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Advisory-analytic agency «Safe handling waste». Overview handling of used oils.

Part 1: World experience of organizing collecting and processing (recycling) of used oils

Keywords: resource, software, industry, handling used oils, collection of used oils, processing of used oils, disposal of used oils, enterprises for processing (recycling) of used oils, organization of the collection and disposal of used oils.

Abstract. Currently, the Russian Federation has been a fundamental change in the basic normative legal acts governing the treatment of waste, including the results from the operation of petroleum products. With regard to the lubricants we are talking about used oil, the intensity of handling which is largely related to the level of economic development, industrial production and state environmental oversight.

In reforming the legislation governing the treatment used oils in the Russian Federation, it is useful to take into account the existing experience of handling (collection and recycling (recycling, recovery)) used oils in economically developed countries, having a historical aspect, as in the world as well as in the domestic scale.

Special attention worthy achievements in the organization and management of handling, as well as the development of infrastructure for the collection and processing (recycling) of used oils in the European Union.

It should be noted that in the economically developed countries waste oils are regenerated, that is, extended life cycle, which is reflected in the adopted laws and regulations.

In the Russian Federation, in the interests of manufacturers of lubricants, legally regulated disposal (recycling) used oils, that is, in general, the completion of the life cycle.

Therefore, in the Russian Federation to the development of regulations and adoption of the federal bodies of executive decisions on the organization of waste handling it is advisable to take into account the experiences and elements of the treatment used oils in Russia taking into account the risks and opportunities for producers and importers of lubricants.

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ACCENT of the ISSUE:

research products of the Azerbaijani experts

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The development of new technology for the regeneration of the waste automobile oils

Keywords: waste oil, specification, structure, regeneration, supercritical dioxide of carbon.

Abstract. The quality of waste motor oil samples with different dark color, high values of acid number, ash-content, carbon residue is considered. The article is devoted to the research on the regeneration of waste oils using SC extraction process involving carbon dioxide in its supercritical conditions. The base oils were three samples of oils for passenger cars: Castrol GTX 5 Lighter (OM–1, OM–3) – multigrade semi-synthetic oil of hydrocracking and engine oil of multigrade series Lukoil-super (OM–2) CF 4/SG semi-synthetic. The starting oil had a viscosity at 100°C 12–16.3 mm²/s, base number 6–9.4 mg KOH/g, they contain active elements Ca/Zn. Considered the quality of waste motor oil samples with different dark color, high values of acid number, ash, carbon residue. Found that oil fractions boiling up to 500°C, after purification by its qualities to meet the requirements of API Group I oils. Defining quality as waste oils and their fractions was performed in accordance with the existing requirements of the standards (ГОСТ and ASTM D). It is shown that the bulk of waste oils (81,5%) are oil fractions boiling up to 500°C, which, after appropriate purification (adsorption treatment or hydrogenation) can be used again, both independently and in a mixture with fresh oil. Waste oil from the fraction boiling above 500°C (yield 15,6%) after extraction with heptane, and SC–CO₂ can also allocate oil fraction (yield 16,8%) and the extract (yield 79,2%).

The scheme for the regeneration of the used oils comprising fractionation process with the subsequent, followed by extraction of the isolated fractions (350–500 and above 500°C) mixture of solvents SC–CO₂ with receiving basic oils and raw materials for bitumen is offered.

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The study of the chemical composition of waste motor oil samples (II report)

Keywords: chemical composition, waste oil regeneration, additives, supercritical carbon dioxide, the quantitative analysis of metal.

Abstract. The article presents the results of the study of the chemical composition of waste motor oils samples (OM) Castrol GTX and Лукойл-супер synthetic and semi-synthetic and after cleaning solvents with supercritical carbon dioxide (SC–CO₂).

