# IMPROVING THE PERFORMANCE OF BIOMASS-DERIVED CARBONS IN RECHARGEABLE LITHIUM BATTERIES

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Carbon continues to be the paradigmatic material for manufacturing anodes for the Li-ion battery,[14,15] which is the energy storage device currently dominating the battery market with its wide use in portable electronic gadgets such as laptop computers, digital cameras, and cell phones, among others. Disordered carbons are usually prepared by pyrolysis of organic-based compounds. At present, activated carbons obtained from biomass are an effective choice by virtue of (i) their providing an alternative method of waste management and (ii) the low cost of the raw materials.[16]

Three different activated carbons obtained from cherry stones were studied. Samples were chemically activated by using an aqueous KOH or $ZnCl_2$, and heating at 500 and 800 ºC for 2 h. A detailed description of their preparation conditions and textural properties can be found elsewhere.[17] Electrochemical measurements were made on 2032 coin–type cells supplied by Hohsen Corp, using a voltage windows between 0.0–3.0 V.

Disordered carbons obtained from cherry stones were tested as electrodes for lithium batteries and their properties compared with those of short multiwalled carbon nanotubes (s-MWCNT), proposed as novel candidates for use in these electrochemical devices. Cells were cycled (up to one hundred cycles) over a wide range of rates (C/10 to 5C). Previously, their structural, textural and morphological properties were examined by X-ray diffraction (XRD) patterns, $N_2$ adsorption data and electron microscopy images (SEM and TEM), respectively.

All carbons exhibited irreversible capacity (IC) to an extent roughly governed by the H/O content among other variables. The best performing carbons were obtained at low calcination temperatures (500 ºC). Although these conditions can increase IC, the effect can be offset by limiting the amount of Li inserted in the first discharge. Moreover, this method improves capacity retention and rate capabilities. This approach allows one to obtain activated carbons with specific capacities as high as 200 mAh $g^{-1}$ at 5C —a high rate indeed. Their performance after as many as one hundred cycles over a wide range of charge/discharge rates was found to surpass that of short multiwalled carbon nanotubes, and also to match that of the best performing carbons reported so far.

Chemically activated carbons obtained from biomass residues (cherry stones here) are attractive candidate materials for anodes in Li-ion batteries provided they meet some simple requirements: i) calcination temperature should be low enough to ensure a high hydrogen content; ii) the first discharge should be limited to an appropriate value.

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