# Porous structure of thermally activated carbon material

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**The aim:** to study the effect of thermal activation on the development of the carbon materials (CMs) porous structure.

**Materials:** the initial material was obtained by thermal carbonization of walnut shells at 800°C [1]. To improve the structural and adsorption characteristics of the obtained CM, thermal activation was carried out at 400°C for 2 hours.

**Methods:** low-temperature porometry.

## Results

In order to determine the structural and adsorption characteristics of CM, the analysis of nitrogen adsorption/desorption isotherms (**Fig.1**) obtained at -196 °C was carried out using the Quantachrome Autosorb automatic sorbtometer.

The data analysis shows that thermal activation leads to changes in the parameters of the porous structure of CM. In particular, during the activation process, the specific surface area $S_{BET}$ increases from 230 to 431 $m^2/g$. In this case, the process of thermal activation promotes the development of a mesoporous structure. This is evidenced by the ratio of the mesopore volume $V_{meso}$ to the total pore volume $V_{\Sigma}$, which is 75%.

**Table 1.** Parameters of the porous structure of CMs

| Method of obtaining | $S_{BET}$, $m^2/g$ | $V_{\Sigma}$, $cm^3/g$ | $V_{meso}$, $cm^3/g$ | $V_{meso}/V_{\Sigma}$, % | $d_{por}$, nm |
|---|---|---|---|---|---|
| carbonization at 800°C | 230 | 0.133 | 0.014 | 11 | 2.2 |
| activation at 400°C | 431 | 0.521 | 0.390 | 75 | 4.8 |

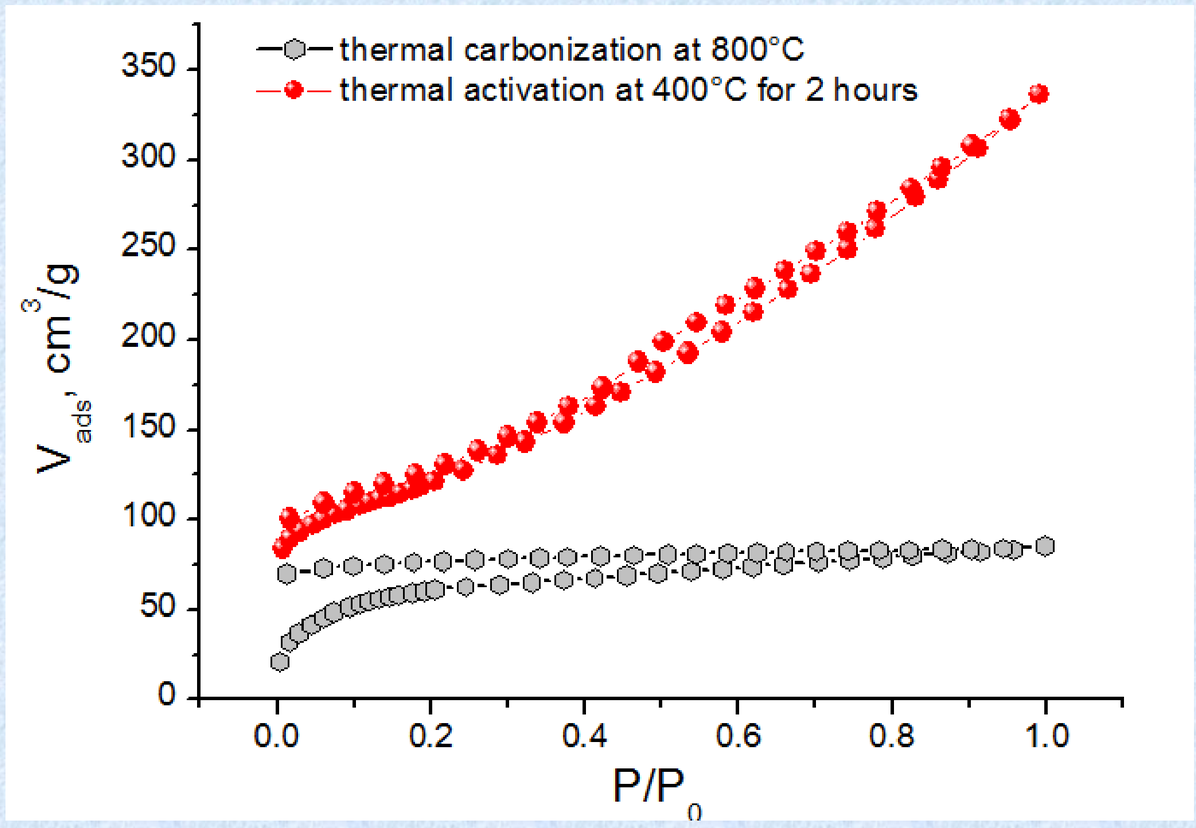


**Fig.1.** Nitrogen adsorption/desorption isotherms for CM.

The theory of the nonlocal density functional (slit-pore model) was applied for the distribution of micropores (**Fig. 2**), which shows that the initial CM is a microporous material with pores of 1.5-2 nm, and thermal activation promotes the development of a mesoporous CM structure.

