

TECHNICAL SCIENCES

STUDY OF THE ENVIRONMENTAL IMPACT OF AROMATIC HYDROCARBONS IN PETROLEUM PRODUCTS

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<https://doi.org/10.5281/zenodo.7779024>

Abstract

In the article, the effects of aromatic hydrocarbons in oil and oil products on the environment and ways of their entry are investigated. The aim of the article is to reveal the toxic effect of aromatic hydrocarbons in petroleum products on nature and living organisms, as well as on human health. However, due to their carcinogenic effect, polycyclic aromatic hydrocarbons are included in the list of priority pollutants of the European Union (EU) and the Environmental Protection Agency (EPA) .

Keywords: oil, environment, hydrocarbon, soil, composition.

Introduction

Pollution of the environment with oil and oil products is currently one of the most widespread reasons for the degradation of natural complexes. This is caused both by the accidental results of the activities at the oil and gas complex facilities, and by everyday pollution problems (leaks, unavoidable losses, etc.). The result of this situation means large-scale pollution of lands and soils, groundwater, removal of land from economic circulation, as well as the need for significant costs for the restoration of damaged natural complexes. In such a situation, the problem of identifying various pollution sources that are formed, accumulated, and damage the environment over a long period of time is very relevant [1].

Soil contaminated with petroleum hydrocarbons adversely affects the development of plants and reduces productivity in the agricultural region. Sometimes agricultural land becomes unusable due to loss of productivity. Waters polluted with petroleum hydrocarbons affect the flora and fauna of aquatic ecosystems. The penetration of oxygen becomes difficult and the balance of the marine ecosystem is disturbed. Since petroleum hydrocarbons are currently one of the main sources of fuel in the world, the use of its products should not be neglected [2].

The main environmental problems in urban and industrial areas are polycyclic aromatic hydrocarbons (PAHs). In the atmosphere, PAHs can react with pollutants such as ozone, nitrogen oxides, and sulfur dioxides. PAHs can be degraded by some microorganisms in the soil. PAHs pollutants have a high molecular mass, PAHs with 4 or more condensed aromatic rings are considered more hazardous than 2- and 3-ring PAHs due to their potency. The behavior of PAHs in the environment depends on properties such

as how easily they dissolve in water and how easily they evaporate in air. PAHs are real pollutants in all areas of the environment: atmosphere, inland and sea water, sediments, soil and vegetation. PAHs (known for their potent mutagenic, carcinogenic and toxic properties) consist of carbon and hydrogen atoms arranged in fused benzene rings. There are thousands of PAHs compounds in the environment , but in practice the analysis of PAHs is limited to identifying 6-16 PAHs as priority pollutants, some of which are e.g. benzo (a) pyrene, chrysene, benzo (a) anthracene are considered potential human carcinogens. PAHs are the most toxic of the hydrocarbon family. Each type of PAHs differs significantly in its physical and chemical properties. The last century of industrial development has led to a significant increase in the concentration of PAHs in the natural environment. A study of the composition of PAHs in ice cores from Greenland showed that the current level of these compounds is about 50 times higher than in pre-industrial times[3].

Pollution with biotoxic aromatic hydrocarbons from various sources seriously affects the clean environment (soil, air, water) and human health. Aromatic hydrocarbon pollution has led to the development of various technologies and strategies for environmental remediation. However, many problems remain unsolved, and remediation of objects contaminated with aromatic hydrocarbons is still a difficult issue [4].

Jet fuel is a complex mixture of thousands of different types of hydrocarbons. The refining process separates crude oil into streams with different boiling points, and kerosene is obtained from the middle distillate fraction of jet fuel. Depending on the geological source of the crude oil, there are various compositional variations, which will cause kerosene to

fluctuate in its complex mixture of aliphatic, aromatic, and heteroatomic compounds, typically with a wavelength in the range of 8 to 16 carbon numbers [5]. This indicates the introduction of aromatic hydrocarbons into the atmosphere from the fuels used by vehicles.

The main component of automobile gasoline is the components of catalytic reforming and catalytic cracking of oil. As a result of research, it was determined that the gasoline of Internal Combustion Engines contains complex condensed tricyclic arenes, and its composition includes phenanthrene, anthracene, as well as their isomers [6].

Environmental pollution adversely affects the ecosystem and its biota. The environment is polluted by human activities and to a lesser extent by natural influences. One of the causes of environmental pollution is oil and gas exploration and related activities. Typically, crude oil and natural gas account for more than 50% of global energy sources. Crude oil is a complex mixture of several compounds divided into various products, including various brands of gasoline, various lubricants, various brands of kerosene, jet fuel, diesel fuel, furnace oil and other chemicals are also petroleum products. Crude oil exploration is carried out both in the sea and on land. For example, offshore oil rigs in Nigeria have pipelines that transport crude oil to leased tanks. Crude oil pipelines can be damaged and cause oil spills. Either way, it can have additional effects on the ecosystem. In the soil, this can lead to changes in its physico-chemical and hydrocarbon composition. The change affects a variety of areas, including microbes, insects, vegetation, and nature. Impacts can lead to direct habitat change, mortality and indirect loss of food resources. However, crude oil is also an energy source for some primitive organisms, such as microbes, especially hydrocarbon-using bacteria and fungi. Oil is a complex mixture of hydrocarbons (aliphatic and aromatic) and organic-metallic complexes such as heavy metals (vanadium, lead, chromium, nickel, etc.). Polycyclic aromatic hydrocarbons is a method to determine their sources, the type of hydrocarbons [7].

Today, due to rapid industrialization, environmental pollution is one of the critical issues facing environmental scientists. The oil industry is one of the main industries that release hydrocarbon pollutants into the environment. Polycyclic aromatic hydrocarbons are priority pollutants released into the environment as a result of oil industry exploration activities. Oil the accumulation of hydrocarbon pollutants is dangerous for human life and aquatic biota [8].

Hydrophobic organic pollutants are a class of compounds that pose a high risk to human health and ecological systems. Polycyclic aromatic hydrocarbons are ubiquitous pollutants in the urban atmosphere. Polycyclic aromatic hydrocarbons enter the environment through incomplete combustion of fossil fuels and accidental leakage of petroleum products, as components of products such as creosote. Due to the

carcinogenic effect of PAHs, they are included in the list of priority pollutants of the European Union (EU) and the Environmental Protection Agency (EPA) [9]. Benzo(a)pyrene (BaP) is evaluated as a marker of the carcinogenic potential of a mixture of polycyclic aromatic hydrocarbons. Lands surrounding crude oil refineries and fuel storage facilities are among the places where PAHs pollution has been detected on an industrial scale. Marine pollution caused by oil spills is one of the most widespread environmental and economic problems worldwide. The transport and distribution of PAHs in the environment is mainly regulated by their physicochemical properties. PAHs have been recognized as a potential health risk due to their chemical stability, high resistance to various types of degradation, and high toxicity to living organisms.

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