CAN POLY(N-ISOPROPYL ACRYLAMIDE) BE ELECTROSPUN FROM WATER? YES!

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Abstract

With increasing toxicity and environmental concerns, electrospinning from water, *i.e.* waterborne electrospinning, is crucial to further exploit the resulting nanofiber potential.[1] Most water-soluble polymers have the inherent limitation of resulting in water-soluble nanofibers and a tedious chemical cross-linking step is required to reach stable nanofibers. An interesting alternative route is the use of thermoresponsive polymers, such as poly(N-isopropyl acrylamide) (PNIPAM), as they are water-soluble beneath their lower critical solution temperature (LCST) allowing low temperature electrospinning while the obtained nanofibers are water-stable above the LCST. Moreover, PNIPAM nanofibers show major potential to many application fields, including biomedicine, as they combine the well-known on-off switching behavior of PNIPAM, thanks to its LCST, with the unique properties of nanofibers. In the present work, based on dedicated turbidity and rheological measurements, optimal combinations of polymer concentration, environmental temperature and relative humidity are identified allowing, for the first time, the production of continuous, bead-free PNIPAM nanofibers electrospun from water (**Figure 1**).[2] More specifically, PNIPAM gelation was found to occur well below its LCST at higher polymer concentrations leading to a temperature regime where the viscosity significantly increases without compromising the polymer solubility. This opens up the ecological, water-based production of uniform PNIPAM nanofibers that are stable in water at temperatures above PNIPAM's LCST, making them suitable for various applications, including drug delivery and switchable cell culture substrates.

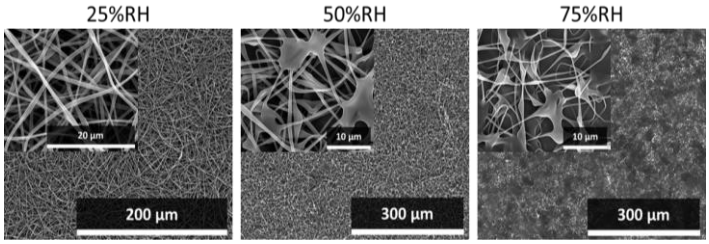

Figure 1. SEM of PNIPAM nanofibers clearly indicate a major influence of relative humidity on electrospinnability.

References

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