Effect of *Rhizobium leguminosarum bv. Trifolii* exopolysaccharide on the cadmium(II) adsorption on nanostructured montmorillonite particles

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Introduction

Exopolysaccharides (EPS) are macromolecular compounds synthesized by soil bacteria. They are excreted into the environment and involved in establishing symbiosis between these microorganisms and *Fabaceae* plants enabling the fixation of atmospheric nitrogen. Exopolysaccharides can also affect the accumulation of toxic compounds in soil, e.g. contribute to a strong immobilization of heavy metal ions on the surface of soil minerals and thus reduce their availability for plants and animals [1]. What is more, EPS can significantly limit the leaching of micro- and macroelements to groundwater and ensure their gradual release at the same time.

Aim of the work

The main aim of this study was to determine the impact of exopolysaccharide (EPS), synthesized by soil bacteria *Rhizobium leguminosarum bv Trifolii*, on the accumulation of cadmium(II) ions on the surface of the selected clay mineral – montmorillonite from the smectite group.

Materials and methods

The applied solid was separated from natural bentonite derived from the Jelsovy Potok deposit in Slovakia. During adsorption/desorption measurements, the concentration of Cd(II) ions was determined using ionselective electrode (Detektor). FTIR spectra were obtained using Nicolet 6700 FTIR spectrometer (Thermo Scientific).