It is shown that waste oils in their composition contain mostly isoparaffin structures, and the share of aromatic hydrocarbons is very small, they are characterized by dark color, high acid number and coking. It is shown that OM after purification and optional purification with SC–CO₂ and hydrogen or an adsorbent may be directed for reuse as the base substrate.

The oils are used with a set of additives to improve anti-corrosion, anti-oxidation, anti-foam properties and to reduce the pour point.

During the operation, oil additives is worn off (as evidenced by the high acidity and low base number).

The quantitative analysis of metals of the used oils is carried out, and it is found that they contain Cu, Ni and Zn. After the vacuum distillation of the used oil additive deposited in the residue.

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Optimization of process of producing conservation liquids on the basis of nitrogen containing derivatives of alkenylsuccinic acids

Keywords: regression, mathematical model, dispersion, adequacy, optimization, conservation liquid, alkenylsuccinic acid.

Abstract. Application of known conservation materials is significantly limited for several reasons, one of which is the low efficiency because of rinsability with atmospheric precipitation. In this regard, today the development of new chemical reagents of complex protective action is practically an urgent task.

For establishment of the quantitative ratios which reflecting the influence of the main factors of a technological mode and which include the ratio of (X_1 , mol / mol) VDA and TEA and concentration of inhibitor (X_2 , %) on indicators of the process (Y) was used method proactive planning of the experiment.

Mathematical expression of depending from the input parameter optimization of the independent variables is presented in the form of the regression equation.

For determining the coefficients of equation (1) we used a program S-plus 2000 Professional, developed by the Mathworks Company for automated mathematical processing of experimentally obtained data.

By the values of the linear coefficients is possible to judge on the extent of the influence of individual factors on the optimization criterion.

Hypothesis about the adequacy of the model was tested by Fischer's criterion.

Comparing the found values of criterion of F with tabular at the selected confidence probability 95% and the number of degrees of freedom $f_1 = 1$ and $f_2 = 2$, we see that the calculated values is less than tabular $F_{\text{tabl}} = 19.3$. This testifies that the equation adequately describe the response surface. Consequently, they can serve as statistical model regularities of changes of the process parameters, and can be used to solve problem of optimization.

For process of nitro compounds on the basis of tetradecinum as criterion chose a maximum of number of days of work in a hydro chamber at which corrosion of a surface is not observed yet. For the solution of optimization problem used the Matlab-6.5 program.

From the solution of the equations follows that at a ratio of initial components (VDA and TEA) that equals 1: 0,5 and their concentration – 20,5%, corrosion protection duration in a chamber G-4 equal to 160 days. Additional researches showed that at increase the quantity of concentration of an inhibitor to 22.5% the number of days increases and makes: 173, 75, 80 days accordingly in a chamber G-4, seawater and in an acidic medium.

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The research work deals with a composition of amidoamines and calcium naphthenate additive to the road bitumens

Keywords: technical petroleum acid, polyethylene polyamine dyethylenepolyamine, amidoamine.

Abstract. The purpose of this research is to improve the quantity of road bitumen producing in Azerbaijan by means of synthetic additives addition. For the additives synthesis technical oil acids, polyethylenepolyamine and diethylenetriamine were used as initial components. Various amides were synthesized on the basis of the specified compounds. Amides, synthesized using the polyethylenepolyamine : technical oil acids ratios as 4:1, 5:1 and 6:1 were established to provide the best bitumen quality. Addition of 0,5wt% amides, obtained using the technical oil acids:polyethylenepolyamine ratio 4:1 to road bitumen resulted in rise of its fragility above 100 sm, and ductility temperature –25°C. At the addition of amide, synthesized on the basis of technical oil acid and diethylenetriamine in molar ratio 2:1 the bitumen ductility amounts 100 sm at

25°, and above 20 sm at 13°C; its fragility temperatures were –24°C and – 26°C. The addition of calcium salt of technical oil acid to road bitumen raises its ductility from 10 to 31sm; fragility temperature decreases to –26°C.

