EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

# Experiment Report Form

| | | |
|---|---|---|
| | **Experiment title:** Structural characterization of insoluble hydrophilic scaffolds for wound healing | **Experiment number**: LS-2988 |
| **Beamline**: ID02 | **Date of experiment**: from: 03-12-2021 to:05-12-2021 | **Date of report**: 06/04/2022 |
| **Shifts:** 6 | **Local contact(s)**: Lauren Matthews | *Received at ESRF:* |


**Names and affiliations of applicants** (* indicates experimentalists):

**Patrizia Hanieh**

**Marco Ruggeri**

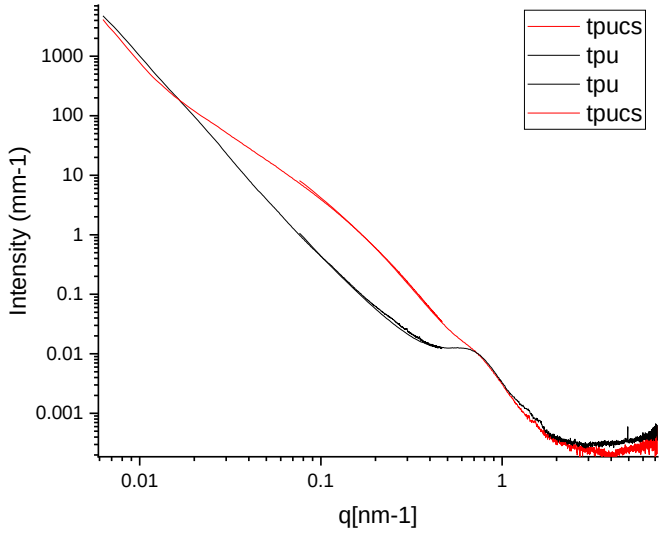
**Eleonora Bianchi**


**Report:**

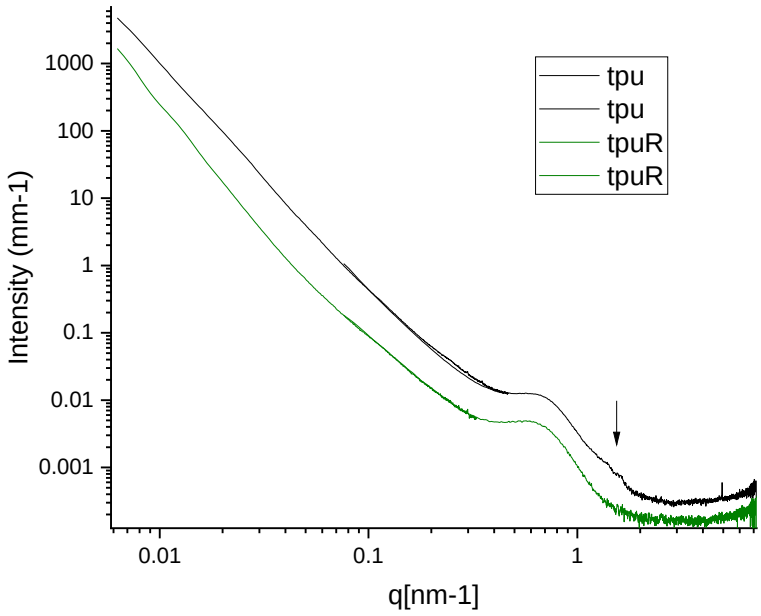
Scaffolds

Scaffolds were obtained from thermoplastic polyurethane TPU or TPU + chondroitin sulfate blends using an electrospinning apparatus (STKIT-40, Linari Engineering, Pisa, Italy) equipped with a high-voltage power supply (Razel R99-E 40 kV), a 10 mL syringe with inox 21G needle, and a volumetric pump (Razel R99-E). A static and flat collector was used to obtain the random. The lengthwise-aligned tubular scaffolds were collected in a tubular shape using a cylindrical rotatingdr um in stainless steel (dimensions: diameter: 3 mm; length: 150 mm; wall thickness:0.3 mm).

