Book of Abstracts

Sixth International Conference of the CIS IHSS
on humic innovative technologies
"Humic substances and ecoadaptive technologies"
(HIT-2021)
September 25–29, 2021
Sailing Club “Vodnik”, Moscow Region, Russia

Crossref DOI: http://doi.org/10.36291/HIT.2021

Edited by Irina V. Perminova, Anna N. Khreptugova,
Natalya A. Kulikova

Desktop publishing by Konstantin S. Larionov
Cover design by Alla Komarova

DOI assignment by Sergey A. Vladimirov

Non-Commercial Partnership “Center for Biogenic Resources “Humus Sapiens” (NP CBR “Humus Sapiens”)

http://www.humus.ru/hit-2021
Moscow – 2021

The humic acids impact on the photodegradation process of alkylphenols

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Keywords: humic acids, photodegradation, excilamps, alkylphenols

DOI:10.36291/HIT.2021.051

Humic acids (HAs) play an important role in the process of migration of pollutants by controlling their flows in the environment and reducing toxicity. HAs cannot be synthesized from other substances, it can be found only in natural sources: soil, peat or brown coal. However, modification of humic acids properties is possible under the influence of, for instance, mechanochemical or photochemical actions or other chemical methods. HAs can absorb light and transfer light energy to other components of aqueous solutions, in some cases strongly influencing the photolysis of xenobiotics. Research on the spectral-luminescent properties of different HAs samples is relevant since it determines the influence of optical radiation of natural and technogenic origin on biogeosystems.

Alkylphenols are world widely detected in aquatic environments, sediments, soil, air and organisms tissues [1]. Alkylphenols are released into aquatic environment as major metabolites of non-ionic surfactants widely used in a variety of industrial, household and commercial application [2]. Moreover, the usage in the production of phenol/formaldehyde-based resins also contribute to alkylphenols occurrence in environment.

The absorption and fluorescence spectra of different samples of humic acids (HAs) are investigated. The samples of HAs were prepared from peat of Arkhangelsk Region. The comparison of this HAs with the samples of humic acids obtained from Aldrich Chemical Co is carried out. The effect of UV radiation from excilamp (KrCl, 222 nm) on the spectroscopic properties of humic acids has been investigated. 2,6-Bis(hydroxymethyl)-4-methylphenol (Aldrich Chemical Co) was selected as a alkylphenolic compound. The presence in the water solution of phenol compound the humic acids has a noticeable effect on the processes of photochemical degradation under the action of UV radiation. The fluorescence intensity of the mixture drops sharply after irradiation, to a much greater extent than in substituted phenol. This allows us to conclude that the addition of Aldrich humic acid significantly increases the photodegradation of the compound under study. The addition of peat humic acid leads to much weaker changes in the absorption and fluorescence spectra of the mixtures, though in the same direction as the addition of the Aldrich humic acid.

HAs were found to have an enhancing effect on the degradation of substituted phenol, which could be due to various processes. First of all, humic substances are important photosensitisers in soil and water environments, due to their ability to produce reactive species under irradiation. This effect may be also caused by energy transfer and by formation of charge-transfer complexes.

Acknowledgements. This work was performed within the framework of the State Assignment of the Ministry of Education and Science of the Russian Federation (Project No. 0721-2020-0033).

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