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APPLICATION IN CAPACITIVE TECHNOLOGIES OF ACTIVATED CARBONS PRODUCED FROM RICE HUSK

V. Pavlenko[1,2], Q. Abbas[3], Zh. Supiyeva[1,2], Z. Mansurov[1,2], Z. Ismagilov[4], F. Beguin[5]

[1] Al-Farabi Kazakh National University, 71 al-Farabi Ave., 050040 Almaty, Kazakhstan
[2] Institute of Combustion Problems, 172 Bogenbay Batyr Str., 050012 Almaty, Kazakhstan
[3] University of Graz, Austria
[4] Institute of Coal Chemistry and Material Science FRS CCC, 18 Sovetsky Av., 650000 Kemerovo, Russian Federation
[5] Poznan University of Technology, 4 Berdychowo, 60-965 Poznan, Poland
e-mail: pavlenko-almaty@mail.ru

Abstract
The advanced low cost activated carbons were prepared on the basis of rice husk by using potassium hydroxide as activating agent through two different approaches. Effects of preliminary grinding and leaching of carbonized rice husk, activation temperature and impregnation ratio on the development of porous structure in resulting carbons have been investigated.

Introduction

Annual manufacture of various types and brands of activated carbons (ACs) is equal to millions of tons, wherein the main consumers are petrochemical, food, mining and pharmaceutical industries. Other advanced application of the activated carbons is to produce on their basis the electrode materials for energy storage systems, mainly for electrochemical supercapacitors [1] as well as for capacitive deionization technology utilized for a desalination of water [2]. The demand for versatile carbon materials having a set of unique functional characteristics such as high specific surface area, electrochemical inertness and electrical conductivity is permanently increasing. Thus, the possibility of conventional synthesis of high performance ACs from widely available biomass precursors such as a rice husk (RH) and environmentally friendly chemical reagents is undoubtedly of great practical interest.

Experimental

The RH was derived from local farms of Almaty region, Kazakhstan, and subjected for cleaning and drying to constant mass before its carbonization at 500 °C ±10 °C in the nitrogen atmosphere for 40 minutes. Carbonized RH mixed with potassium hydroxide in a weight proportion of 2:1. The mixture was placed to stainless steel crucible and subjected to activation at 700 °C, 800 °C and 900 °C under nitrogen atmosphere for 1 hour. The resulting mixture after activation and full cooling was subjected to decantation by cold water with subsequent washing until the neutral pH, followed by drying to a constant mass.

Results and discussion

The porous material derived through the carbonization of RH is characterized by low specific surface area which is equal to 160 m^2/g. The physicochemical composition of the RH is characterized by the presence of a large amount of amorphous silicon oxide, the content of which in the original fibers varies at a level of 20 wt.% [3]. For this reason the chemical activation of carbonized RH with KOH which allows producing of ACs with highly developed porosity along with further leaching of silica was realized.

The carbonized RH gave the Raman shifts represented in Fig. 1a which were changed dramatically as a consequence of subsequent chemical activation shown in Fig. 1b,c,d. The intensity ratio of the D- and G-bands decreased from 0.83 to 0.74 with an increase in the activation temperature from 700 °C to 900 °C, with the formation of the maximum ID/IG=0.96 at 800 °C.