

APPLICATION OF HYDROCHARS FOR CHLORPYRIFOS REMOVAL

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INTRODUCTION

- In order to protect water quality and human health, it is necessary to understand adsorption mechanism onto carbon-rich materials as potential adsorbents 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

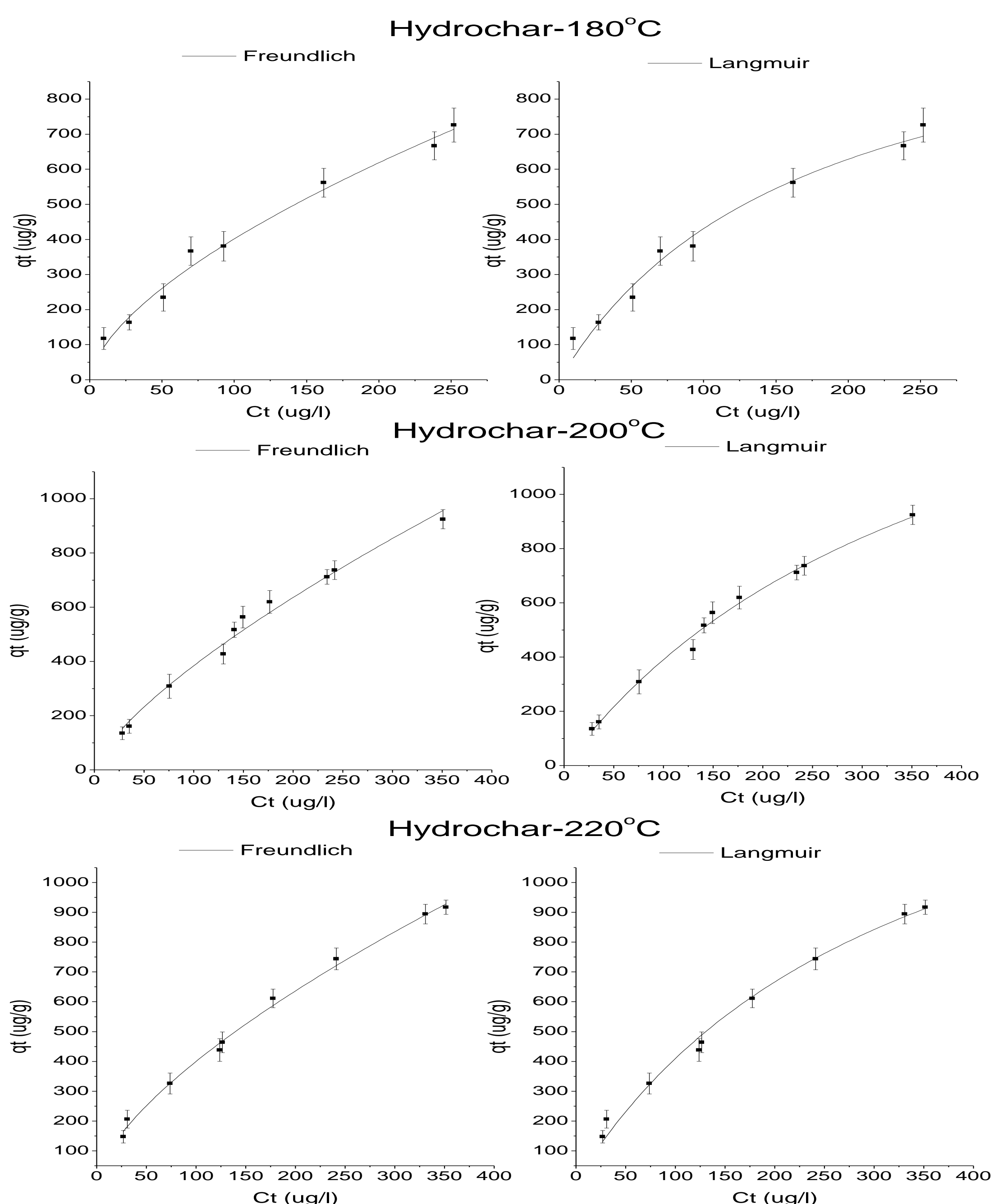


Figure 1. Adsorption isotherms of chlorpyrifos on investigated hydrochars

- All adsorption isotherms well fitted by Freundlich model ($R^2=0,973-0,995$).
- 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 $HTC-180^\circ C < HTC-200^\circ C < HTC-220^\circ C$ 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 $HTC-220^\circ C$ 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.

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