



# Humic substances and plant raw materials in the context of a closed-loop economy

Tenth International Conference of the CIS IHSS  
on Humic Innovative Technologies

September 25-27, 2025  
Syktyvkar, Russia

**International Humic Substances Society,  
Chapter of the Commonwealth of Independent States (CIS)**  
**Federal Research Centre "Komi Science Centre of the Ural  
Branch of the Russian Academy of Sciences"**  
**Institute of Biology of Komi Science Centre of the Ural Branch  
of the Russian Academy of Sciences**  
**RITM Carbon Consortium**  
**Isaev Centre for Forest Ecology and Productivity  
of the Russian Academy of Sciences**

## **Book of abstracts**

### **Tenth International Conference of the CIS IHSS on Humic Innovative Technologies**

# **Humic substances and plant raw materials in the context of a closed-loop economy**

September 25-27, 2025

Syktyvkar, Russia

**Syktyvkar, Russia  
IB FRC Komi SC UB RAS  
2025**

УДК 547:631.417:615.32

ББК 24.73:41.8

Н 91

**Edited by Dr. Evgeny D. Lodygin**

Н 91        **Humic substances and plant raw materials in the context of a closed-loop economy** : book of abstracts : Tenth International Conference of the CIS IHSS on Humic Innovative Technologies : September 25–27, 2025, Syktyvkar, Russia. – Syktyvkar : IB FRC Komi SC UB RAS, 2025. – 69 p.

ISBN 978-5-6053974-2-7 (Electronic book)

This book contains abstracts of reports from the Tenth International Conference of the CIS IHSS on Humic Innovative Technologies “Humic substances and plant raw materials in the context of a closed-loop economy”. The conference covers a wide range of topics, from the theoretical foundations of the molecular analysis of humic substances and plant raw materials using modern analytical methods, to new applications of artificial humification products and the processing of plant biopolymers within the bioeconomy and circular economy. It also discusses the role of humic substances and soil organic matter components in the carbon cycle in terrestrial and aquatic ecosystems. Particular attention is paid to the use of humic preparations and plant raw materials in nature conservation and biomedical technologies. **Abstracts published in the author's edition.**

УДК 547:631.417:615.32

ББК 24.73:41.8

ISBN 978-5-6053974-2-7 (Electronic book)

DOI: 10.5281/zenodo.17198173

© IB FRC Komi SC UB RAS, 2025

## CONTENTS

<b>1. Modern analytical methods for studying humic substances, soil organic matter and plant raw material.....</b>	<b>9</b>
Byvsheva S.M., Volkov D.S. Calibration-based assessment of molecular formula assignment accuracy in UHRMS analysis of humic substances using a flavonoid reference material.....	10
Chabina E.A., Ishwah B., Andrianova M.Ju. Optical characteristics of urban waters containing humic substances .....	11
Cherepanov I.S., Egorova A.I., Tarasova D.A. Study of furan derivatives formation from the carbohydrate raw material under thermal conditions using PY-MS and FTIR spectroscopy methods .....	12
Djalilova G., Nurullaev A. Study and modeling of soil erosion processes under artificial rainfall conditions .....	13
Gruzdev I.V. Soil organic compounds determination by gas chromatography-mass spectrometry .....	14
Khreptugova A.N., Gorbunov D.M., Volkov D.S., Perminova I.V. Predictive modeling of antioxidant activity in fulvic acid fractions based on HRMS and fluorescence data .....	15
Khreptugova A.N., Petrov K.V., Starr S., Spencer R., Semiletov I.P., Perminova I.V. Molecular composition of dissolved organic matter in the Siberian Arctic Shelf: evidence of permafrost influence from FT-ICR MS analysis .....	16
Kozhamuratova U.M., Kassenova Zh.M., Malgazhdarova A.B., Kazankapova M.K., Bekbosynov A., Yermagambet B.T. Study of the effectiveness of soil purification from petroleum products using humic substances.....	17
Kushnareva A.V., Bezuglova O.S. Changes in the humus composition of dark chestnut soils in the post-meliorative period.....	18
Lodygin E., Nesterov B., Alekseev I. A new approach to assessing the content of natural hydrocarbons in soils .....	19
Lyu-Lyan-Min E.I., Shamrikova E.V., Gruzdev I.V., Zhangurov E.V. Extraction and fractionation of lipid components of soil by chromatographic methods.....	20
Shamrikova E., Vanchikova E., Kondratenok B., Lapteva E., Kostrova S., Tumanova E., Zonova T., Lyu-Lyan-Min E., Kyzyurova E., Bondarenko N. Is it possible to harmonize the SOC measurement? Results of the 1st Eurasian GLOSOLAN PT (2023/2024) .....	21
Vasilevich R.S., Zhrebker A.Y., Kuznetsov O.L. Stabilization of soil organic matter of palsa bogs as a response to climate change in Holocene .....	22
Yakovleva E.V., Gabov D.N., Vasilevich R.S., Gruzdev I.V., Shchemelinina T.N., Anchugova E.M., Gunderina E.D. Polycyclic aromatic hydrocarbons and phenanthrene derivatives in long-term stored bark and wood waste .....	23
<b>2. The role of humic substances and components of soil organic matter in the carbon cycle of terrestrial and aquatic ecosystems.....</b>	<b>24</b>
Bondarenko N.N., Kyzyurova E.V., Lapteva E.M. Organic matter of clear-cut soils .....	25
Dergacheva M. Current issues of Humus science .....	26
Dymov A.A., Kutyavin I.N., Startsev V.V., Gorbach N.M., Severgina D.A., Pausova I.V.,	6

