NAZARBAYEV UNIVERSITY

Institute of Batteries

ADVANCED ENERGY STORAGE SYSTEMS AND FUNCTIONAL NANOMATERIALS RESEARCH GROUP

ABSTRACT BOOK

INESS 2016

The 4th International Conference on Nanomaterials and Advanced Energy Storage Systems

August 11-13, 2016 | Al-Farabi Kazakh National University | Almaty, Kazakhstan

Nazarbayev University, Al-Farabi Kazakh National University, Institute of Batteries LLP, Nazarbayev University Research and Innovation System, National Laboratory Astana

www.batterykazakhstan.com

Supercapacitor electrode materials prepared from biomass derived activated carbons

V. Pavlenko[1, 2], M. Bijsenbaev[2], N. Prihodko[2], A. Kurbatov[1], F. Beguin[3], Z. Mansurov[1, 2]

[1] *Al-Farabi Kazakh National University, Al-Farabi ave. 71, Almaty 050040, Kazakhstan*
[2] *Institute of Combustion Problems, Bogenbay Batyr str. 172, Almaty 050040, Kazakhstan*
[3] *Poznan University of Technology, ul. Piotrowo 3, 60-965, Poznan, Poland*

Email: *pavlenko-almaty@mail.ru*

Abstract

The objective of using the proposed method based on microporous structure development is to produce new inexpensive carbon matrix which could be used as an efficient active component of electrode material implemented in electric double layer capacitors (EDLC).

Produced carbons are characterized by a highly developed polymodal porous texture [1]. These nanostructured materials were produced through the process of one step carbonization and chemical activation of vegetable biomass by the use of phosphoric acid. It was found that in the development of activated carbon's microporous structure, the impregnation ratio can play a crucial role. Also, the range of temperature treatment and the initial carbonaceous precursor features can contribute to that. The specific surface areaof samplesderived on the base ofrice husks, apricotstonesandwalnut shell calculated by BETwas equal to1690m^2/g,2030m^2/g and1380m^2/g, respectively [2].

Micro-mesoporous activated carbons were electrochemically investigated as active components of symmetric electrodes in a two electrode cell. The specific capacitance of the cell retains 160 F/g after 1000 charge-discharge cycles in 1 MLi_2SO_4 aqueous electrolyte. Electrode materials are also characterized by a great ability to polarization. The indicated value of specific capacitancecorresponds to thecharacteristics of thecapacityof commercially availablecarbons based on carbonized coconut shell. However, proposed porous carbons with advanced surface texture were produced by simple processing of vegetable biomass that traditionally grows in Kazakhstan and usually forms a large-tonnage waste.

The average pore size of the sample presented by the carbon derived through activation of rice husk lies between 1.2 and 1.6 nm. In this case,the pore diametercorresponds to the dimensionof the solvatedionsin the electrolyte. This trend can positively influence the diffusion processes associated with the mass transfer in the micropore volume of the electrode material. Therefore, main specific characteristics based on EDLC can be improved significantly.

References

[1] Azat, S., Pavlenko, V.V., Kerimkulova, A.R., Mansurov, Z.A. (2012). "Synthesis and structure determination of carbonized nano mesoporous materials based on vegetable raw materials",Advanced Materials Research, Vol.535-537, p.1041-1045. [2] Pavlenko V., Bijsenbaev M., Beguin F., Mansurov Z. "Development of active carbons' porous structure derived from biomasses for their application in supercapacitors". Proceedings of the International Conference "Carbon". Drezden, Germany, 2015. P. 150.