The temperature of reaction furnace of a typical Clause Sulfur Recovery Unit is adjusted to ensure suitable NH_3 destruction. Moreover, the inlet temperatures of SRU converters are determined in order to achieve proper conversion without any processing problems. The process temperatures are important in designing the Claus sulfur recovery units.

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PRODUCTION OF SULFONATE ADDITIVES FOR LUBRICATING OILS FROM PETROLEUM AND SYNTHETIC FEEDSTOCKS

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This article gives a brief overview of the stages of production and mechanism of action of sulfonate additives (detergents). The prospect of switching to synthetic raw materials in the production of high-alkali sulfonate additives at the enterprise JV «LLK-Naftan» is considered.

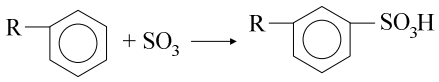
JV «LLK-Naftan» has the largest and most complex facilities for production of lubricant additives in the CIS area. The assortment of manufactured additives and additive packages for lubricating oils includes products of different functional groups capable of providing a wide range of operating properties of modern and prospective lubricants. A special place among the additives, according to their universality of application, efficiency, production volumes, occupy sulfonate additives that have detergent, dispersant, neutralizing and anti-corrosion properties.

The main purpose of detergent and dispersant additives is to prevent the deposition of oxidation products and their consolidation on metal surfaces, reducing the amount of residue, and carbon deposits on the details.

The synthesis of additives depends on the choice of raw materials and a sulfonating agent. As a raw material for petroleum sulfonates (C-150, C-300) highly purified oil distillates are used. Sulfonate additives CCK-300, CCK-300D, CCK-400, and CCK-400D NSSK-30 are produced on the basis of synthetic materials, for example, sulfonate additive CCK-300 is synthesized on a synthetic alkyl benzene sulphonic acid.

The production process of sulfonate additives consists of the following steps:

1) Oil-sulfonation with gaseous sulfur trioxide:



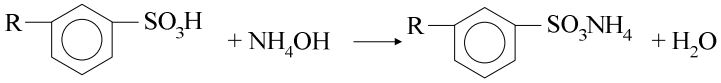
Adverse reactions:

$SO_2 + H_2O \rightarrow H_2SO_3$;

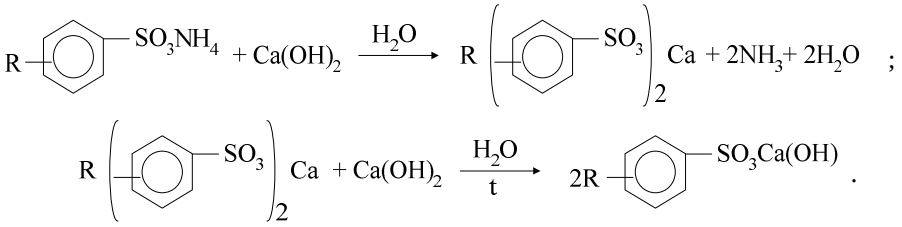
$SO_3 + H_2O \rightarrow H_2SO_4$.

2) Separation of the acid tar from oil.

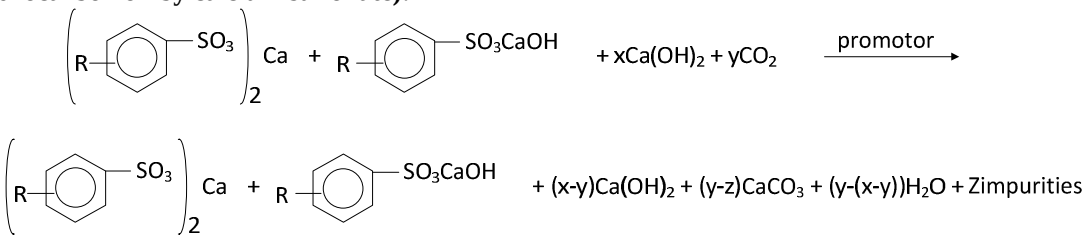
3) Neutralization of the sulfonated oil and extraction of ammonium sulfonate:



4) Stage of exchange reaction (exchange decomposition reaction) and partial receiving of calcium sulfonate salt as a result of «thermal stabilization»:



5) Carbonation (receipt of the colloidal dispersion of hydroxides and calcium carbonate stabilized in hydrocarbon oil by calcium sulfonate):



where x, y, z – coefficient

Carbonation step should be conducted so that the overbased products obtained colloidal stability of not less than 80 %.

