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We conducted creep experiments on CFs from and mouse tail tendon collagen fibrils and nano DMA experiments on obth CFs and electrospun PLLAs. Both experiments are facilitated through a recently developed instrument then NanoTens, for testing of nano- and microscale fibers with quick coupling and uncoupling [3].

In creep experiments we show that the transient behaviour at medium strains can be empirically described using a linear Burgers model in Kelvin-Voigt configuration. Here elastic elements exhibit moduli in the range of 0.2-10 GPa and viscous elements exhibit viscosities in the range of 102-104 MPa.s for the dashpot within the Kelvin-Voigt body and 103-106 MPa.s for the dashpot in series.

In nano DMA experiments We observe similar elastic behavior in monotonic tensile tests and elastic response in nanoDMA for CFs and PLLAs. However, the loss modulus and tangent of PLLAs is significantly higher compared to CFs. This warrants room for further optimization of PLLA material properties.

In conclusion, the the NanoTens opens the door for assessing the time-dependent properties of indivudal CFs and thus to establish a unified constitutive CF model.

1. Sensini and Cristofolini, Materials, 11(10), 2018.

2. Sensini et al., Front.Bioeng.Biotech. 2(9), 2021.

3. Nalbach et al., Rev. Sci. Instrum., 2022. Rev.Sci.Instrum. 93 2022

Triaxial electrospun fibers for prolonged drug release

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Electrospun nanofibers are a challenging system for effective and targeted drug delivery in tissue engineering applications. The triaxial technique is a fairly new method under investigation. The fibers obtained by this method consist of three layers: a core and two layers surrounding the core. Triaxial electrospinning is a competitive method to solve the critical limitations in other techniques, i.e. uniaxial, and coaxial, such as lack of sustained and controlled drug release, poor solubility of drugs, problems with loading multiple drugs, and biodegradation, not adequate biocompatibility.

The first objective of the research is to optimize the manufacturing process using triaxial electrospinning to get homogenous-free beads fibers and beneficial effects on drug release.

For the development of the fibers, a combination of biodegradable synthetic and natural polymers were used: polycaprolactone (PCL) (core layer), poly(lactic-co-glycolide) (PLGA) (shell layer), and gelatin (intermediate layer). Natural polymer improves biocompatibility, while the combination of PCL and PLGA is expected to maintain preferred structural properties e.g. hydrophilicity and morphology. As a model of the drug, Rhodamin B (Rh B) was loaded for the optimization process.

Preliminary investigations including optimization of manufacturing triaxial fibers are discussed. Microscopic images demonstrated homogenous free-beads fibers were developed as a result of many trials. Furthermore, it was observed fibers are covered with an outer layer according to the expectancy. Under the shell layer, there is a middle surrounding the core layer indicating that the proposed process with parameters selected in this way allows producing of core-shell fiber structure. Preliminary *in-vitro* studies were performed with Rh B to investigate release profiles from triaxial fibers compared to coaxial fibers. The results showed triaxial fibers decreased initial burst release significantly over the coaxial fibers.

The research reported here shows triaxial fibers as promising biomaterials that can be used as novel drug delivery systems in biomedical applications.

Synthesis and characterization of drug loaded hybrid mesoporous silica particles for biomedical applications

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Mesoporous silica materials are promising candidates for drug delivery systems, due to their high specific surface area, large pore volume, ordered network and narrow pore size distribution.

Traditionally, non-ionic or ionic surfactant micelles were used as a structure directing agent of silica. However, a polyion complex (PIC) assembly, which is based on interactions between a pH stimuli-responsive double-hydrophilic block copolymer (DHBC) with a weak polyamine, benefits from functional hybrid silica mesoporous shell and a tuneable stimuli responsive copolymeric core [1]. This gives them specific functionalities, such as the ability of drug encapsulation and release in a specific pH[2].