

# FTIR Spectroscopic Study Of S-Metolachlor Sorption On Inorganic And Organically Modified Montmorillonite From Bogovina

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Дигитални репозиторијум Рударско-геолошког факултета Универзитета у Београду

[ДР РГФ]

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| Lazar Kaluđerović, Zorica Tomić, Jelena Bogosavljević, Ljubomir Životiћ, Maja Milošević | 3rd International and 15th  
National Congress - Soils for Future under Global Challenges, Sokobanja, Serbia | 2021 | |

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# **BOOK OF ABSTRACTS**

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## **Publisher**

Serbian Society of Soil Science

## **Editors**

Prof. Dr Boško Gajić  
Assist. Prof. Dr Ljubomir Životić  
MSc Aleksa Lipovac

Each contribution included in the Book of Abstracts was positively reviewed by referees.

## **Organized by;**

Serbian Society of Soil Science  
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## **Supported by:**

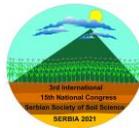
Ministry of Education, Science and Technological Development of the Republic of Serbia  
Maize Research Institute “Zemun polje”, Belgrade, Serbia  
Semenarna d.o.o., Niš, Serbia  
Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia –  
Directorate for Agricultural Land  
Terra Optima d.o.o., Topola, Serbia  
Best Seed Producer d.o.o., Feketić, Mali Idoš, Serbia

## **Printed by:**

SistemCD, Belgrade, Serbia, 2021

Published in 130 copies

**ISBN-978-86-912877-4-0**



Soils for Future under Global Challenges

## FTIR SPECTROSCOPIC STUDY OF S-METOLACHLOR SORPTION ON INORGANIC AND ORGANICALLY MODIFIED MONTMORILLONITE FROM BOGOVINA

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### Abstract

Environmental problems related to the use of herbicides are a causing concern due to their increasing presence in soil, groundwater and surface water. Numerous methods are developed in order to reduce herbicide mobility and protect natural water resources. The results presented in this paper show the interaction of herbicide S-metolachlor with inorganic and organically modified montmorillonite from Bogovina (Boljevac municipality, Serbia). Clay sample from Bogovina represent Ca-Na montmorillonite with a small amount of quartz, cristobalite and carbonate minerals. Organic montmorillonites were obtained after modification with different concentrations of organic complex (HDTMA and PTMA), whereas inorganic modification was performed with 1M NaCl solution. The interaction between minerals and herbicide was monitored using infrared spectroscopy.

IR bands observed in the inorganic modified montmorillonite (Na-montmorillonite) are typical for smectites with a high Al content in the octahedron position.

The intercalation of HDTMA<sup>+</sup> cations into the interlayer space produces redshift of the IR bands that originate from the vibrations of the adsorbed water, as a consequence of the reduction of the hydrogen bond strength in HDTMA-montmorillonite. Also, the intensity of these bands decreases significantly with increasing concentration of HDTMA<sup>+</sup> cation. All these changes are related to the decreasing of the water content in the interlayer space by increasing the content of HDTMA. The occurrence of the stretching CH<sub>2</sub> vibrations is generally the main difference in the spectrum of HDTMA modified montmorillonite in comparison with the spectrum of inorganically modified montmorillonite. The wavenumber, intensity and width of these bands are sensitive to conformation in hydrocarbon chains.

On the other hand, after the organic modification of the montmorillonite with the PTMA complex, stretching vibrations of phenyl ring occur.

Analysis of FTIR spectroscopy data showed that the hydrogen bond is one of the most important mechanisms that occur between Na-montmorillonite and S-metolachlor. Comparing the FTIR spectra of herbicides before and after the sorption, it can be concluded that carbonyl group participate in the binding process.

Sorption of S-metolachlor on HDTMA-montmorillonites causes the redshift of the C = O absorption band. Shifting to lower wavenumbers and joining with the deformation vibration band of water indicates that the C = O group participated in the formation of a bond with the montmorillonite.

Sorption of S-metolachlor molecules on PTMA-montmorillonite takes place through the interaction between the aromatic benzene ring of S-metolachlor and the aromatic benzene ring of the organic complex ( $\pi$ - $\pi$  bonds). Also, the formation of a hydrogen bond occurs between the molecules of S-metolachlor and the molecules of water that are in the interlayer space and/or oxygen on the surface of the tetrahedral sheet of the montmorillonite.

Keywords: adsorption, S-metolachlor, HDTMA, PTMA, infrared spectroscopy