Vachruchev L.A., Dubrovskiy Yu.A., Nechaev R.A., Arzubov P.A., Ogorodnia S.A., Osipov A.F. The impact of harvesting operation on Albic Retisols in the middle taiga of the Komi Republic.....	27
Dymov A.A., Pausova I.V., Gorbach N.M. The role of fires in the transformation of soil organic matter .....	28
Gorbov S.N., Skripnikov P.N., Tishchenko S.A. The dynamics of water-soluble organic matter in constructed soils of different composition .....	29
Kovaleva N., Sidorova I., Kovalev I. Organic matter of buried soils as a carbon depot .....	30
Kubik O., Shamrikova E., Deneva S., Panyukov A. Features of the organization of amino acids in the plant-soil system of marsh ecosystems .....	31
Kudryavtsev A.E., Vaganov E.S., Sorokin A.S. Qualitative and quantitative characteristics of organic extract from plant materials used in lentil cultivation.....	32
Kuznetsov M.A., Osipov A.F. Emission of CO <sub>2</sub> from spruce soils at the Lyalsky test site (Komi Republic) .....	33
Lapteva E., Likhanova I., Skrebenkov E., Bondarenko N., Smotrina Yu., Shchanov V. Soil organic matter and carbon stocks in soils on binary sediments .....	34
Lasareva E.V., Parfenova A.M. Effect of the nature of humic substances and ionic strength on the stabilization of colloidal bentonite.....	35
Nekrasova O., Uchaev A. Specificity of soil humus substances at ash dumps .....	36
Perminova E., Lapteva E. Is there a relationship between the carbon content of microbial biomass and soil organic matter parameters in clear-cut soils of the taiga zone? .....	37
Petrov K.V., Kheuptugova A.N., Larionov K.S., Vladimirov S.A., Pechnikova G.S., Zhurba V.S., Perminova I.V. Comparative analysis of optical data from Solzan landfill storage cards .....	38
Polyakov V., Abakumov E. Post-agrogenic dynamics of molecular composition of humic acids in North-West Russia .....	39
Zavarzina A. The role of laccase in synthesis and degradation of humic substances.....	40
<b>3. The use of humic substances and plant raw materials in nature conservation and biomedical technologies .....</b>	<b>41</b>
Alferova V.S., Kosolapova N.I., Nevedrov N.P. The detoxification potential of activated peat hydrosol towards cadmium ions .....	42
Bezuglova O., Gorovtsov A., Lychman V., Polienko E. The influence of humic preparations on soil fertility and the yield of pea ( <i>Pisum sativum</i> L.) .....	43
Chukov S.N. Humification is a natural, nature-preserving technology that can be used in a closed-loop economy .....	44
Gileva D.A., Inisheva L.I., Porokhina E.V. Chemical and biological activity of peats.....	45
Karpova A.E., Skripkina.T.S. The use of humic acids and their salts to extract gallium from the fly ash of brown coal thermal power plants .....	46
Karpova Y.I., Igumnova A.A., Tikhonova T.V. Antioxidant activity of various fractions of humic substances in cosmetic compositions .....	47
Kocheva L.S., Karmanov A.P., Raskosha O.V. Lignins as promising plant polymers for biomedical applications .....	48

