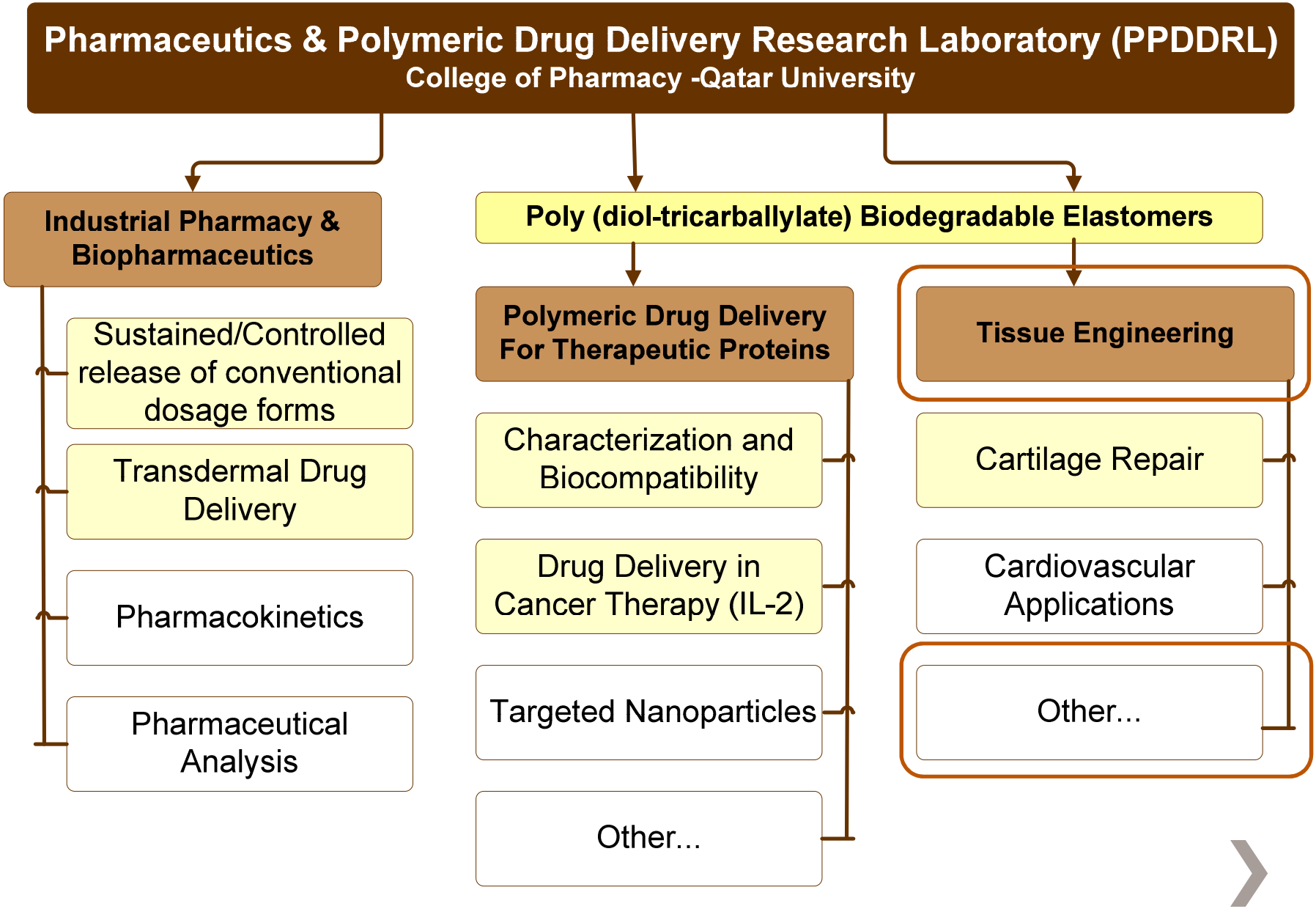
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Fabrication & characterization of 3D electrospun biodegradable nanofibers for wound dressing, drug delivery and other tissue engineering applications

The 5th International Conference and Exhibition on Pharmaceutics & Novel Drug Delivery Systems - Dubai, UAE
March 17th , 2015


Pharmaceutics & Polymeric Drug Delivery Research Laboratory (PPDDRL)
College of Pharmacy -Qatar University
Industrial Pharmacy & Biopharmaceutics
Sustained/Controlled release of conventional dosage forms
Transdermal Drug Delivery
Pharmacokinetics
Pharmaceutical Analysis
Poly (diol-tricarballylate) Biodegradable Elastomers
Polymeric Drug Delivery For Therapeutic Proteins
Characterization and Biocompatibility
Drug Delivery in Cancer Therapy (IL-2)
Targeted Nanoparticles
Other...
Tissue Engineering
Cartilage Repair
Cardiovascular Applications
Other...

