Stability of electrohydrodynamic cone-jets of biopolymer solutions: Influence of chain entanglements and solution rheology

Hamid Taghipour[1], *and Christine Jérôme*[1, *].

[1]The Center for Education and Research on Macromolecules (CERM), Complex and Entangled Systems from Atoms to Materials (CESAM), The University of Liège (ULiège) Liège, Belgium.

*Corresponding author: c.jerome@uliege.be

Abstract

Electrospun fiber mats of biopolymers find applications notably in the biomedical field as bioactive implants or as scaffolds for tissue engineering. These biopolymers, such as polysaccharides, are mainly electrospun from solutions. In this work, we experimentally characterized the stability of the Taylor cone-jet mode during the electrospinning process, with a special attention to the effects of chain entanglements and solvent surface-tension on fiber formation that are evaluated quantitatively. To do so, the results of a series of electrospinning experiments of a PCL solution and nine binary solutions of long linear chitosan (CS) blended with ultrahigh-molecular weight poly (ethylene oxide) (PEO) in acidic medium while varying their concentrations and the aqueous acetic acid concentration are investigated. The solution properties and fiber spinning morphologies are analyzed by rheology and SEM respectively. Our results provide a framework for developing a rigorous understanding of the relation between solvent characteristics, solution viscoelasticity, and electrospinnability of biopolymer solutions to enable the design of more complex spinning fibers.