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ABSTRACTS

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Surface interactions during the removal of emerging contaminants by hydrochar based adsorbents from biomass

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The increasing range of activated carbon (AC) applications as well as their consolidation as simple, low cost, and effective materials to provide both high adsorption capacity and selectivity has led a continuous increase of AC market during last years. Studies have demonstrated that hydrothermal carbonization (HTC) of biomass results in the formation of beneficial materials without entailing green house gas emissions. This process is advantageous in relation to other thermochemical processes such as pyrolysis, due to its simplicity and very low operating costs, apart from the fact that it allows high solid yields to be obtained, and retains the most of the biomass carbon on the final product [1].
The presence of pharmaceuticals in the environment; specially, in the case of ground waters, which is the final deposit of these compounds, due to their low volatility and low reactivity is of high concern [2]. For their removal, adsorption onto ACs is regarded as an efficient process, providing many advantages in comparison with other methods, such as low cost and ease of implementation.
This work investigates the capability of the activated hydrochars (HC) described in ref. [3] as adsorbents of two emergent contaminants, namely fluoxetine and nicotinic acid, in aqueous solution. Provided the structural differences between these two compounds, this study was aimed to elucidate how the dissimilar surface characteristics of the adsorbents might influence their adsorption process mechanisms. To the best of the authors´s knowledge, the removal of none of these adsorbates has been studied before by adsorption onto HC-based ACs.
Adsorption studies showed that the adsorption capacity was mainly determined by the chemical nature of the adsorbents, namely the presence of specific functional groups and their ionization in aqueous solutions, while the porous structure had a secondary role. The activated carbons produced by air activation showed a higher adsorption capacity of fluoxetine, whilst the samples produced by carbon dioxide had a better performance for the removal of nicotinic acid. In general, surface acidity was advantageous for fluoxetine and detrimental for nicotinic acid removal. The adsorption mechanisms involved in each case were discussed and related to the adsorbents characteristics. The maximum adsorption capacity, Q_0, given by the Langmuir model was 44.1 and 91.9 mg g^{-1} for fluoxetine and nicotinic acid adsorption, respectively.

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Silvia Román is associate professor at the University of Extremadura; her teaching includes subjects like technical thermodynamics and thermal engineering. Her research is focussed on the use of wastes for energy via thermochemical processes as well as the production of porous materials for several applications. She has been awarded with research recognition prizes such as “Excellence to young researcher career” and “teaching excellence”, both given by the University of Extremadura.