Objectives

- Prepare biodegradable electrospun fibers using drug-unloaded and drug-loaded polymers to demonstrate the formation of 3D electrospun scaffolds.

- Characterize the prepared electrospun fibers using Differential Scanning Calorimetry (DSC), Fourier Transform-Infrared Spectroscopy (FT-IR) and Scanning Electron Microscopy (SEM).

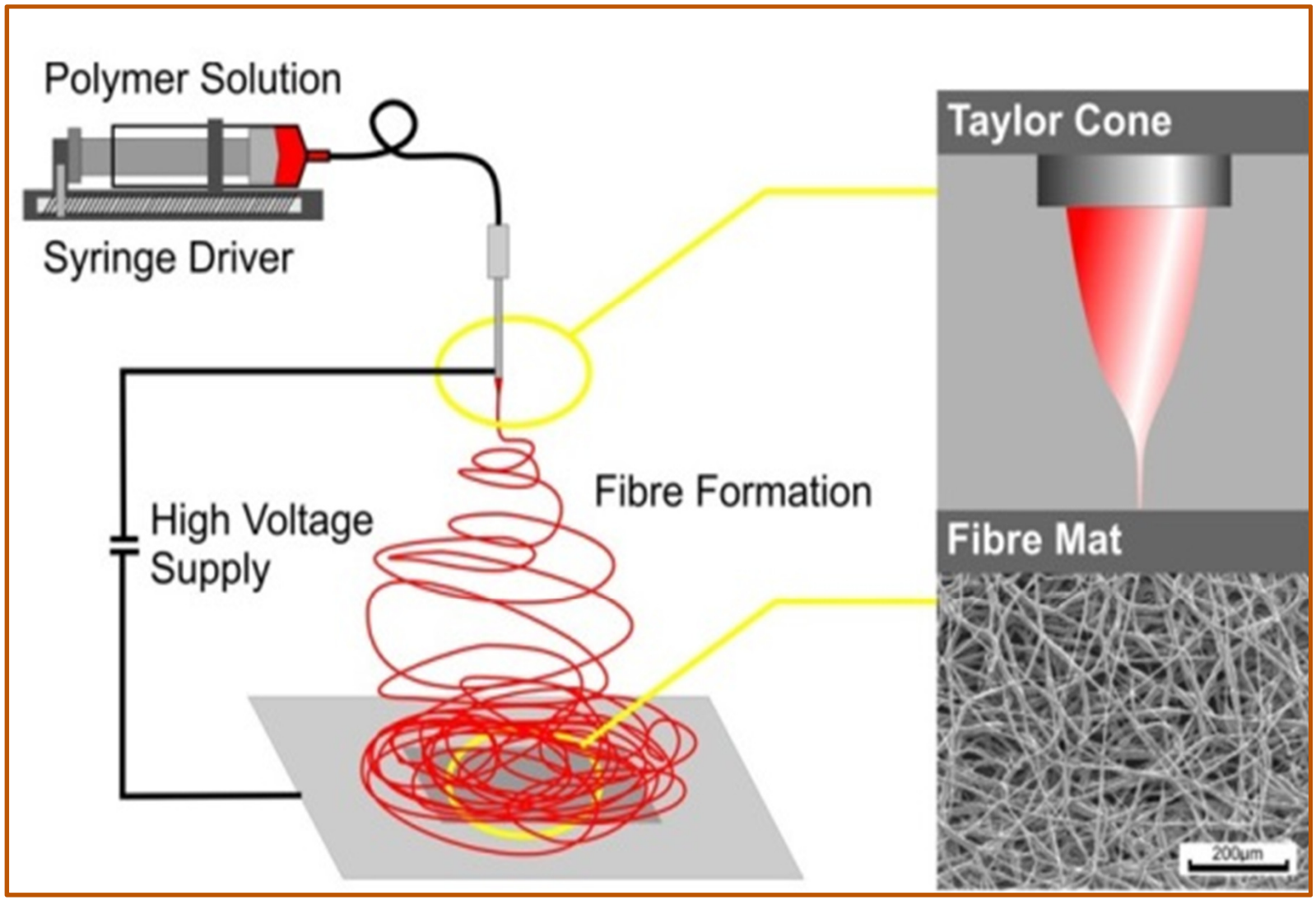


- The main purpose of using a wound dressing is to protect the wound from environmental threats and promote tissues re-generation and replacement.
- Traditional dressing challenges direct towards advanced multifunctional wound dressing development.
- Use of polymers in tissue engineering and drug delivery.

> **Electrospinning**

Background





Electrospinning

