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Ionothermal carbonization: an opportunity for the valorization of raw lignocellulosic agrowastes

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PURPOSE OF THE ABSTRACT
Since 2002 and the first article demonstrating their ability to dissolve cellulose [1], ionic liquids (ILs) have been widely employed in biorefinery, both as derivatizing and nonderivatizing solvents. Beyond dissolution and selective deconstruction, ionic liquids were also employed for the thermochemical conversion of carbohydrates into porous carbonaceous materials [2]. Usually, ionic liquid is involved either as a soft-template in water or as a functional solvent playing the role of catalyst and/or porogenic agent. While the first approach falls in the category of hydrothermal carbonization (HTC), the second one can be regarded as ionothermal carbonization (ITC; by analogy with hydrothermal carbonization) yielding ionochars (by analogy with hydrochars). Thus far, such ionothermal treatment has not yet been fully exploited as it has been mainly restricted to monosaccharides [2]. Recently, Xie et al. [3] applied the ITC approach to a renewable and low-cost raw material, i.e. Jujun grass. The beneficial inputs of ITC in terms of porosity and electrochemical capacitive performance were clearly evidenced, making this two-step approach really promising. Herein, we propose to provide further insights into biomass-derived ionochars via thorough physico-chemical characterizations and comparison with hydrochars analogous. With this aim, we applied the ionothermal carbonization approach to various polysaccharides and raw lignocellulosic agrowastes, i.e. cocoa shell wastes from Cameroon. Various imidazolium-based ILs, including [Bmim]Cl, a well-known commercial ionic liquid, and [Bmim]FeCl4, a Lewis acid IL analogous, were employed as reaction media. This approach allowed a fine control over textural properties (Figure 1) [4]. Subsequent physical activations were performed yielding highly porous carbons with promising properties as sorbents for carbon dioxide capture and electrodes for energy storage and conversion devices.

FIGURES

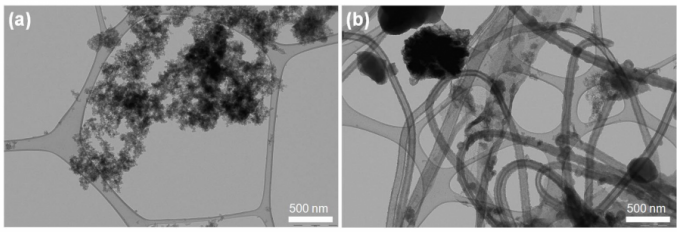

FIGURE 1

Textural control

TEM micrographs of ionochars obtained from cocoa shells treated in iron-based ionic liquids.

FIGURE 2

KEYWORDS

Agrowaste | Ionic liquid | Biomass | Porous carbon

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