HYDROLISED OLIVE CAKE AS NOVEL BIOSORBENT FOR THE COPPER REMOVAL FROM INDUSTRIAL FERTILIZER WASTEWATER

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PURPOSE OF THE ABSTRACT

The fertilizer industry is one of the industries that discharge wastewater containing copper into the environment. For removal of high concentrations of copper, the main methods in use are: 1) chemical precipitation which is not economically feasible and produces huge amounts of sludge; 2) ion-exchange that employs expensive resins whose regeneration causes secondary pollution; 3) adsorption using materials like activated carbon which is restricted due to high cost, between others. Recently, biosorption has become one of the alternative treatment methods due to its cost effective and eco-friendly nature. The aim of this work was to demonstrate the feasibility of the application of biosorption by hydrolysed olive cake, a solid residue of the olive oil industry, in the treatment of copper polluted wastewater from fertilizer industry. The performance of the system was evaluated in three different configurations (serial columns) under the same experimental conditions (flow rate 2 mL/min; bed height 18 cm).

A complete characterization of the material was made by authors in a previous published work (Fernández-González et al., 2018). On the other hand, the wastewater analysis has shown a copper content that exceeds the law limits. Regards to heavy metals, before the biosorption, only copper is upper the law limits.

Figure 1 shows the breakthrough curves of copper biosorption in one column, two serial columns and three serial columns configurations and Figure 2 the characteristic parameters of these three breakthrough curves. Breakthrough time (tb, min), exhaustion time (tex, min), total metal removal expressed as percentage at exhaustion time (R, %), total mass of metal in the column until the breakthrough time (qtotal, mg) and biosorption capacity at exhaustion time (qe, mg/g) were calculated according equations reported in Ronda et al. (2015).

A medium effectiveness of the column in one column configuration was observed. However, the amount of copper removal by gram of hydrolysed olive cake was especially increased when three columns configuration was used. Also, when the first configuration (one column) was used, the copper concentration of the outlet effluent didn't keep below the legal limit concentration any time. However, when a configuration of two or three serial columns was used, the breakthrough time was increased to 65 and 245 min, respectively.
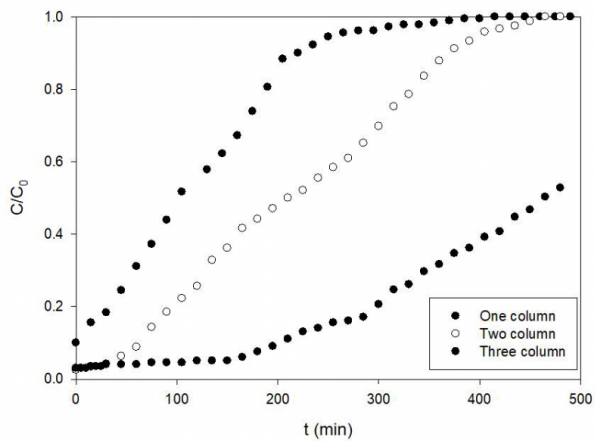
FIGURES

	One column	Two columns	Three columns
t_b, min	0	65	245
t_{ex}, min	210	375	850
R, %	23.11	49.80	88.64
q_{total}, mg	55.46	127.51	273.69
q_e, mg/g	3.08	3.49	5.07

FIGURE 1
Breakthrough curves of copper biosorption in one column, two serial columns and three serial columns configurations.

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FIGURE 2
Characteristic parameters of copper breakthrough curves.

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KEYWORDS
Biosorption | Olive Cake | Waste valorization | wastewater

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