MWP – Young Researcher Abstract 2023

Project title: Highly graphitized lignin-derived porous carbon with hierarchical "core-shell" superstructure for advanced supercapacitor performance	
Author: Hao Zhang	
Affiliation: Åbo Akademi University	**E-mail: hao.zhang@abo.fi**

Abstract (approx. 200 words)**:**
Porous carbon nanoparticles have been widely utilized as electrode materials for supercapacitors owing to their rich microporous and mesoporous structures. We successfully prepared lignin-based carbon with a hierarchical porous "core-shell" graphitized superstructure via a two-stage carbonization-graphitization process. The prepared carbon possesses a high graphitization degree, high porosity with micro/meso porous hierarchical structure, and high content of N/O co-dopants induced by activation treatment, thus guaranteeing advanced electrochemical performance. It is worth mentioning that the synergistic effect of the introduced metal-organic framework carbon core and lignin carbon shell successfully obtained the largest specific surface area of 2307.3 m2$\cdot g^{-1}$, which has a positive effect on improving the capacitor capacity (462.6F$\cdot g^{-1}$) and super-long cycling performance (more than 10000 times).

By utilizing lignin, which is typically burned for energy production during cellulose fiber production, this research provides an innovative approach to valorizing these resources and has a significant impact on the forest-based industry. It also contributes to the overall societal impact. This research provides an available approach to harness the underutilized lignin as feedstock in advanced energy storage applications, helping to address energy storage challenges and promote the use of renewable materials and mitigate environmental concerns associated with electrochemistry technologies.

Key words:
lignin, hard carbon, supercapacitor