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NEW C, S, N-CONTAINING PLASTIC LUBRICANTS AS PRODUCTS OF COMPLEX PROCESSING OF INDUSTRIAL WASTE

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Анотація

Досліджена комплексна переробка промислових відходів різних виробництв, що дозволило зменшити використання матеріальних та енергетичних ресурсів та покращити екологічний стан навколишнього середовища. Комплексній технологічній переробці підлягали відходи хімічної, нафтохімічної, машинобудівної та харчової промисловості.

При цьому використовували регенерований сумішевий сорбент (активоване вугілля + кізельгур), на поверхні якого проходили топохімічні перетворення хімічних речовин, що входили до складу промислових відходів. Очищення відпрацьованої індустріальної оливи, яка складала мінеральну основу розроблених нових С, S, N-вмісних пластичних мастил проведено з використанням регенерованого сумішевого сорбенту. Дослідження трибологічних властивостей нових С, S, N–вмісних пластичних мастил показали їх високі протизношувальні і термостійкі властивості та можливість ефективного використання у високонавантажених вузлах тертя.

Ключові слова: комплексні технології, промислові відходи, пластичні мастила, сорбція, модифікована поверхня, топохімічні реакції.

Abstract

The complex processing of industrial waste from various industries was studied, which made it possible to reduce the use of material and energy resources and improve the ecological state of the environment. Chemical, petrochemical, machine-building and food industry wastes were the subject for complex technological processing.

At the same time, a regenerated mixed sorbent (activated carbon + kieselguhr) was used, on the surface of which topochemical transformations of chemicals that were a part of industrial waste took place. The purification of used industrial oil, which was the mineral basis of the developed new C, S, N-containing plastic lubricants, was carried out using a regenerated mixed sorbent. Studies of the tribological properties of new C, S, N-containing plastic lubricants have shown their high anti-wear and heat-resistant properties and the possibility of effective use in highly loaded friction nodes.

Keywords: complex technologies, industrial waste, plastic lubricants, sorption, modified surface, topochemical reactions

Introduction

The production of oils is the most valuable product of oil processing. 1 barrel (159 dm3) of crude oil must be spent to produce 1 dm3 of oil by vacuum distillation, therefore, in order to rationally use this important natural resource, used oils must be considered as a valuable secondary industrial raw material. Production of modern plastic lubricants is connected not only with technological issues of their production, but also with the market value of their components (MoS2, ultradispersed diamonds, fullerenes). Such functional additives provide high multifaceted functional properties of plastic lubricants within the framework of the circular economy. In this regard, the circular economy is considered as a new economic model capable of limiting the use of natural and energy resources and reducing the negative impact of industrial production on the environment [1].

Modern plastic lubricants, which include lubricating fluids (petroleum, synthetic, vegetable oils), organic and inorganic thickeners (Li, Na, K, Ca - soaps, highly dispersed modified silicon dioxide, oleophilic graphite, molybdenum disulfide and other compounds) and functional additives of various purposes, ensure reliable operation of friction pairs of machines and mechanisms, for example, in conditions of high temperatures and loads [2,3]. At the same time, plastic lubricants must be considered as a highly structured dispersed phase, which, due to adsorption, capillary and other physical bonds, keeps the dispersed medium / lubricating liquid in its three-dimensional framework. Especially effective are modified nanoscale thickeners, which are formed directly on a solid surface due to topochemical reactions [4].

Results of research

A comprehensive approach to purification industrial waste from various industries is based on the effective use of regenerated mixed sorbent (AC + K) from food industries [5-7]. At the same time, the sorbent (AC + K) was used for the direct purpose of purification the circulating water of the processing of obsolete pesticides and galvanic washing waters, respectively, cycle I and cycle II, which are shown in the logistic scheme of industrial waste treatment of various industries (Fig. 1).

