

Lignin nanostructures: from lab to market

Matteo GIGLI, Department of Molecular Sciences and Nanosystems, Ca' Foscari University of Venice

Lignin is a widely available material, being the most abundant aromatic biopolymer on the planet. It is obtained as byproduct of pulp and paper and biorefinery industries at a rate of about 70 Mt/year. Although it displays very interesting features, such as antimicrobial, antioxidant, UV-shielding and complexing ability, lignin is mainly burned to produce energy. This is largely due to its variability and heterogeneity that not only depend on the botanical origin, but also on the different processes and harsh conditions adopted for lignin extraction, hampering its full valorization into high added-value products.^[1] Nevertheless, in the last years, the generation of lignin micro- and nano-structures (LNS) has received steadily growing interest because it permits to preserve all the desired characteristics of the starting material, while allowing for the entrapment and controlled release of active compounds. Thanks to the above-mentioned properties, LNS protect the encapsulated agent from the environment and exert other useful functions, producing beneficial synergistic effects.

In this contribution, the preparation of lignin-based nanoparticles and microcapsules by simple, scalable and cost-effective strategies will be outlined, with a specific focus on physical methodologies that do not involve any chemical pretreatments of the chosen lignin. Structure-property relationships, as well as loading ability, kinetics of release and particles' stability in various conditions will be also illustrated, with the aim of providing a brief overview on the marketability of the presented technologies.