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ASSESSMENT ON THE REMOVAL OF PHARMACEUTICAL COMPOUNDS IN THE ORHEI CONSTRUCTED WETLAND

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Summary
Introduction. Pharmaceutically active compounds (PhACs), including antibiotics, are emerging pollutants that pose risks for ecosystems and human health. One of the greatest concerns is their effect on the spread of antibiotic resistance, due to their continuous release through wastewater effluents. Constructed wetlands (CW) offer a cost-efficient and eco-friendly solution for the removal of PhACs from wastewaters. However, limited studies have evaluated their efficiency in full-scale systems. This study aimed to assess the removal of 60 PhACs, including 30 antibiotics, through the treatment chain of a vertical flow full-scale CW (VF-CW) treating municipal wastewater.
Material and methods. Sampling was conducted in July 2023 in a medium-size system: Orhei CW (20,000 population equivalents, Orhei, Moldova). Water samples were collected at the influent, middle and effluent points and sent refrigerated for analysis to Spain. Following solid phase extraction, a set of 60 PhACs were analyzed by liquid chromatography coupled to tandem mass spectrometry.
Results. Macrolides, quinolones, sulfonamides, lincosamide and trimethoprim were the main antibiotic families detected in influent at 20-2035 ng/L range. The average of antibiotics removal in the VF-CW was 93%, with exception of metronidazole, which increased its concentration during treatment. Additionally, 14 PhACs from 5 therapeutic families were detected in influent at 10-1543 ng/L. The stimulant caffeine reached the highest influent concentration at µg/L. Following treatment, removal efficiency was satisfactory (84% average for 12 PhACs). However, some psychiatric drugs (carbamazepine, its metabolite epoxy-carbamazepine and alprazolam) remained at similar or even higher levels at the effluent, presenting negative removals. This behavior has been reported for other systems, both nature-based or conventional treatments.
Conclusions. Antibiotics and other 5 PhACs therapeutic families are mostly removed from water following VF-CW treatment, proving the efficiency of this eco-technology as primary and secondary treatment of Orhei municipal wastewater. The negative removal for a few compounds highlights the need to continue developing improvements in this type of technology to achieve better removal of pollutants.
Keywords: antibiotics, wastewater, constructed wetland, full-scale.

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