Bio-derived disordered carbon for high performance lithium ion battery anodes
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Abstract: Here we attempted to synthesize carbon anode materials from naturally based materials that provide high fixed carbon with low impurity. The three naturally based materials, i.e., coconut coir pith (CP), rice husk (RH), and rice straw (RS), were fired to obtain carbon for use as high performance lithium ion battery anodes. The carbons were characterized using XRD, SEM, CHNO, and BET-surface analysis. In this work, we studied and compared effects of various parameters on the phase formations and their microstructures, i.e., the starting material morphology, the firing temperatures, the atmospheres, and the pretreatment processes. It was found that the pyrolysis temperatures and the atmospheres had significant effects on the phase forms and properties of the carbon electrode. X-ray diffraction studies indicated a highly disordered carbon structure. The highest surface area achieved was 832 m²g⁻¹, accommodated by the highest pore volume among the compared conditions. The electrochemical properties of the carbons were evaluated using galvanostatic/potentiostatic cycling. The results showed that the carbons delivered almost 3 times higher initial capacity than the maximum theoretical capacity of perfect graphitic structures (372 mAhg⁻¹). The consistently high capacities and good cycling stability and rate capability were achieved.

Keywords: Natural based carbon; Anode material; Li-ion batteries