

EGU24-8943, updated on 07 Feb 2025

<https://doi.org/10.5194/egusphere-egu24-8943>

EGU General Assembly 2024

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Effects of root-derived organic acids on sorption of pharmaceuticals in cultivated sandy soil

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Pharmaceutically active compounds (PhACs) in cultivated areas have become an important issue and have received significant public attention because of their availability to plants during nutrient uptake. This study highlights the effects of low-molecular-weight organic acids (LMWOAs) generated in the root environment on the sorption processes of PhACs in cultivated sandy soil. Sorption experiments are conducted using three PhACs characterised by different physicochemical properties: carbamazepine (CBZ), 17 α -ethynylestradiol (EE2), and diclofenac-sodium (DFC). The results suggest that the adsorption of EE2 is more intense than the other two PhACs, whereas DFC and CBZ are primarily dominated by desorption. Additionally, LMWOAs mainly provide additional low-energy adsorption sites for the PhACs, and slight pH changes do not significantly affect the sorption mechanism. During competitive adsorption, the high-energy sites of the adsorbents are initially occupied by EE2 owing to its high adsorption energy. In addition, during multicomponent adsorption, new low-energy binding sites enhance the adsorption of DFC and CBZ. Our results show that LMWOAs promoted the adsorption of PhACs into the root environment, thus rendering PhACs available to plants.

This research was supported by the National Research, Development, and Innovation Office (NKFIH), Hungary (project identification number: 2020–1.1.2-PIACI-KFI-2021-00309; 2021–1.2.4-TÉT-2021-00029, and K-142865). Project no. KDP-1015196 has been implemented with the support provided by the Ministry of Culture and Innovation of Hungary from the National Research, Development and Innovation Fund, financed under the KDP-2020 funding scheme. This study has also been supported by the Doctoral Excellence Program (DKOP-23) of the Ministry for Culture and Innovation, Hungary, from the source of the National Research, Development and Innovation Fund.