INDUSTRIAL BY-PRODUCT VALORISATION AS NEW BIOMATERIALS: ADSORPTION AS A SOLUTION FOR THE ENVIRONMENTAL PROBLEMS CAUSED BY PHARMACEUTICALS.

Environmental and industrial biotechnology (Bioenergy, bioremediation)

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Body

One of the most important environmental problems the modern world has to tackle with is water pollution derived from emerging pollutants (EPs). Pharmaceutical consumption has been increasing for decades, turning pharmaceuticals (PhACs) into the most frequently detected EPs. These compounds are persistent and resistant to degradation, so they can have harmful consequences on the environment and human health. Adsorption is a suitable alternative for the removal of PhACs from wastewater.

The objective of this study is the production of biomaterials that can act as adsorbents. Based on circular economy principles, the raw material for the synthesis of the biomaterials was an industrial by-product (pine bark), which underwent surface modification through chemical and high-pressure modification processes. In the case of the chemical modifications, the experimental tested conditions included the particle size (1-1.4 mm), temperature (25 ºC), time (24 h), agitation (180 rpm), solid:liquid ratio (1:30 - 1:100 g/mL), chemical reagent (acid: HNO_3 1M, base: NaOH 2.5 M, oxidising agent: H_2O_2 1 M). High-pressure modifications were conducted in an autoclave with the following conditions: particle size (1-1.4 mm), temperature (121 ºC), time (30 min), solid:liquid ratio (1:50 g/mL). The produced biosorbents were washed with distilled water until no colour and constant pH and then dried. Biomaterials were used to remove two PhACs, fluoxetine (FLX) and carbamazepine (CBZ), in a binary system. Adsorption tests were performed using solid:liquid ratio (10 g/L), FLX 5 mg/L, CBZ 5 mg/L, natural pH (5.5), constant agitation (160 rpm) and temperature (25 ºC). The best adsorption results for both PhACs were obtained with the biosorbent produced by chemical modification using NaOH. In the case of CBZ, this biosorbent reached removal levels of 30.09% in 48 h. FLX adsorption was much faster, thus after 2.5 min around 78.71% of removal was obtained with a maximum at 30 min (97.10%). The obtained results show that chemical modification using NaOH allows, in a simple way, the transformation of wastes into biomaterials with high adsorptive capacities.

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Palavras-chave : Biomaterial, Pharmaceuticals, Adsorption, Surface modification