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PETROLEUM PRODUCTS: TECHNOLOGY, INNOVATION, MARKET

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Application of sulfur petroleum coke in the cement industry

Keywords: petroleum coke, cement, technology, fuel, sulfur oxides, coke quality, economics.

Abstract. The problems of sulfur petroleum coke application in the cement industry have been considered. The possibility of cement production flue gases sulfur oxides removal by calcium oxide, the main feed component of cement production, have been noted. Price levels of sulfur petroleum coke and consumption potential are shown.

It was noted that residual fuel oil is not suitable as a fuel for the cement industry by its price characteristics. Petroleum coke may be interesting as fuel only if its cost is acceptable at the nozzle, compared to the cost of natural gas at the nozzle – 800–1500 rubles per ton of coke. It is important to consider that the cost of separation for the preparation of solid fuel for combustion at a cement plant is getting close to 15–20% of the cost of all the equipment and the preparation of 1 ton of solid fuel and its grinding require an additional 7.2 kW/h per 1 ton of clinker.

The elemental compositions of sulfur petroleum coke and cement have been analyzed in comparison. Both feed and petroleum coke has bound sulfur. It has been noted that the content of sulfuric acid anhydride in cement should not be less than 1.5 and not more than 3.5–4.0%, alkali oxides – less than 2%, chloride ion Cl – not more than 0.10%. However, most of the sulfur from the feed and fuel in the cement production process goes to clinker. Therefore, neutralization of sulfur oxides in the flue gases of cement production will not require significant costs.

The questions of cement production process within the possible influence of sulfur contained in the coke on the surrounding environment have been considered. An important process aspect of sulfur petroleum coke application as the fuel in cement industry in countercurrent of feed and fuel is the accumulation of acidic sulfur oxides and alkali metal compounds in the flue gases within the furnace. To avoid accumulation of sulfur oxides in the flue gases of the furnace, a part of sulfur oxides and alkali metal compounds from the flue gases are removed in the form of solid component, for example, from the cyclone precipitator, located in the bypass line. However, it is possible to eliminate the circulation of sulfur oxides and other substances in the system of cyclone heat exchangers - calciner – furnace by using direct flow scheme of feed and fuel.

Quality indicators of petroleum coke and questions of its preparation for use as a fuel in the cement industry have been analyzed. A very important task is the development of the technology of coke preparation for its further combustion. It's been noted that a lower yield of volatile substances increases the mechanical strength of the coke, which leads to increased costs for its grinding. However, volatile yield should not be low, since a significant quantity of volatile yield in the coke increases the temperature of the flare flame, and tightens the requirements to the furnace lining. Optimum volatile yield value in the coke has been defined – it is about 10–13%. An assessment of the possible fineness of sulfur petroleum coke has been executed, providing solid fuel combustion in the rotary furnace in the range of 0.1–0.3 s. It's been noted that the shorter rotary furnace, the thinner petroleum coke should be grinded. The schematic block diagram of coke preparation for combustion

has been represented. It is concluded that there is a possibility of reducing the cost of cement production without harming the environment.

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Domestic turbine oils for power generation industry. The latest achievements

Keywords: power generation industry, single shaft combined cycle turbine, turbine oil, ISO requirements, lubricating properties, oxidation stability.

Abstract. Changes currently undergoing in power generation industry move a new approach to quality of oils for electricity production from gas. Gas and steam turbines combined in single units give raising overall efficiency of the process to 50-60%. The latest developments, designed the steam, gas turbines and generator on a single shaft, have led to conclusion, that the lubricants should meet the requirements for the lubrication all pieces of equipment. Standard ISO 8068, issued in 2006 year, gives current specification for modern turbine oils. Our article describes performant properties of two Russian turbine oils (ТП-22Б and ТП-СУ), which fully meets requirements for categories ISO-L-TSA and ISO-L-TGA ISO 8068:2006. The oils production has started by Russian companies in 2013 and 2014 years. The authors believe that the oils could be used in all categories of gas and steam turbines on Russian power plants.

