

Basic Principles of Recycling Waste Plastic Lubricants into Boiler Oils and Marine Fuels

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Abstract

The article presents the results of a study aimed at confirming the possibility of processing waste plastic lubricants - various types of boiler and motor fuels. This approach will allow for the disposal of hazardous industrial waste while simultaneously generating additional thermal and electrical energy and minimizing the negative impact on the environment. The direct use of waste plastic lubricants as boiler fuel, as well as the products of its thermal and thermocatalytic processing into compounded boiler and marine fuels, was investigated. It has been established that when burning used oils, compared to fuel oil of brand 100, a smaller amount of carbon (by 0.215-0.715 %), sulfur dioxide (by 17.9-20.24 %), nitrogen dioxide (by 1.43-5.39 %), carbon monoxide (by 1.41-5.77 %) and benzene (by 0.39×10^{-5} to 0.46×10^{-5}) is formed. When compounding fuel oil of brand 100, 25-40 % of the 200-350°C fraction obtained by thermal cracking of used plastic lubricants, it is possible to obtain a composite boiler fuel with a kinematic viscosity at 80°C of 50-85 mm²/s and a pour point of 10-25°C. By subjecting used greases to thermocatalytic cracking, it is possible to obtain a fraction with boiling points of 180(200)-360(380)°C, which, in accordance with ISO 8217:2017, is promising for the production of distillate marine fuels of grades DMA, DFA, DMZ, DFZ.

Keywords: Waste lubricants; Preparation; processing; Thermal cracking; Thermocatalytic cracking; Boiler fuel, fractions; Marine fuel; Combustion products; Energy carriers; Environmental friendliness.

1. Introduction

The development of principles and technologies for utilization of the used end product, together with minimization of the negative environmental impact from emissions arising from their implementation, is an essential component of solving the problem of recycling of used lubricants. Creating a closed cycle from the production of greases to their disposal after the loss of consumer properties is a priority task for the industry. Such an approach will ensure the sustainable functioning of the country's circular economy, which is aimed at the efficient use of resources, minimizing waste and keeping products and materials in circulation as long as possible. The implementation of the specified economic model will partially solve the problem of raw material shortage through a more complete use of secondary raw materials.

2. The objective of the research

Considering the regeneration of used greases directly, it should be noted that this area is very complex and requires significant production costs for its implementation due to contamination of greases during their operation and deep chemical transformations in their chemical composition. In addition, after regeneration, additional amounts of thickener, filler and additives must be added to the resulting product to achieve a certain level of performance, which in turn increases the cost of the final grease product.