APPLICATION OF HYDROCHARS FOR CHLORPYRIFOS REMOVAL

Marijana Kragulj Isakovski, Irina Jevrosimov, Snežana Maletić, Jelena Molnar Jazić, Aleksandra Tubić, Jelena Tričković, Jasmina Agbaba

University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, e-mail: marijana.kragulj@dh.uns.ac.rs

INTRODUCTION

- In order to protect water quality and human health, it is necessary to understand adsorption mechanism onto carbon-rich materials as potential adsorbers for organophosphorus pesticides removal.
- Organophosphorus pesticides (OPPs) are a group of compounds which are relatively quickly degraded in the environment and have no tendency for bioaccumulation. Their low market price is a further reason for their intensive use.
- The main objective of this study was to investigate the adsorption potential of hydrochars toward chlorpyrifos.
- Hydrochars were produced from hydrothermal carbonization of sugar beet pulp on different reaction temperature (180 to 220°C).

MATERIALS AND METHODS

- All adsorption isotherms were performed in batch adsorption experiments.
- The background solution was 0.01 M CaCl₂ in distilled water with 100 mg/l NaN₃ as a biocide.
- The procedure was as follows: flasks containing premeasured adsorbent and background solution were agitated at ultrasonic bath for 15 min before a certain volume of methanol stock solution of chlorpyrifos was spiked and equilibrated at room temperature by continuous shaking for 48 h.
- Sample of supernatant was removed for gas-chromatographic determination of the chlorpyrifos.

RESULTS AND DISCUSSION

- All adsorption isotherms well fitted by Freundlich model ($R²=0.973-0.995$).
- The nonlinearity of isotherms ranged from 0.620 to 0.731.
- Direct comparison of adsorption affinities could not be made because of their different units as a result of the nonlinearity of the adsorption isotherms. Therefore, distribution coefficients ($K_d$) were calculated at selected equilibrium concentration (100 μg/L).
- The results showed that $K_d$ values increased in the order HTC-180°C<HTC-200°C < HTC-220°C showing a good correlation with the reaction temperature of the thermal carbonization process.
- These results suggest that reaction temperature during the synthesis of hydrochars have a significant role in the application of investigated materials.
- In addition, the highest $q_{max}$ value was obtained for HTC-220°C indicating that with increasing a temperature, the content of carbon increases, and thus the ability to adsorb organic compounds.

CONCLUSION

- Adsorption potential of hydrochars depend on the temperature of hydrothermal carbonization.
- Further research should focus on a more detailed characterisation of investigated materials in order to better understand the adsorption mechanisms of organic compounds on carbon-rich materials.

Acknowledgments

The authors gratefully acknowledge the support of the Provincial Secretariat for Higher Education and Scientific Research, Autonomous Province of Vojvodina (Project No. 142-451-2813/2018-01/01).

Contact:
Marijana Kragulj Isakovski
University of Novi Sad, Faculty of Sciences
Department of Chemistry, Biochemistry and Environmental Protection
Trg D. Obradovića 3, 21000 Novi Sad, Republic of Serbia
tel: +381 (0)21 485 2725; fax: +381 (0)21 454 065
E-mail: marijana.kragulj@dh.uns.ac.rs