- **Amoxicillin Trihydrate (AMX),** one of the most important antibiotics used in wound dressing and other tissue regenerative applications, has been used as a model drug.
- AMX- loaded **PEG 35000** biodegradable electrospun nanofibers (BENS) were successfully produced by electrospinning and the interaction between Amx and PEG fibers was fully investigated.

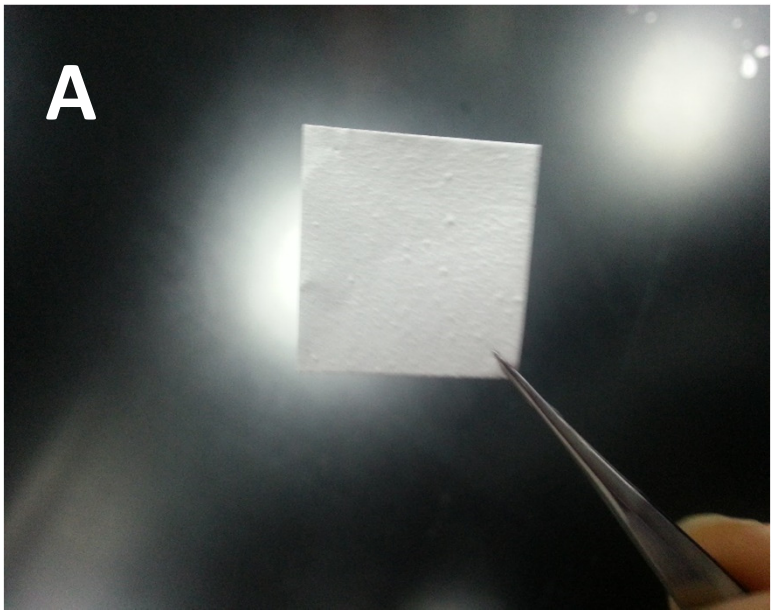
What was done?

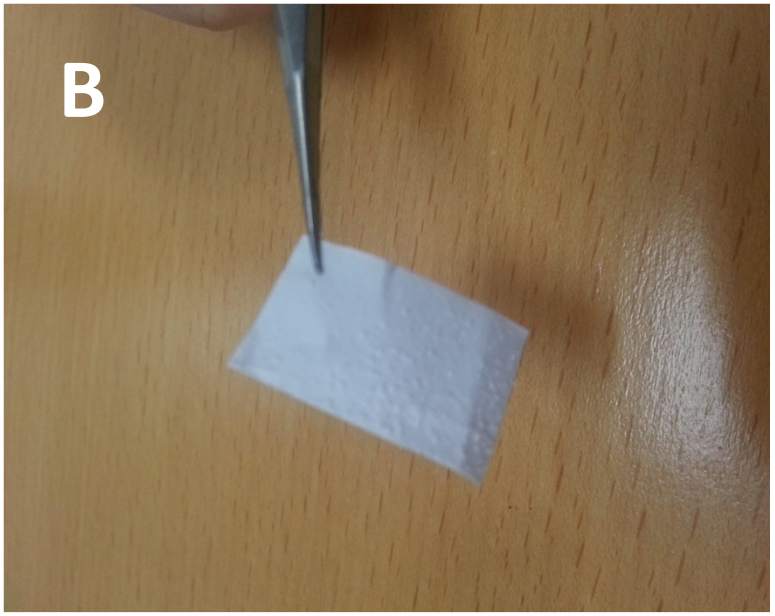
- Solutions of PEG35000 in chloroform of varying concentrations (20, 30, **35**, 40 % w/v) were prepared.
- These solutions were used to fabricate BENS using ET. Different Voltage, flow rate and distance to collector were set to standardize the method.
- 10% w/v AT in PEG35000 solutions were prepared and fabricated to produce AMX loaded BENS.

