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Comparison of single-needle and nozzle-free electrospinning methods

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The most common and simplest way to produce nanofibers is electrospinning (ES), a process in which a liquid jet is generated by an electric force and is then transported towards the collector. The easiest way to form nanofibers from electrospinning solution is by single-needle ES, where fibers are formed through a metal nozzle. Since only one jet is formed through the needle at a time, the productivity of single-needle ES is low. In contrast, nozzle-free equipment can increase the productivity and could be used for massively producing nanofibers.

Our aim was to produce rapid-release ciprofloxacin-loaded nanofibers by single-needle ES and then to increase productivity by transporting the method into a nozzle-free ES and finally, to compare the two preparation methods.

For the comparison micrometric properties were examined by scanning electron microscopy (SEM), physicochemical properties by powder X-ray diffraction (XRPD) and differential scanning calorimetry (DSC) and the homogeneity of the nanofibrous mats by Raman mapping. The rate of drug release was determined by *in vitro* dissolution tests.

Based on our results, nozzle-free ES provides acceptable morphology and more homogeneous ciprofloxacin distribution than the traditional single-needle ES technique. From the nanofibrous mats, the drug release was immediate and complete. The ciprofloxacin was in amorphous form in every nanofibrous sample. The nozzle-free ES method may be worth further development in the future.

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