Processes involving the removal of sulfur compounds from gases and liquid petroleum products are analyzed. Economic expediency of the implementation of low-waste methods of demercaptanization of gases, gasoline and kerosene cuts, gas condensates, and light crudes with the polymeric catalyst KSM is substantiated. A complex desulfurization flow plan, which permits maximum extraction of natural sulfur-organic compounds, lowering of the content of total sulfur in the light cuts, and improvement of hydrofinishing conditions of the heavy cuts is proposed.

Demercaptanization of Light Hydrocarbon Stock – Demer-LHCS

Of the existing methods employed for the demercaptanization of light hydrocarbon stock (LHCS), methods of the alkali extraction of mercaptans with regeneration of saturated mercaptides of the alkali solution by oxidation with atmospheric oxygen in the presence of a homogeneous [1], or heterogeneous [2] phthalocyanine catalyst have come into the most widespread use.

Merpeisov et al. [3] propose a method for the alkali-free “dry” demercaptanization of liquefied gases, gasoline, kerosene, gas condensates, and crude by passing the stock with air over an MARC catalyst via a filter with a catalyst, or by inducing contact between the product being treated and the stoichiometric amount of air directly in the flow of stock – in the pipelines and settling tanks. This method is non-regenerative, and in contrast to extraction methods of alkali treatment, does not permit recovery of mercaptans from gases and gasolines, i.e., reduction in the total-sulfur content of the latter.

The catalyst in the homogeneous-catalyst process of alkali treatment [1] is dissolved or dispersed in the alkali solution, and circulates with it in the treatment system from the extractor to the regenerator, and back to the extractor. The presence of a catalyst in the alkali solution results in oxidation of the mercaptides with the formation of disulfides both in, and beyond the regenerator – in the pipelines and the extractor itself (due to the existence of residual oxygen in the regenerated alkali solution). The disulfides that are formed beyond the regenerator proceed into the extractor from the alkali in the product being treated, increasing its total-sulfur content and liquid resid.
which can be strictly regulated in the gases in accordance with GOST 20448–90.

Moreover, the water-soluble phthalocyanine catalysts are neither chemically nor thermally stable, and are subject to hydrolysis in alkaline media; this limits their service lives to 3-4 months in the alkali-treatment system. The alkali solution of the KTK catalyst is considered spent, and is replaced by a fresh KTK solution when its concentration of free alkali is reduced to $\leq 6\%$ by weight; this will also result in contamination of the discharges by alkali and metal salts.

As compared with familiar domestic and foreign analogies, use of the polymer-based heterogeneous catalyst KSM for regeneration of the mercaptide-containing alkali is a basic advantage of the Demer-LHCS process (Fig. 1). The composition and procedure employed in the preparation of this catalyst promotes stable retention of the catalytically active components in the polymer carrier, their increased resistance to catalytic poisons, alkalis, and thermal effects, and stable activity over their entire industrial service life. This eliminates flushing of catalytically active components from the KSM catalyst and their access to the alkali solution, the need for periodic or continuous replenishment of the KCM with expensive salts of variable-valence metals, and undesirable contamination of industrial discharges.

The KSM catalyst is produced in the form of a stereoregular-packing unit with a developed geometric surface, which contributes to improved mass exchange between the alkali being regenerated and the air. It is securely fixed in the regenerator; this limits the sphere of action of the catalyst, preventing oxidation of the mercaptides that remain in the alkali with the formation of disulfides beyond the regenerator.

The Demer-LHCS process is used for the demercaptanization of the butane-butylene cut (BBC) in all plants designed for the combined refining of G-43-107 and KT-1 crudes of the former USSR. These plants have operated successfully from 1990-1996 to the present at the Mazheikia, Moscow, Ufa, and Lisichansk oil refineries. The process in question was introduced to the Novo-Yaroslav refinery for demercaptanization of the propane-butane-butylene cut with a 1A/1M cat cracker in 2000 [4], and at oil refineries operated by