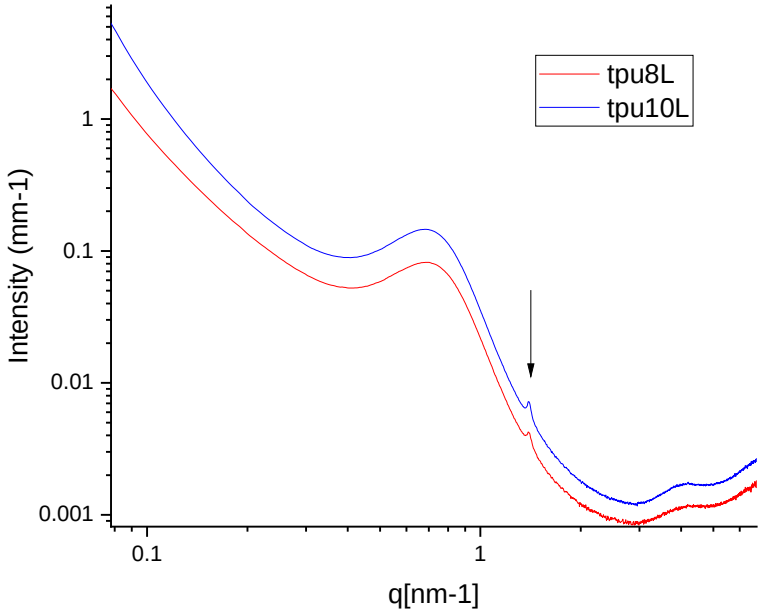
Scaffolds were hydrated in water and observed at two saple-to-detector distances ( 1m and 10m)




TPU are linear block copolymers consisting of thermodynamically incompatible soft (SB) and hard (HB) blocks that undergo a microphase separation. The broad peak at q = 0.7 $nm^{-1}$ is related to a characteristic distance depending on the length of soft and hard blocks.
Effect of chondroitin sulfate on the arrangement of aligned scaffolds. The addition of the polysaccharide affects dramatically the structure of scaffolds on the mesoscale. The intensity decay behaviour changes from $I(q) \div q^{-3.8}$ to $I(q) \div q^{-2}$, suggesting a lamellar arrangement on the length-scale < 400 nm.

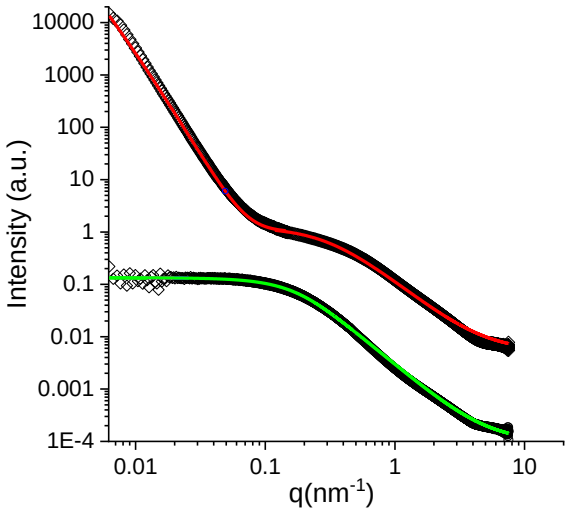



Aligned samples display peaks in the q region $1<q<2$ $nm^{-1}$ that disappear in the random- prepared samples. The small peak at q = 1.4 $nm^{-1}$ is characteristic for thermoplastic polyurethane as visible in the scaffolds prepared by lyophilisation from mold  at 8% or 10% concentration)

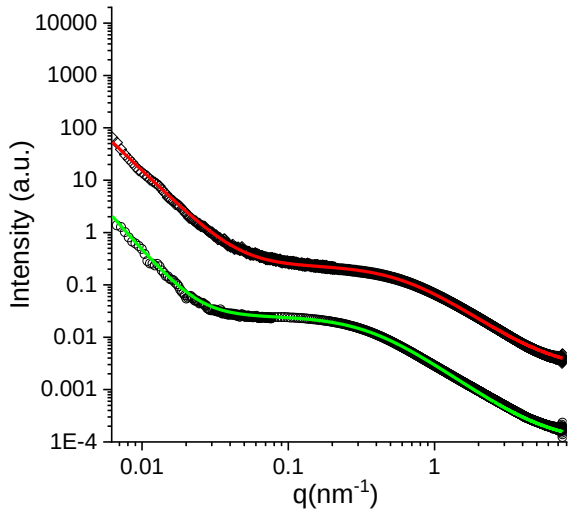



Microparticles

Microparticles based on polysaccharides (maltodextrin or dextran) to improve wound healing. The microparticles were prepared by spray-drying and then cross-linked by heating to obtain insoluble systems in aqueous fluids. Both not cross-linked and cross-linked systems (hydrated with water) were characterized at two sample-to- detector distances (1m and 10m ).




Maltodextrin-based systems. Not cross-linked (bottom) and cross-linked (top). Fitting lines have been obtained with a polydisperse polymer coil model (green line) or with the same model + Porod's regime at low q values.




Dextran-based systems. Not cross-linked (bottom) and cross-linked (top). Fitting lines have been obtained with a polydisperse polymer coil model + $q^{-s}$ regime at low q values ( s = 3.2 green, s = 2.7 red)