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BOOK OF ABSTRACTS

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Adsorption of Pharmaceutically Active Compounds Using Exhausted Chestnut Wood Hydrochar

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Abstract

A growing amount of pharmaceutically active compounds have been found in surface waters worldwide, which can cause adverse effects on aquatic organisms and humans. The main sources of these compounds are effluents from urban wastewater treatment plants (WWTPs), as the most commonly used processes in these plants are not designed to remove emerging contaminants. Therefore, it is necessary to examine possible solutions for effective quaternary treatment of municipal wastewater. This study examines the use of hydrochar, obtained from exhausted chestnut wood from tannin extraction, as a sorbent for the removal of selected pharmaceutical compounds from WWTP effluent. The exhausted chestnut wood leftover from tannin extraction was obtained from a tannin production facility in Radicofani (SI), Italy. Hydrothermal carbonization (HTC) of the exhausted chestnut from the tannin extraction industry was performed at a fixed temperature (270 °C), a fixed residence time (60 mins), and a solid/liquid mass ratio of 1/10, according to the procedure described in (1). Hydrochar obtained after four cycles of process water recirculation (HY4), and the hydrochar obtained with distilled water (HY0) were used for the adsorption tests. The effluent was collected from a municipal wastewater treatment plant in Subotica, Serbia, and a target analysis of a selected number of pharmaceutical compounds that have been found in waters in Serbia (2) was performed. Adsorption tests were performed in batch conditions by mixing 0.1 g of hydrochars with 100 mL of the effluent samples on a magnetic stirrer for 24 hours and filtered through a glass-fiber filter with a pore size of 0.45 μm. High-performance liquid chromatography coupled with triple quadrupole mass spectrometry, UHPLC-MS/MS, (Thermo Fisher Scientific, USA) was used for the instrumental analysis of selected compounds.

According to the obtained results, the efficiencies of both tested adsorbents were very good for all investigated compounds, except for clarithromycin and sotolol. Removal efficiencies of selected compounds were in the range of 12.58-99.91% for the HY0, and 27.81-99.91% for the HY4. Similar results were reported by Šobić et al (3) for the removal of cephalexin and propiconazole. Results of this study indicated that tested hydrochars have a great potential for the removal of pharmaceutically active compounds from wastewater, which makes them a promising eco-friendly alternative to commercial adsorbents. Additionally, it can be concluded that process liquid recirculation during HTC does not significantly affect the adsorption efficiency of tested hydrochars. Further investigation should focus on isotherm and kinetic studies, as well as the evaluation of the costs of the entire process.