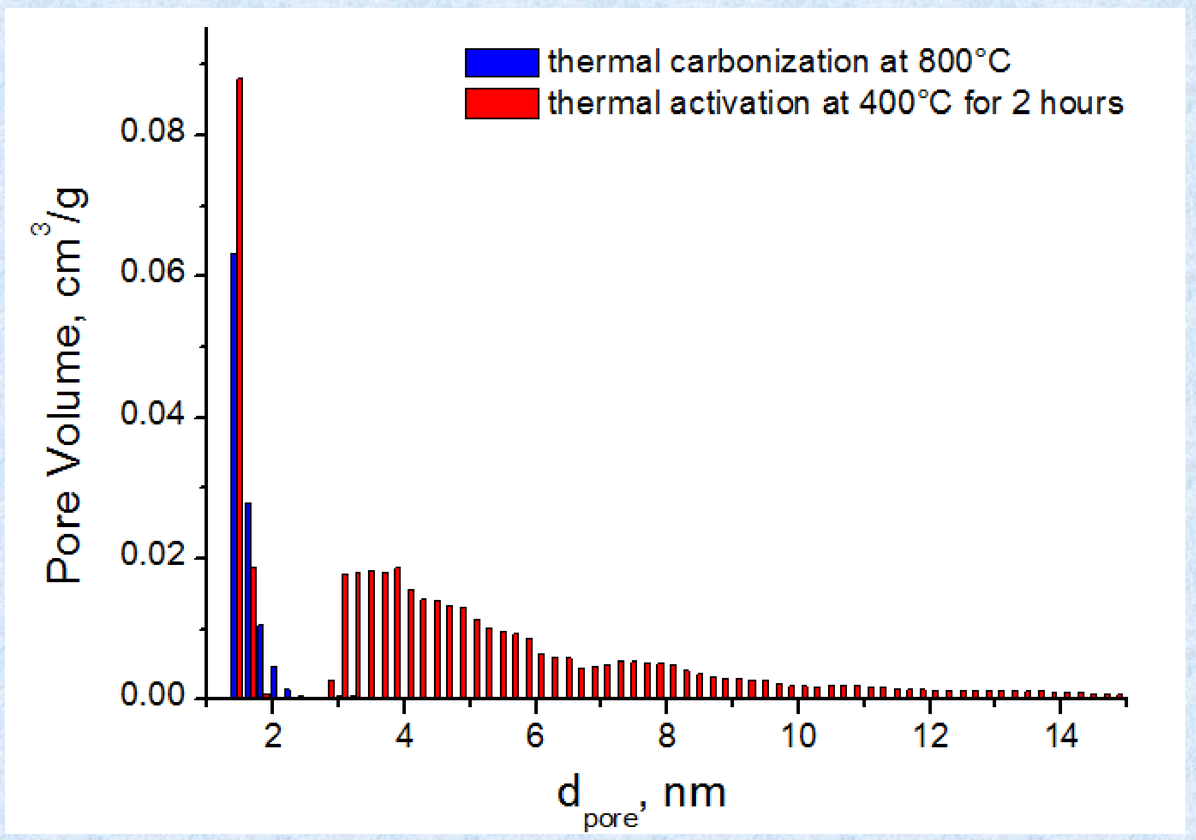


**Fig.2**. Distribution of pores by size.

**Conclusions:** Thermal activation stimulates the development of the micro- and mesoporous structure of the carbon material. For the activated sample, the values of the specific surface increased by approximately 2 times, and the main pore volume was in the range of micropores 1.5 - 2 nm and mesopores 3 - 10 nm.

**References:**

[1]. *Ivanichok N. Ya., Ivanichok O. M., Rachiy B. I., Kolkovskyi P. I., Budzulyak I. M., Kotsyubynsky V. O., Boychuk V. M., Khrushch L. Z.* Effect of the carbonization temperature of plant biomass on the structure, surface condition and electrical conductive properties of carbon nanoporous material // Journal of physical studies -2021.-**25**, N 3.-P. 3801(10 p.).