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HISTORY PAGES

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Development of catalytic refining processes. The historical aspect

Keywords: catalytic cracking, catalytic reforming, hydrodesulfurization, hydrocracking.

Abstract. Catalytic processes largely determine both the depth of oil refining and getting products to meet the latest environmental standards. Most development in the world oil refining has catalytic cracking of distillate and residual materials, as well as hydrogenation of petroleum distillates.

The overall performance of catalytic cracking units in the United States is over 250 million tons/year by raw material. This process is very widely developed in the countries of Western Europe. The total capacity of catalytic cracking units in the United States reached more than 35% of the capacity of primary oil refining, 15,0% – in Western Europe, and 10,0% – in Russia. The total capacity of hydrotreating processes in the United States achieved about 55% of the capacity of primary oil refining (49% – in Western Europe and 27% in Russia).

Simultaneously with the hydrotreating process, refineries worldwide mastered process of catalytic reforming of straight-run gasolines. In 1949, the company UOP developed industrial technology of the process, based on the use of aluminum platinum catalyst. During 50–60's various modifications of catalytic reforming became the basis for the production of high-octane gasoline. Along with gasoline and aromatic hydrocarbons, catalytic reforming process can yield large amounts of hydrogen (about 1% by wt. on feedstock), which contributed to the further development of hydrogenation process.

In 1959 in the industrial practice of overseas refineries was used a new catalytic process – hydrocracking (“Chevron” Corporation, “isocracking” process). This process can yield large amounts of light oil of the highest quality. Due to the presence of cheap hydrogen on modern refinery hydrocracking process was rapidly accepted worldwide. Despite the high capital investment, hydrocracking unit are constructed at many refineries. The total capacity of hydrocracking unit reached in US – more than 9,0%, in Western Europe – about 7,5%, in Russia – about 2,0% of primary oil refining.

A major role in improving of process of catalytic cracking and hydrocracking played new highly effective catalysts on the basis of zeolites (molecular sieves).

These catalysts promote a significant increase in the yield of light petroleum products, in particular in catalytic cracking zeolite-containing catalysts provide an increased yield of high-octane gasoline from vacuum

distillates at minor reconstruction of systems. In the hydrocracking process also attained a better conversion of feedstock to produce high-quality products.

The past 20 years mainly constructed catalytic cracking units under foreign licenses on the basis of technology, providing preliminary hydrotreating of feedstock. Special place is occupied by catalytic cracking unit with sulfur vacuum distillate (without hydrotreating), built in TAIF-NK (Nizhnekamsk). All in all under the development of domestic institutes in CIS and Baltic countries were built units of hydrotreatment: 63 – for straight-run distillate feedstock; 8 – for fuel vacuum distillates; 16 – for oil fractions. Currently, most of the diesel hydrotreating units are switched on the work with the receive of low-sulfur products (sulfur content – less 50 ppm and less than 10 ppm) which meet the requirements of Euro-4 and Euro-5 standards.

A variation of deep hydrocracking in suspended phase is hydroconversion of oil residues, developed by specialists INHS RAS and GrozNII. In the basis of hydroconversion lies fundamentally new type of catalytic process in which directly in the reaction medium is formed a catalyst with particles diameter less than or equal to the size of asphaltene associates. For this purpose, added to the feedstock precursor of catalyst, consisting of salts of metals of groups VI-VIII is used.

According to the General plan of development of Russian oil refining until 2020, it is scheduled to introduce in domestic refineries of 126 new technological processes, 116 of them – under foreign developments, and only 10 – under developments of Russian research organizations.

This predominance of foreign licensors poses a threat to national security. Given the urgency of the problem of import substitution seems to appropriate to review the list of these objects licensors involving the creation of new technological installations predominantly of Russian developers.

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