How Was it is done?

Characterization

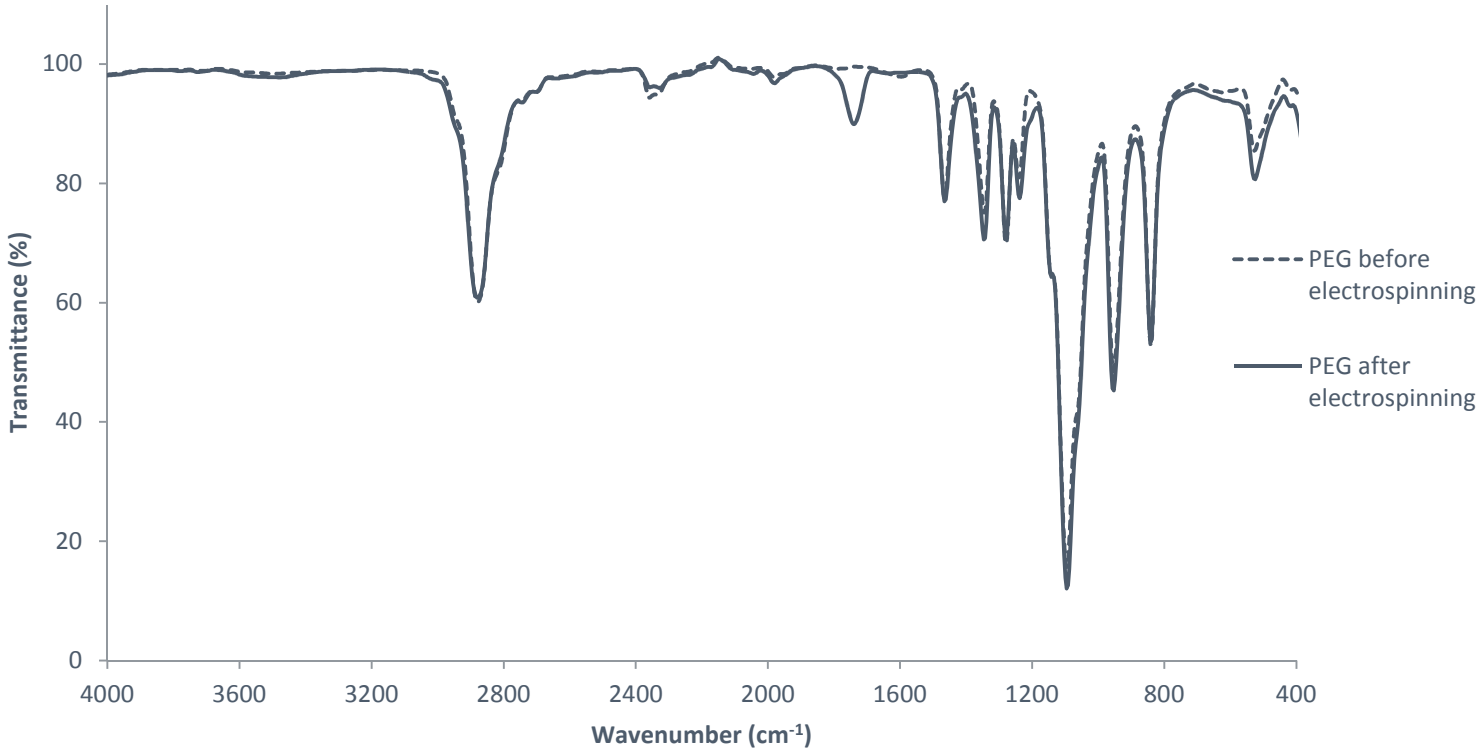
- Morphology, size and diameter of BENS were assessed using **Scanning Electron Microscopy** (SEM).
- **Fourier Transform Infrared** (FT-IR) Spectroscopy was used to identify the interaction between PEG35000 and AMX.
- **Differential Scanning Calorimetry** (DSC) was used to assess the crystallinity and thermal behavior of the prepared BENS.
- **X-Ray Diffraction Analysis** (XRD)
- **Cytocompatibility studies** on unloaded BENS.



