a magnesium-calcium high-alkali alkylsalicylate additive, corresponding to the recommended standards, was obtained. The researches conducted in oil M-11 have shown that developed magnesium-calcium high-alkali alkylsalicylate additive is compatible to the detergent alkylsalicylate additives Detersol-50, Detersol-140 and Kompleksal-250, the succinimide additive C-5A, the multipurpose additives DF-11 and A-22.

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Technology for production of alkylsalicylic acids by alkylation of salicylic acid of olefins

52-55

Keywords: alkylsalicylate acid (ASA), technical alkylsalicylate acid (TUSK), α -olefin, salicylic acid, alkyl.

Abstract. Alkylsalicylate additives take a special place among the additives, a detergent-dispersant action. They provide oils with high washing, antioxidant, anticorrosive and antifriction properties at elevated temperatures. Due to the difficulty of obtaining alkylsalicylate acids, these additives are produced in a limited volume.

The basis for the production of alkylsalicylate additives are alkylsalicylic acids (TASK), which are currently obtained by carboxylation of sodium alkylphenolates by the Kolbe-Schmidt reaction. The process of production of ring-Schmidt task includes the following stages: alkylation of phenol with α -olefins; distillation of phenol from the alkylation product; distillation of the unreacted fraction of α -olefins; production of sodium alkylphenolate; carboxylation reaction; production of technical alkylsalicylic acids (TASK).

This technology is a multistage and costly process with the formation of a large amount of waste in the form of salt runoff during neutralization and washing of the resulting alkylsalicylic acids. The disadvantage of this process is the low yield of alkylsalicylic acids.

In order to reduce the number of technological stages of the process and obtain a cleaner composition of alkylsalicylic additives, a technology for producing alkylsalicylic acids by alkylation of salicylic acid with olefins has been developed.

The process of alkylation of salicylic acid with α -olefins includes the following stages: alkylation of salicylic acid with α -olefins; isolation from ASC of unreacted salicylic acid and its return to the stage of alkylation.

Based on the conducted studies, it is shown that the reaction time is not a decisive condition for the process of alkylation of salicylic acid α -olefins and, to a greater extent, is limited by diffusion factors. The optimal conditions of synthesis are established: molar ratio of salicylic acid to olefins 1:1,2, temperature 120°C, reaction time 30 hours, at which the maximum transformation of salicylic acid into ask occurs.

It is established that the content of ask in washed alkylate is 28% higher than their content in task, which allows to increase the volume of production of alkylsalicylic additives by 1.3 times.

The results of the motor-bench tests showed that the additives obtained by the new technology are identical to the commodity ones and can be used in the production of motor oils that meet the requirements of GOST 8581.

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Keywords: hydraulic oil, way oil, gear oil, compressor oil, item characteristics, qualification tests.

Abstract. The import substitution programme outlined by the President and Prime Minister of the Russian Federation is one of the priorities. PJSC “MidVolgaNIINP” for more than fifty years is a leading Institute for the development of modern domestic industrial oils and has many years of practical experience in their implementation in production, in this regard, the task of import substitution of oils for industrial equipment is allocated in one of the main activities of the Institute. Currently, specialists of PJSC “MidVolgaNIINP” successfully carried out the replacement of imported lubricants at 10 or more domestic enterprises.

Foreign oils are widely used in domestic enterprises as lubricants for hydraulic systems and gearboxes of industrial equipment, sliding guides and compressor equipment. In order to reduce the dependence of domestic enterprises on the supply of foreign lubricants, qualification tests were conducted, based on the results of which the possibility of replacing imported oils with domestic analogues was determined.

The choice of domestic substitutes was made on the basis of the analysis of nomenclature characteristics of imported lubricants and conditions of their application in industrial equipment: maximum and minimum application temperatures, the presence of filtration systems, the presence of friction parts from non-ferrous metals, contact with aggressive environment, maximum loads and revolutions, etc.

First research the products of Rosneft Oil Company produced by LLC “Rosneft-Lubricants”.

In PJSC “MidVolgaNIINP” complexes of test methods for industrial oils of different function taking into account the specifications operating in the Russian Federation and abroad are made.

On the basis of the carried-out qualification tests of import and domestic industrial oils taking into account conditions of their application on the concrete equipment possibility of import substitution more than 50 brands of lubricants is defined.

The substitution of imported lubricants will reduce 20-30% of the cost of purchasing oil abroad, to ensure technological and economic independence from imports.