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Ultrasound-enhanced electrospinning of active-loaded nanofibrous mats

Electrospinning (ES) has been widely used to produce nanostructures relevant to many applications including e.g., filtering media, composite materials, drug delivery systems, and scaffolds for tissue engineering. Conventional ES uses an electric potential difference and spinneret to draw fine, typically micro or nano-scale, fibers from a polymer solution or suspension. The standard ES has a number of well-known drawbacks, such as limited productivity, clogging of the spinneret system and ES of viscous polymers solutions. We have developed a new ultrasound-enhanced ES technique (USES) for fabricating polymeric nanofibers and nanofibrous mats for pharmaceutical and biomedical applications. In this technique, nanofibers are generated without any spinneret (nozzle) using high-intensity focused ultrasound. The USES allows production of constructs with better spatial control over anisotropic properties, e.g. gradients in nanofiber thickness to control drug release profile or to modify the mechanical or topological properties of the nanofibers for tissue engineering purposes. Such constructs could be the basis for tomorrow’s active wound dressings and tissue engineering. Some selected state-of-the-art applications of nanofibrous systems in drug delivery and tissue engineering with a special reference to wound healing applications, will be reviewed.