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Extended Abstract

Nanoemulsions Based on Biopolymers Loaded with Humic and Fulvic Acids Derived from Hydrothermally Treated Biomass †

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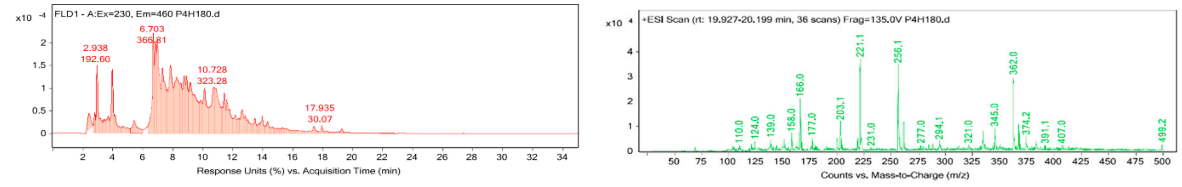
Humic substances (HS) are complex systems widely spread in nature as a result of the humification process of biomass, although hardly quantifiable and understood. Various polyphenols are considered to be the main precursors of HS. HS are naturally synthetized in reactions involving hydrophilic, hydrophobic, ionic, and donor–acceptor intermolecular forces of different biomass-derived components, such as amino acids, carbohydrates, lignins, and pectines [1]. Humins, as macromolecular associations, and fulvic acids, as lower-molecular-weight compounds, present appealing properties that make them interesting for use in formulations with potential biostimulant effects for plants development [2].

Nanoemulsions were prepared by vigorously mixing on a magnetic plate a solution of 0.2% bacterial nanocellulose (BNC) previously obtained by purification and microfluidization [3], with 1% or 3% chitosan dissolved in 1% acetic acid, a 1% alginate solution, and a liquid phase containing humic and fulvic compounds obtained from un-catalyzed and catalyzed hydrothermal processes of lignocellulosic biomass. For catalyzed hydrothermal conversion (HTC) process, a Cu–Pd–Ce/γAl_2O_3 catalyst was used. The samples, as well as the liquid phase from the HTC process, were characterized by means of XRD, TGA, FTIR, and HPLC–FLD-MS.

HPLC–FLD-MS analyses performed on the liquid phase from the hydrothermal process of lignocellulosic biomass evidenced the presence of valuable compounds like high-molecular-weight humic acids (300–600 Da) and fulvic compounds, as shown in Figure 1.

The liquid phase resulting from the HTC process of lignocellulosic biomass (corn stalks) contained a huge number of organic compounds, including polyphenols, humic and fulvic acids, aldehydes, amino acids, and other small organic molecules with potential biostimulant properties for plant growth and protection against abiotic stress, such as drought and nutrients scarcity.



(**a**) (**b**)

Figure 1. (**a**) HPLC-FLD-MS analyses of the liquid phase from the hydrothermal process and (**b**) MS spectrum of the humic components.

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