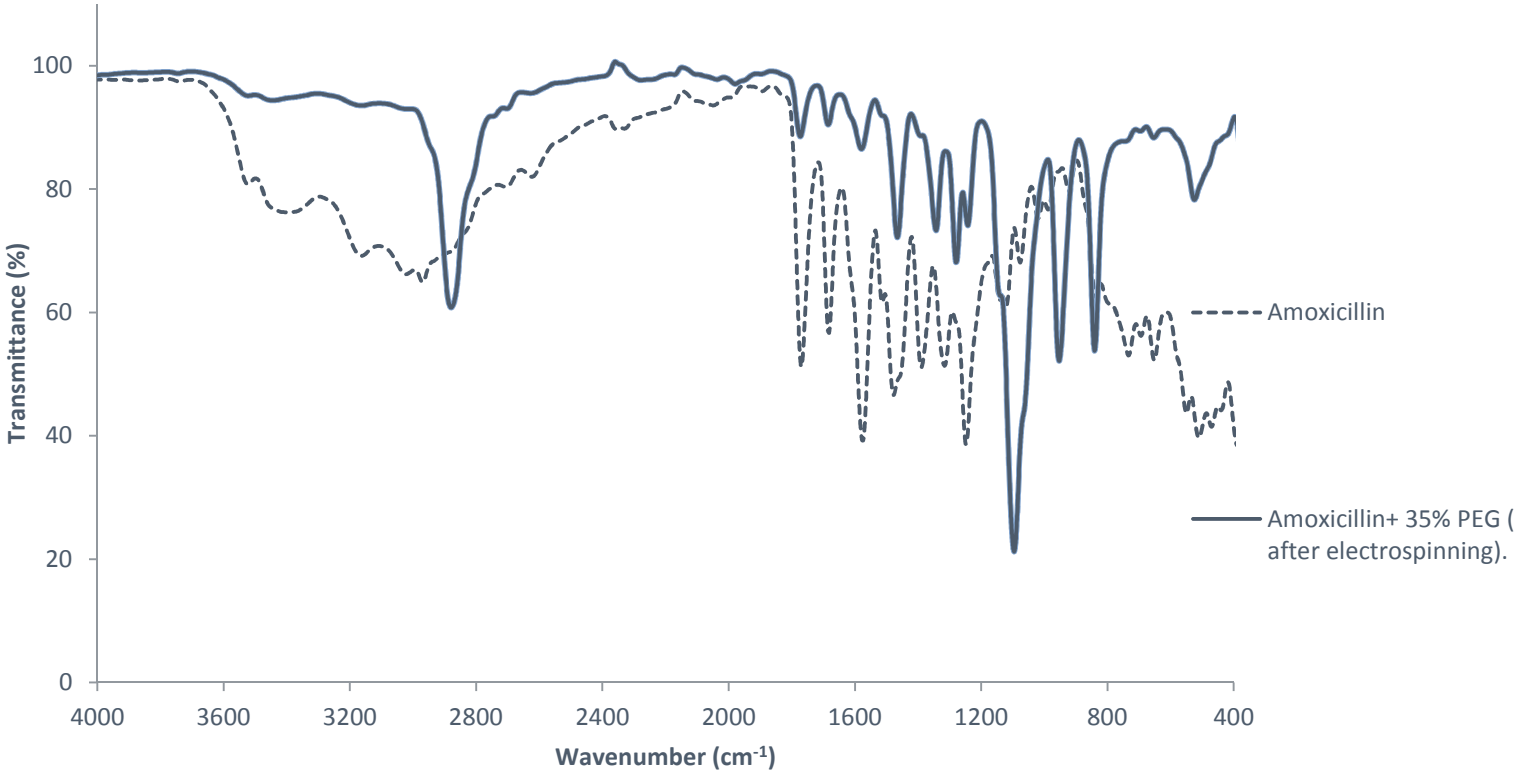


Images of (A) Blank & (B) AT loaded BENS

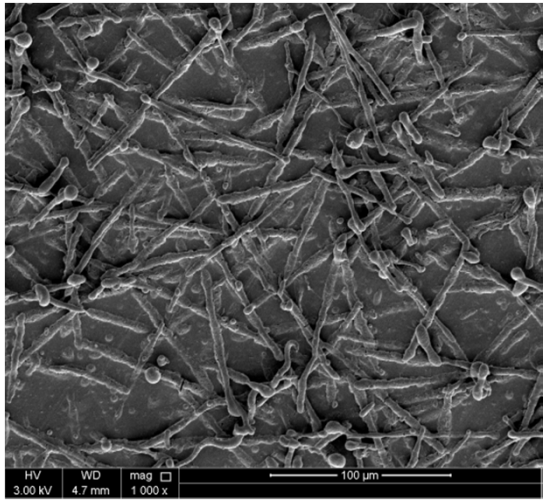
Scaffolds/Dressings ›

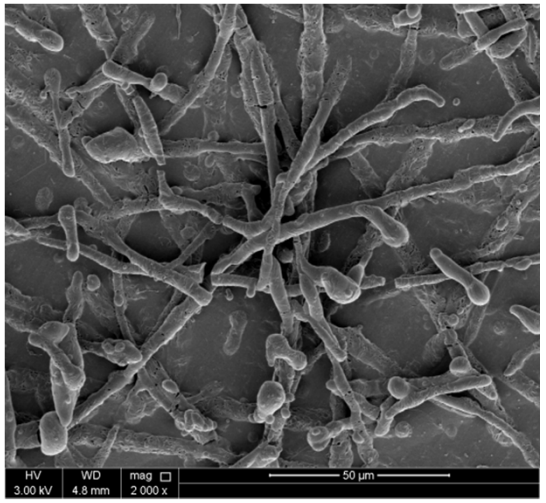

100
80
60
40
20
0
Transmittance (%)
4000
3600
3200
2800
2400
2000
1600
1200
800
400
Wavenumber (cm-1)
PEG before electrospinning
PEG after electrospinning

