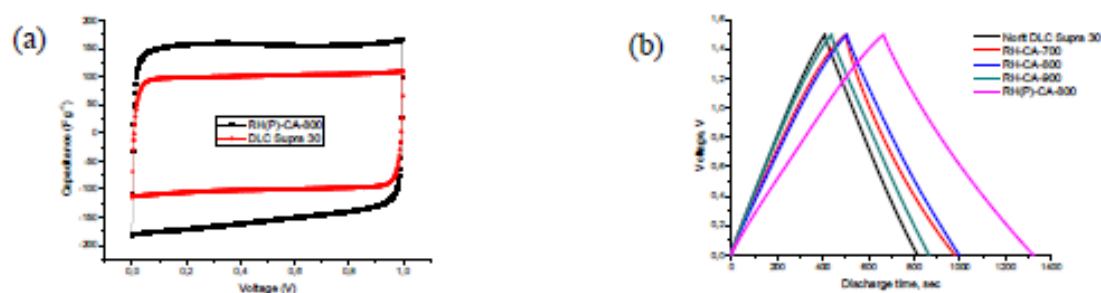


Results and Discussion

The low-temperature nitrogen isotherms corresponding to resulting ACs belong to Type I (according to IUPAC), a characteristic of microporous materials. The existence of hysteresis loop presented on each isotherm indicates the presence of mesopores that have diameter larger than 2 nm. The specific surface area calculated by BET and DFT have a maximum attributed to 800 °C used as activation temperature. The change in the activation temperature toward a decrease or increase resulted in a drop in this value. Thereby, this temperature is found to be the most adequate for the high temperature treatment of carbonized rice husk during its activation by KOH.

It is established that application of powdered RH leads to formation of AC with sufficiently higher developed porosity. The specific surface area (SSA) calculated by BET for ACs obtained through activation at 800 °C was 35-55% higher when the powdered RH is used compared to non-grinded RH precursor. In particular, the resulting SSA values were equal to 1519 m/g compared to 2315 m/g calculated by BET and also 1555 m/g versus 2001 m/g calculated by DFT respectively as it shown in Table 1. Wherein the volume of micropores in RH(P)-CA-800 increases significantly, while the volume of mesopores remains moderate and even lower compare to RH-CA-800.

The cyclic voltammograms (CVs) in 1 mol/l Li_2SO_4 for the RH derived AC and Norit DLC Supra 30 used for comparison are presented in Figure 1a. The AC/AC cell assembled with RH-CA-800 is represented by rectangular CVs, typical for a quasi-ideal electrical double-layer capacitor and shows the good charge propagation properties. The comparative galvanostatic charge-discharge curves for two-electrode AC/AC cells in 1 mol/l Li_2SO_4 using carbons prepared from RH are represented in Figure 1b.



(a) cyclic voltammetry at 2 mV/sec; (b) Galvanostatic charge-discharging

Figure 1 – Electrochemical measurements of 2E cells:

The cell assembled with carbonized RH activated with KOH at mild temperature (700 °C) displays more resistive character and worse symmetry of charge-discharge curve. Meanwhile all the systems display moderate ohmic drops at current load of 200 mA/g. Finally, one can see that the values of gravimetric capacitance corresponded to KOH-activated RH is much higher than the commercially available carbon Norit DLC Supra 30.

Conclusions

Our present study revealed that when the RH is used in a powdered form the overall specific surface area became enhanced in the range of 35-55%, which means that one of the most important factors is the control of the size of precursor particles subjected to impregnation or direct activation.