**Activated carbon monoliths from lignocellulosic biomass waste for electrochemical applications**

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**Introduction**

Activated carbons monoliths (ACMs) have shown promising results as electrodes for supercapacitors, due to their high volumetric density and large porosity. However, they are usually, made by compressing the corresponding activated carbon in the presence of a binder, which usually implies a reduction of pore sizes due to partial blocking, or in less extent in absence of any type of additive by applying a very high pressure In this work, different binderless ACMs were prepared and tested for electrochemical applications.

**Experimental**

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| Figure 1. Activated carbon disk from: a) Olive stone; b) Alcell lignin; c) Kraft lignin. |

Cylindrical activated carbon disk were prepared from olive stone, Alcell® and Kraft lignin by chemical activation with H3PO4 by extrusion without any kind of binder. Activated carbon disk were activated under inert atmosphere at 700 ºC and washing with distilled water. N2 and CO2 adsorption, XPS and CO-CO2 TPD techniques were used to characterize the carbon electrodes. Their electrochemical performances were evaluated by cyclic voltammetry and galvanostatic charge-discharge at different current densities, without using binder and conductive promoter.

**Results and discussion**

Figure 1 shows the activated carbon disks used in this work. Carbon electrodes presented pore size distributions in the micro and mesopore range, with high surfaces areas (c.a. 1500 m2/g) and relatively high mesopore volume (0.35 cm3/g). The bulk density of the monoliths is also very high (~1.1 g/cm3 for ACM from Alcell lignin), with compressive strength of 7.6 MPa. The activated carbon disk from olive stones presents the highest specific capacitance, with approximately 217 F/g and 205 F/cm3. The values of specific capacitances for these ACMs are comparable or even better than others reported in the literature with similar porosity, but their volumetric capacitances are considerably higher than the values obtained at similar conditions by other authors.

**Conclusions**

Binderless ACMs from lignocellulosic waste were prepared by a simple preparation method from biomass waste precursors. These ACMs showed significantly high bulk densities and volumetric capacitances.

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**References**

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