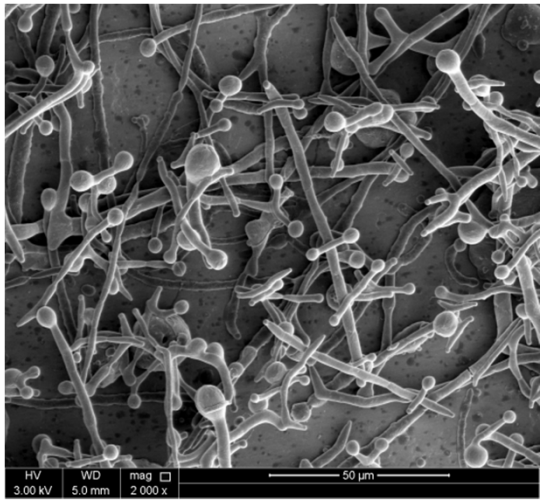
FT-IR of PEG

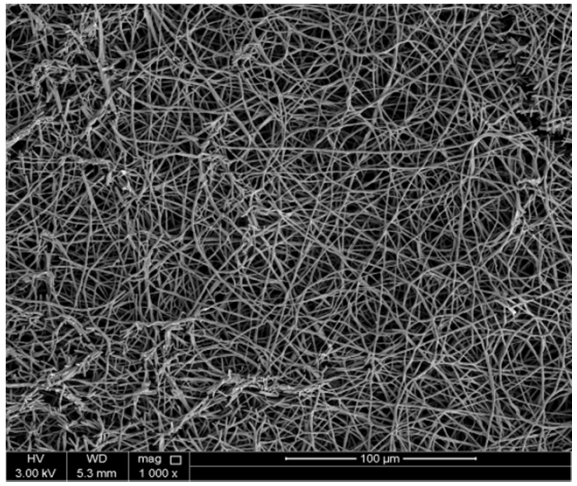