Kriuchkova D.S., Zhirkova A.M., Shestakov K.D., Larionov K.S., Volkov D.S., Konstantinov A.I., Perminova I.V. Injection fluids based on humic acid-3-aminopropyltriethoxysilane complexes for immobilization of heavy metals .....	49
Kuzmin D.V., Burtsev I.N., Brovarova O.V. Investigation of the properties of humic acids of coal sludge from the Inta Mining and Processing Plant .....	50
Minkina T.M., Bauer T.V. Processing of plant raw materials using closed-loop technologies to enhance soil quality and safety .....	51
Nazarov A.M., Chetverikov S.P., Davletshin T.K. Fuel oil contaminated ecosystems treatment using microbiological preparation in combination with dispersants based on humic substances and natural raw materials.....	52
Poloskov A.I., Tovpeko D.V., Yu Z., Larionov K.S., Soloviev D.A., Mitiukov A.S., Alexander-Sinclair E., Perminova I.V., Glushakov R.I. Study of some biological effects of humic substances.....	53
Rubtsova S.A., Chukicheva I.Yu., Hurshkainen T.V., Udaratina E.V., Kutchin A.V. Development and achievements of the scientific school «Scientific Fundamentals of Plant Materials Chemistry and Technology» .....	54
Shunkova D.M., Pilguk G., Tagirov T.R., Karpova M.R., Zykova M.V. Antifungal effect of silver-containing bionanomaterials based on humic ligands .....	55
Ushakova K.A., Badun G.A., Chernysheva M.G., Farsobina O.A., Zhirkova A.M., Perminova I.V. Synthesis of iron(III)-humic substances complexes of different lipophilicity profile with a use of alcohol precipitation .....	56
Zhirkova A.M., Lakienko G.P., Kriuchkova D.S., Gadzhibagomedov R.A., Rajabzoda P.A., Perminova I.V. Humic substances-assisted immobilization of magnetite onto sawdust increases surface area and copper bonding of the sorbent.....	57
Zhurba V.S., Yakimenko O.S. Effect of C-based soil conditioners on the composition and properties of soil organic matter .....	58
 <b>4. The role of humic substances and plant biopolymers in the context of the bioeconomy.....</b>	<b>59</b>
Dinu M. Biospheric functions of humic substances – geochemical barriers and nature-like technologies.....	60
Efanov M.V., Konshin V.V. New methods of chemical functionalization of peat .....	61
Kondratiev V.M. The use of LLC Lignohummat preparations containing humic substances in agriculture.....	62
Martynov V.V., Shchemelinina T.N., Anchugova E.M., Perestoronnii D.V., Molodkina N.R. The principle of cascade utilization in the processing of coffee silverskin .....	63
Perminova I.V. Evolutionary chemistry of carbon as a molecular basis for ecoadaptive technologies.....	64
 <b>Advertisement .....</b>	<b>65</b>

## Study of furan derivatives formation from the carbohydrate raw material under thermal conditions using PY-MS and FTIR spectroscopy methods

Cherepanov I.S.<sup>1</sup>, Egorova A.I.<sup>1</sup>, Tarasova D.A.<sup>1</sup>

<sup>1</sup>Udmurt State University, Izhevsk, Russia, cherchem@mail.ru

Keywords: carbohydrates, furan, thermodestruction, mechanism, spectroscopy  
 doi: 10.5281/zenodo.17321919

The results of furan structural fragment's formation in *D*-maltose (as model carbohydrate system) thermodestruction products study are presented. Using derivative IR Fourier transform spectroscopy and pyrolysis-mass spectrometry (PY-MS) methods It has been shown that in processes of alkaline cleavage and dry caramelization of the initial carbohydrate the polymeric structures, containing furan heterocycles of varying substitution degree, form as a result of intramolecular condensations.

