

# Accepted Manuscript

Preparing hierarchical porous carbon aerogels based on enzymatic hydrolysis lignin through ambient drying for supercapacitor electrodes

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PII: S1387-1811(18)30089-1

DOI: [10.1016/j.micromeso.2018.02.024](https://doi.org/10.1016/j.micromeso.2018.02.024)

Reference: MICMAT 8787

To appear in: *Microporous and Mesoporous Materials*

Received Date: 26 December 2017

Revised Date: 4 February 2018

Accepted Date: 21 February 2018

Please cite this article as: J. Xu, X. Zhou, M. Chen, S. Shi, Y. Cao, Preparing hierarchical porous carbon aerogels based on enzymatic hydrolysis lignin through ambient drying for supercapacitor electrodes, *Microporous and Mesoporous Materials* (2018), doi: 10.1016/j.micromeso.2018.02.024.

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1 Preparing hierarchical porous carbon aerogels based on enzymatic hydrolysis lignin through ambient  
2 drying for supercapacitor electrodes

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6 ABSTRACT

7 Hierarchical porous lignin-based carbon aerogels, synthesized through a low-cost and simple method,  
8 are promising for applications in supercapacitor electrodes. Lignin-based carbon aerogels are  
9 prepared by pyrolysis and KOH activation of lignin-based aerogels. Lignin-based aerogels are  
10 prepared by mixing of enzymatic hydrolysis lignin (L), resorcinol (R) and formaldehyde (F) under  
11 the catalysis of Na<sub>2</sub>CO<sub>3</sub> (C) followed by gelation, aging and ambient drying process. The results  
12 show that lignin-based carbon aerogels with a L/(L+R) ratio of 20%, exhibit a high specific surface  
13 area of 779 m<sup>2</sup>/g, a large total pore volume of 0.48 cm<sup>3</sup>/g, and a large micropore volume of 0.29  
14 cm<sup>3</sup>/g. The obtained lignin-based carbon aerogels exhibit an interconnected, hierarchical porous  
15 network structure and a high degree of graphitization, which further contributes to their excellent  
16 electrochemical performance as electrodes in supercapacitors. The specific capacitance reaches  
17 142.8 F/g at a current density of 0.5 A/g. Even at a large current density of 10 A/g, the specific  
18 capacitance of the CA-L20 electrode remains 112.5 F/g. After 2000 charge/discharge cycles, the  
19 specific capacitance still maintains 96% of its initial value, which indicates an excellent durability.

20 **Keywords:** Enzymatic hydrolysis lignin; Carbon aerogels; Ambient drying; Hierarchical porous

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