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Influencing factors on the adsorption-desorption processes of Pharmaceutically Active Compounds (PhACs) in various agricultural soils

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The fate of Pharmaceutically Active Compounds (PhACs) in the environment may depend on a number of interrelated processes. Their environmental risk is mainly influenced by their adsorption and desorption processes in the soil. The present work aimed to study the adsorption and desorption of PhACs (17α-ethinyl estradiol (EE2), carbamazepine (CBZ), diclofenac sodium (DFC)) on various agricultural soils formed under different redox conditions: an Arenosol with fully aerobic conditions and a Histic Gleysol sample with suboxic and anoxic conditions. The objectives of the study were to investigate how the soil properties modify the sorption processes of the PhACs. Adsorption isotherms were applied to estimate the model parameters using Langmuir, Freundlich and Dubinin-Radushkevich model in a batch technique experiment. The different composition of the soil samples significantly affected the amount of adsorbed PhACs (CBZ, DFC, EE2). Top soil samples with a high organic matter content adsorbed higher amounts of PhACs, while the amount of adsorbed PhACs decreased gradually with depth. In desorption experiments, the amount of PhACs released also varied with depth. In contrast, the rate of desorption was lowest at the topsoil samples and increased with depth. In samples where the deeper levels were characterised by higher clay mineral content (e.g. the C-level of the Histic Gleysol), significantly less PhACs could be desorbed. The physico-chemical properties of the soil showed that the amount of the desorbed PhACs mainly influenced by the specific surface area and clay content of the soil. This study could be useful for understanding of the movement of PhACs in soils formed under different conditions. This study was funded by the Hungarian National Research, Development and Innovation Fund (*2020-1.1.2-PIACI-KFI-2021-00309*).