Obtained results

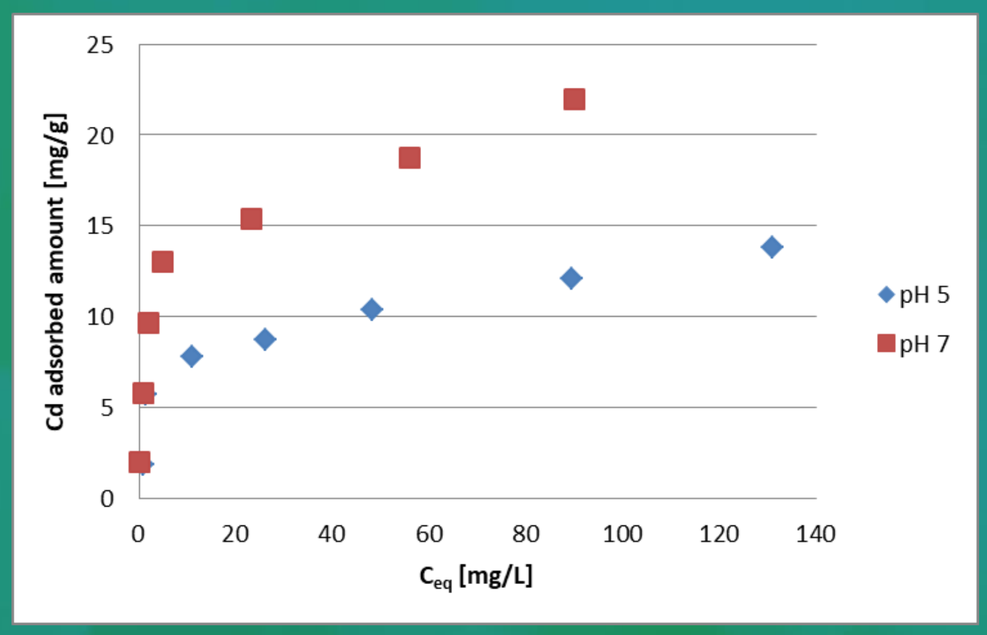

Fig. 1. Adsorption isotherms of Cd(II) ions on montmorillonite at pH 5 and 7

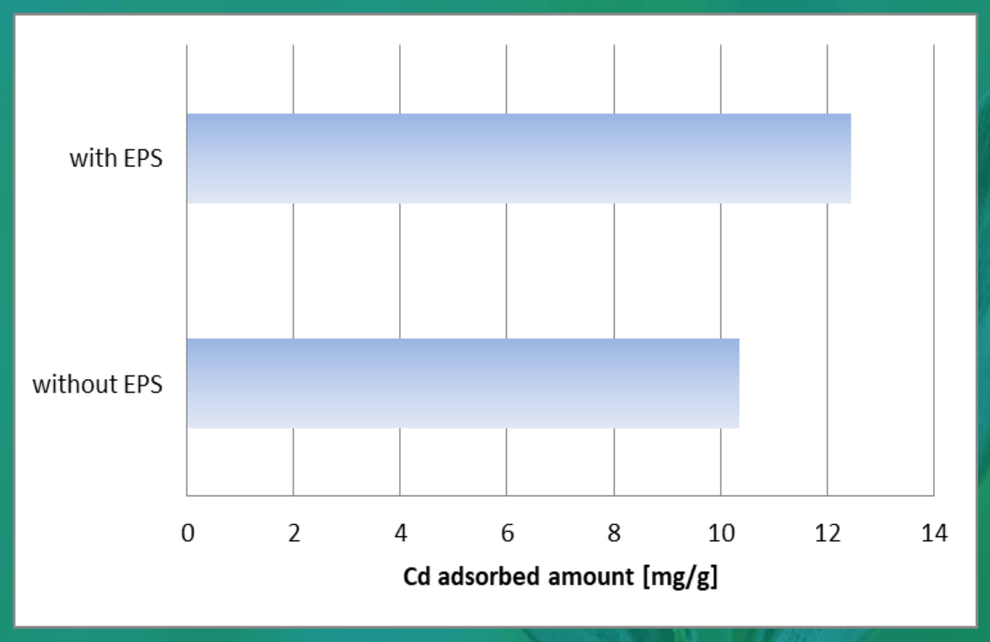

Fig. 2. Cd(II) adsorbed amount on the solid without and with EPS at pH 5

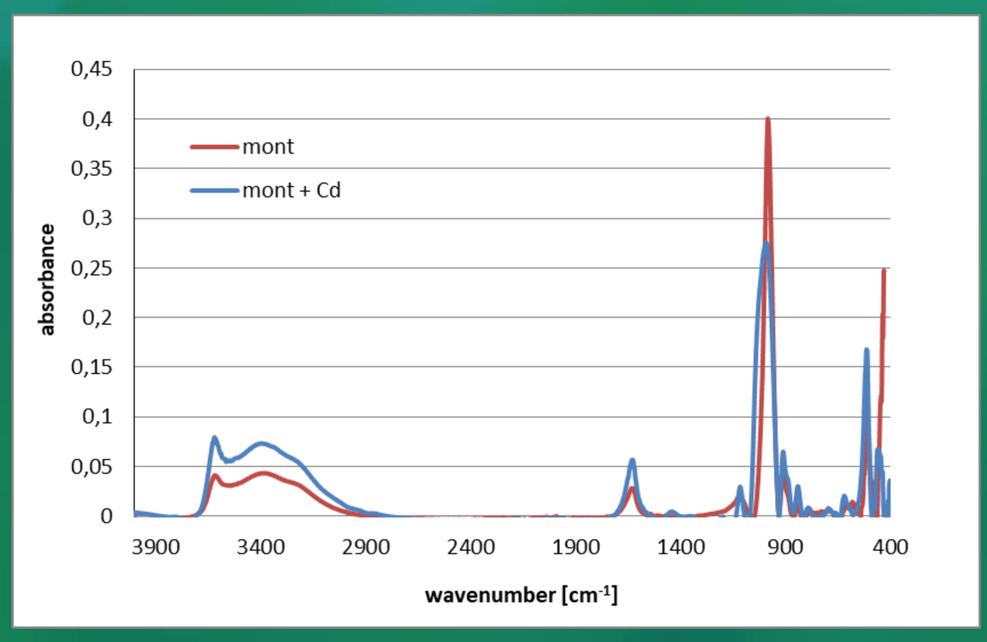

Fig. 3. FTIR spectra of montmorillonite before and after Cd(II) adsorption

Tab 1. Cd(II) desorption degree from the solid using water and EPS solution at pH 5 and pH 7

Cycle Number	pH 5		pH 7	
	H_2O	EPS	H_2O	EPS
1	6.22%	4.01%	3.19%	1.06%
2	2.10%	1.09%	0.55%	0.22%
3	2.20%	0.35%	0.25%	0.176%

CONCLUSIONS

- The obtained results indicated that at pH 5, for the initial Cd concentration 100 ppm, experimental Cd(II) adsorbed amount on montmorillonite equaled 10.36 mg/g. The EPS addition increased the ion immobilization to the value of 12.44 mg/g. It was probably dictated by formation of polymer-metal ions complexes of intramolecular character,
- The obtained FTIR spectra confirmed that Cd(II) ions interacted with siloxane, silanol and aluminol groups of montmorillonite,
- In the EPS presence, the desorption degree of Cd(II) ions from montmorillonite was smaller, which was also equivalent to the reduction in heavy metal ion mobility in the examined system.

Literature: [1] Palansooriya K.N. et al., Environ. Int.-2020-134.-105046.

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