Formation of furan derivatives from carbohydrate may be presented as scheme Figure 1, **A**, illustrating intramolecular activation by the attack of O(C<sub>2</sub>)-atom on the anomeric C<sub>1</sub>-centre [1]. Cleavage of glycoside bond provides the monosaccharides and furfural (peaks at m/z = 68, 82, 96 in PY-MS spectra), further condensations lead to polymeric products, which structure depends on reaction conditions and our earlier investigation assume formation of  $\alpha$ - and  $\beta$ -furan humic-like systems [2].

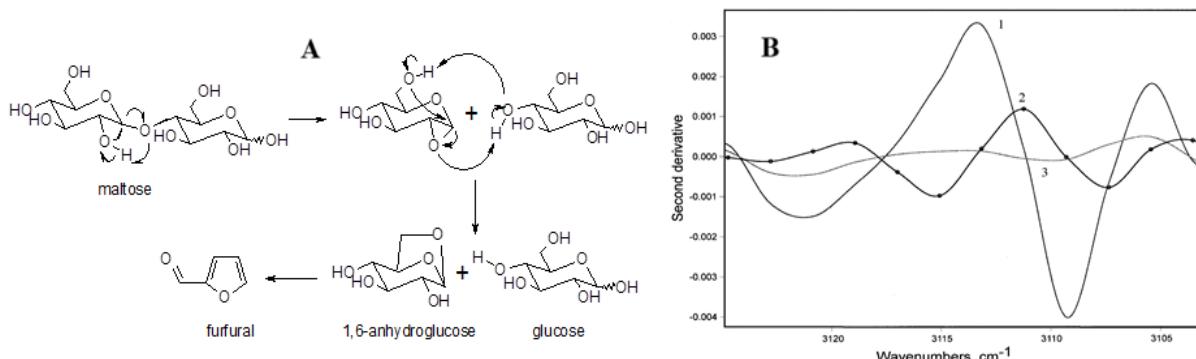


Figure 1. **A**, Proposed furfural formation mechanism; **B**, second derivative FTIR-spectra of solid phases: 1. – maltose alkaline cleavage products; 2. – maltose dry thermodestruction products; 3. – alkaline cleavage products after dry thermodestruction.

Analysis of 3150-3100 cm<sup>-1</sup> FTIR spectral area of solid phases of various maltose thermodestruction products allows to estimate furan cycles substitution degree [2]. Second derivative FTIR spectra (Figure 1, **B**) show difference between  $\alpha$ / $\beta$ -[=C-H] content in various polymeric furans: alkaline cleavage products (intensive doublet at 3109 and 3122 cm<sup>-1</sup> in spectrum 1) contain significant part of non-substituted rings (free =C-H bonds), as soon as dry thermodestruction solid phases of initial disaccharide and its alkaline cleavage products (spectra 2 and 3) are more condensed (no sharp signals). It is also postulated, that the [=C<sub>α</sub>-H]-fragments react by the electrophilic substitution mechanism, but the [=C<sub>β</sub>-H]-centers transform via oxidative condensation pathway. These experimental facts are in agreement with the literature data obtained [1] and may be used in biotechnologies, perspective as a synthetic platform for biomass transformation to heterocyclic compounds.

### References

1. Maliekal V. et al. Activation of cellulose via cooperative hydroxyl-catalyzed transglycosylation of glycosidic bonds. *ACS Catal.* 2019, 9, 1943–1955.
2. Cherepanov I.S. Carbonization products in *D*-glucose-*p*-toluidin system as sorbents of carbohydrate caramels from aqueous solutions. *IOP Conf. Ser.: Earth Envir. Sci.* 2019, 315(6), 062001.

*Научное издание*

Tenth International Conference of the CIS IHSS  
on Humic Innovative Technologies

## **Humic substances and plant raw materials in the context of a closed-loop economy**

Book of abstracts

Оригинал-макет: Е. Лодыгин  
Технический редактор: Л. Огородовая

Электронное издание

Подписано в печать 01.10.25. Усл. печ. л. 4.8.  
Заказ 08(25).