6)Stripping reaction of methanol and water after the step of carbonation.

7) Purification of carbonated product from mechanical impurities.

The Stage of mechanical purification is important for products with a maximum colloidal stability.

8) Distilling of the solvent from the additives after the purification step [1].

The mechanism of action of detergent additives (detergents) can be explained by their adsorption on the surface of the insoluble particles in the oil. As a result, a sheath is formed on each particle of hydrocarbon radicals which are converted in the volume of oil. It prevents the coagulation of particles of pollution, and their contact with each other. Polar molecules of additives form an electric double layer, which gives similar charges to the particles on which they are adsorbed [2]. Due to this the particles repel and the probability of their incorporation in large aggregates decreases (Fig. 1).

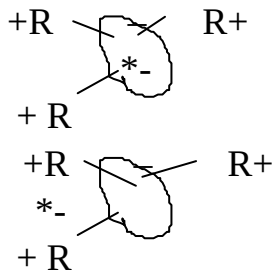


Fig. 1. The mechanism of action of detergent additives

Level of the ability of the detergent to neutralize the acid is characterized by its base number. The higher the value of the base number, the better the effect of the detergent. Model of the structure of the overbased sulfonate is shown in Figure 2.

Overbased sulfonate additives of JV «LLK-Naftan» company are involved in the production of multifunctional packages for multigrade engine oils for passenger cars and commercial vehicles.

The traditional additives production technology at JV «LLK-Naftan» by sulfonation petroleum feedstock has a number of drawbacks [3]:

– Insufficient dispersing properties and low thermal stability of resulting additive.

– The low output of the desired product.

– A significant share of by-products.

– Low environmental efficiency of the technology.

Switching to the industrial production of sulfonates based on synthetic raw materials provides the following advantages:

1. The reduction of the technological production chain (the stages of raw materials sulfonation with sulfuric anhydride, separation of acid tar from oil, neutralization of the sulfonated oil, extraction of ammonium sulfonates are excluded).

2. The increase of target product output by 52 %.

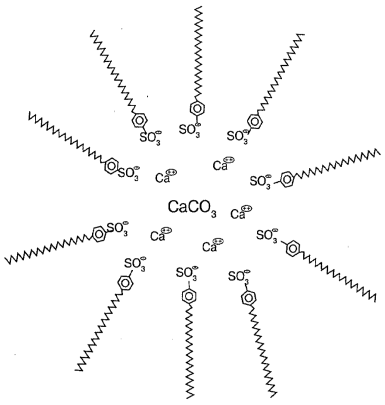


Fig. 2. Model structure overbased sulfonates

3. Ensuring the company's competitiveness in the long term.

4. Increase of profit by 60 %.

5. Solution to the problem of realization of by-products obtained during the process of sulfonate additives production.

6. Independence from the «Naftan» in terms of supply of raw materials for the sulfonation.

7. Will enable JV «LLK-Naftan» to become one of the largest producers of oil for modern engines of automotive technology in Eastern Europe.

Thus the transition to the synthetic base production of overbased sulfonate additives is economically and technologically practical.

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OUTLINE OF LOCAL ADDITIVES PRODUCTION PROBLEMS

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The article describes the actual problems of local additives manufacturing. Analysis of the lubricants quality is performed.

In order to satisfy the consumer needs in respect of car market production, today engineers are obliged to construct that sort of internal-combustion engines which will provide durable and good mechanism working under extremely severe conditions. However, perfection of engines construction leads to increasing of the load which present-day lubricants must withstand to satisfy the requirements of modern technique. Simultaneously the environmental aspect is considered which consists in the toughening of requirements imposed on the quality and composition of the lubricants produced. It is impossible to update the quality of marine, motor and gear oils without inserting of high-quality additives of different functionality in their composition for the reason that additives give the required functional properties to oils. Nevertheless, there are tendencies to reduce the content of additives in commercial oils and to increase its quality defined by the environmental requirements for the relevant products. In this way a difficult task is set before the manufacturers of additives, which includes the production of goods which will be competitive on the world market because of their high quality and at the same time will be characterized by low additives content.

One of the ways to improve the oils quality is to expand the range of additives. Unfortunately at present additives packages are formed and inserted into base oils only depending on their functional effects. However, the fact that the presence of several additives may cause changes in the intermolecular interactions of the solutions of additives in the oil as well as the solubility of additives in different base oils is not taken into account. Eventually all this factors lead to deterioration in the quality