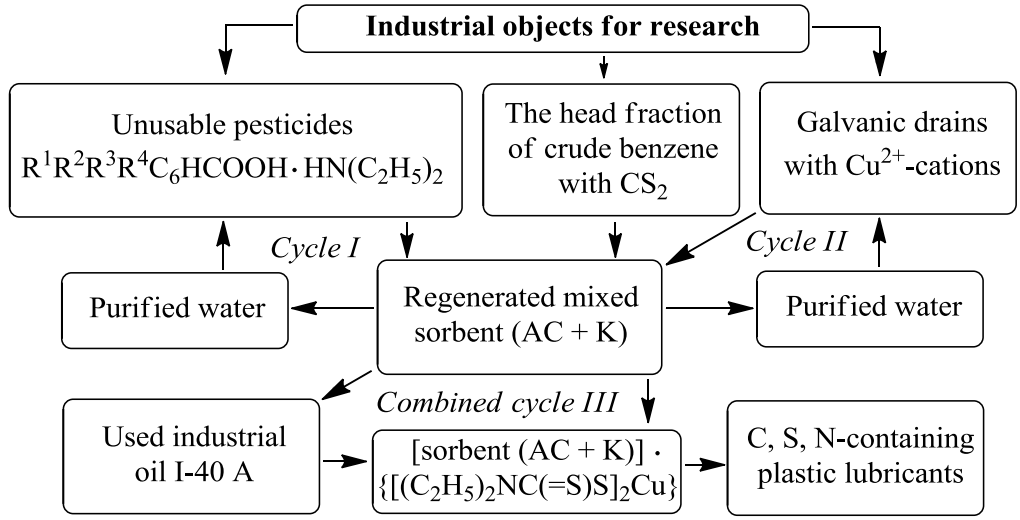

Fig. 1. Basic technological scheme for obtaining C, S, N-containing plastic lubricants using industrial waste from various industries

In addition to sorption purification and reagent separation of active substances of industrial facilities, the research includes technological aspects of the integration of separated chemical components into the demanded final product, namely new C,S,N-containing plastic lubricants. Today, plastic lubricants based on sodium, sodium-calcium, complex calcium and lithium components no longer meet the increased conditions of operation of modern equipment. The issue of developing new, highly effective and multipurpose plastic lubricants that ensure the operation of machines and mechanisms in a wide range of temperatures, workloads and aggressive environments is particularly relevant [2].

It should be noted that the developed new C,N,S-containing plastic lubricants included a new thickener in the form of a structured frame with a modified surface (Fig. 2), which provided them with high operational properties. Modification of the surface of activated carbon (AC) was provided by the final adsorption of bis-(diethyldithiocarbamato)copper(II), and the surface of kieselguhr (K)/silica gel by the formation of surface structures between the sorbed fragment of monoethanolamine and ethylamine (N→B) borane (Fig. 2).

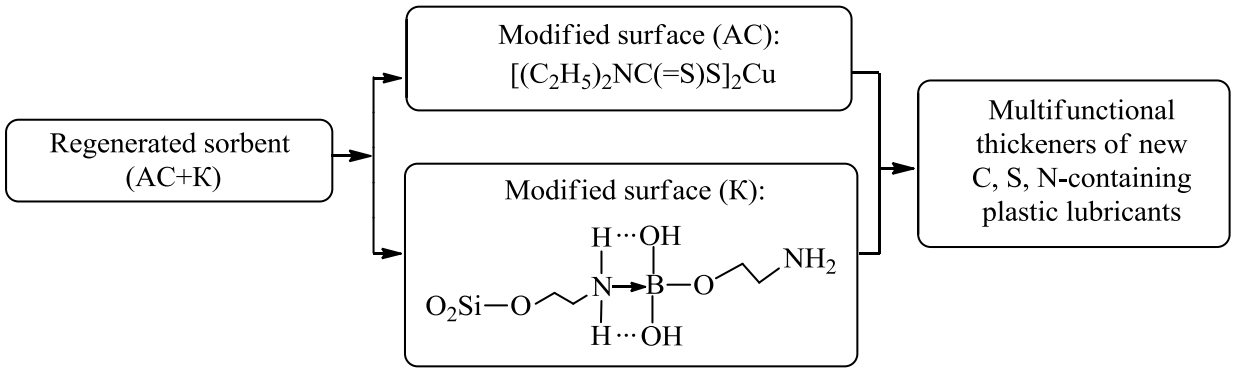

Fig. 2. Scheme of formation of structural framework fragments of new C, S, N-containing plastic lubricants

Performed laboratory studies showed that the temperature of the PM-6 – PM-9 lubricating composition in the friction nodes did not exceed the standard requirements according to GOST 1033-79, and the surface of the bearing rolls remained clean, smooth, without rolls and cracks after 12 months of preventive observations.

Conclusions

The performed research proposed a complex technology for the processing of industrial waste from various industries with the production of new C,S,N-containing plastic lubricants based on them. The perspective of using the developed new C,S,N-containing plastic lubricants in industrial machines and units is shown.

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