

Multifaced carbon nanoparticles from spent coffee grounds for photo-induced and electrochemical applications

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The electronic and optical features so far observed for carbon-nanostructures encourage the investigation on these innovative, functional, bio-compatible and eco-sustainable materials, focusing the attention on the development of green synthesis procedures, in the frame of circular economy, starting from waste biomass.[1] In particular, for their wide potential photoinduced application in different fields, from biology to technology, it's useful tuning the photochemical and photophysical features of carbon nanoparticles (CNPs) and this is possible thanks to CNPs easiness of processing with high precision, nanometric size and the possibility to be functionalized through sustainable procedures. Further, protocols with low environmental and energy impact can be designed exploiting waste materials as carbon source. In this contribution, indeed, various bio-waste and by-products, such as coffee grounds and coffee silver-skins, were used as carbon sources. [2] CNPs were thus obtained by means of simple, cheap and ecological hydrothermal synthesis procedures according to an oxidation process. The obtained CNPs were characterized by various spectroscopic techniques including, UV-Visible absorption fluorescence, FT-IR, Raman and XRF spectroscopy. CNPs morphology, instead, was investigated by means of Atomic Force Microscopy. The synthesized CNPs have been investigating as electro-catalysts for water oxidation processes and as photosensitizers for photodynamic therapy applications.[3]

[1] Meng, W., Bai, X., Wang, B., Liu, Z., Lu, S., Yang, B. (2019). Biomass-Derived Carbon Dots and Their Applications. *Energy Environ. Mater.*, 2(3), 172-192.

[2] Bettini, S., Ottolini, M., Pagano, R., Pal, S., Licciulli, A., Valli, L., Giancane, G. (2021). Coffee Grounds-Derived CNPs for Efficient Cr(VI) Water Remediation. *Nanomaterials*, 11(5), 1064-1077.

[3] Zhang, X., Jiang, M., Niu, N., Chen, Z., Li, S., Liu, S., Lix, J., (2018). Natural-Product-Derived Carbon Dots: From Natural Products to Functional Materials. *Chems.*