High Throughput Electrospinning and Electrospraying for the Design of Innovative Nanomaterials and Structures of Application Interest

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Abstract

Looking genuinely at nature, nanofibers often serve as a basic platform where either organic or inorganic components are built upon. For instance, cellulose nanofibers would represent the building block in plants while collagen nanofibers in the animal body. Electrospinning is a physical process used for the formation of ultrathin fibers by subjecting a polymer solution to high electric fields. At a critical high voltage, the polymer solution droplet at the tip of the injector distorts and forms a Taylor cone to be ejected as a charged polymer jet. This stretches and is accelerated by the electrical field towards a grounded and oppositely-charged collector. As the jet travels through the electric field, the solvent completely evaporates. This results in the creation of ultrathin polymer fibers in a process called electrospinning or in particles in a process called electrospraying (1,5).

Since recently this process has been scaled up to an industrial level by companies such as Bioinicia S.L. and it is now possible to form materials and composites in larger volumes.

The current paper will highlight some recent advances carried out within our research group in which various applications of the high throughput electro-hydrodynamic processing technique making use of biopolymers and biopolymeric blends will be reviewed. These include examples in which new nanocomposites, coatings, multilayers, antimicrobial and bioactive nanostructured materials and encapsulates were successfully developed with application interest in packaging, biomedical, pharmaceutical and food fortification applications, respectively.

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References

[1] Olsson et al., 2010 Macromolecules
[2] Martinez et al., 2013 Biomacromolecules.
[3] Basar et al., 2017 Materials. Science and Engineering C.
[4] Cherpinsky et al., 2018 Cellulose.
[5] S. Torres et al., 2017 Journal of Agricultural and Food Chemistry