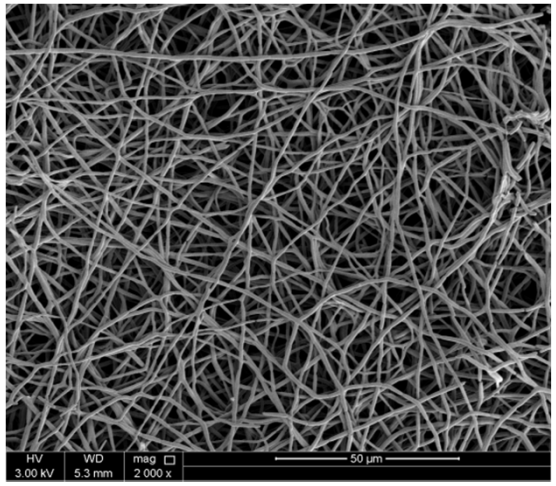
FT-IR of AMX BENS





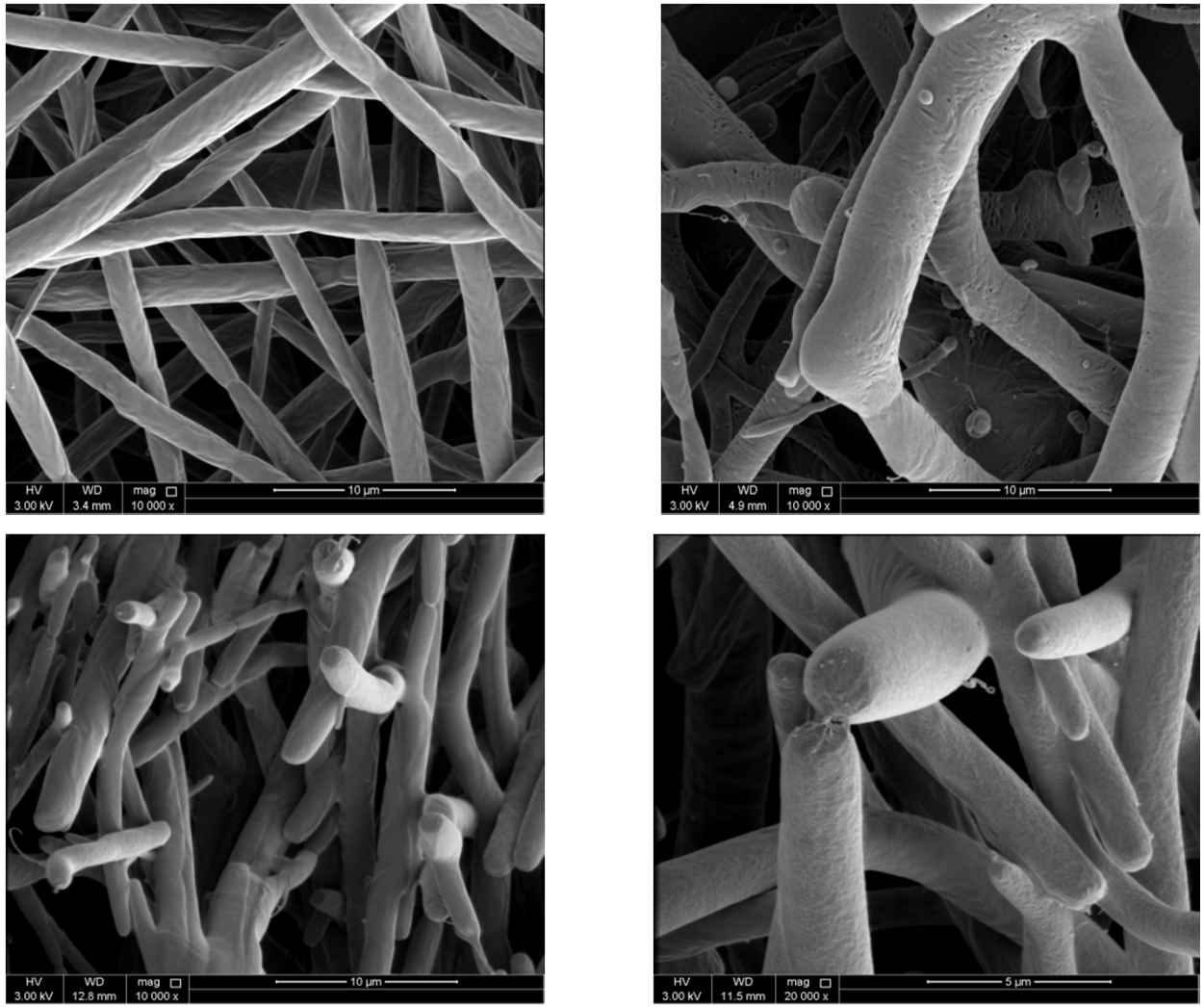




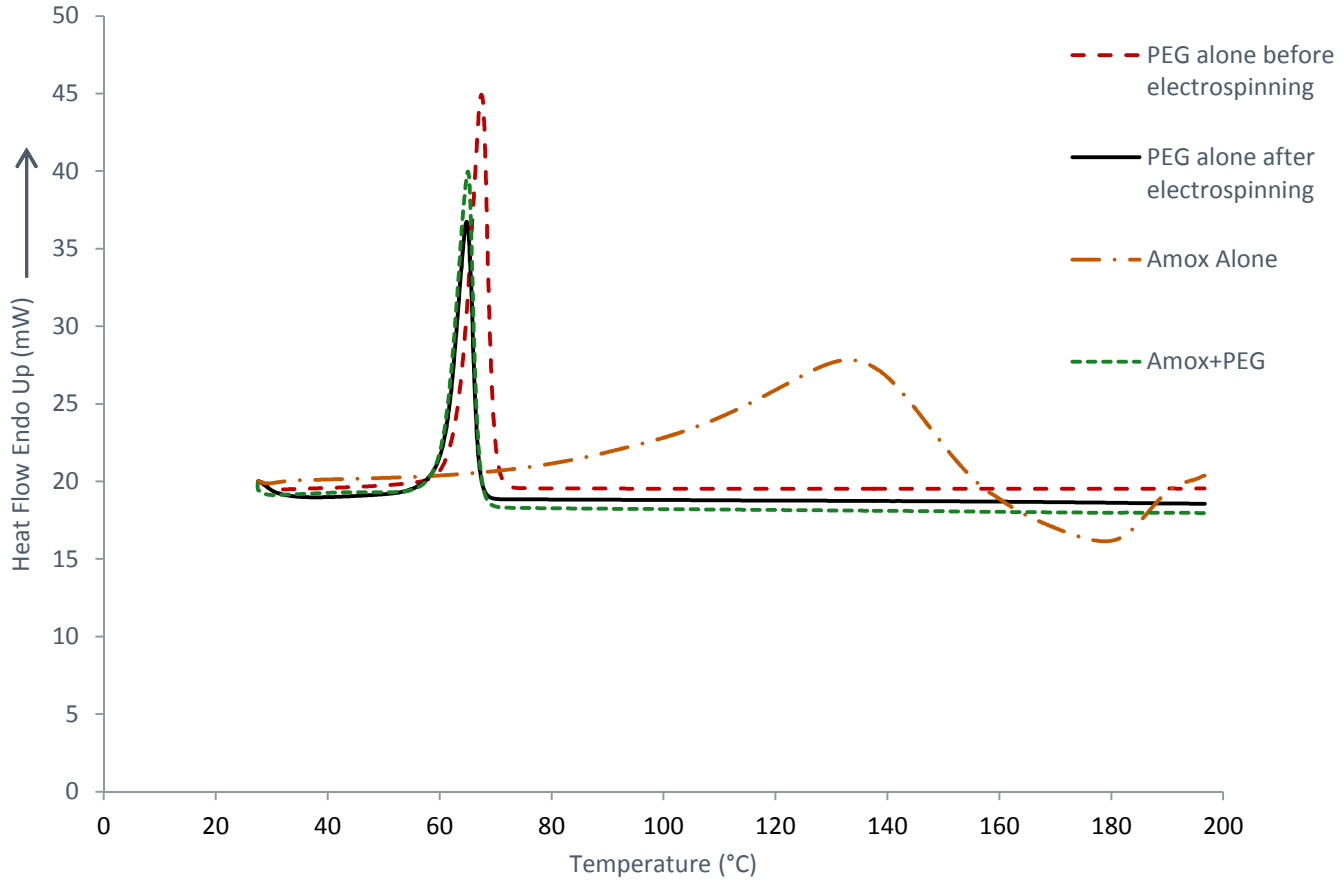


SEM Analysis

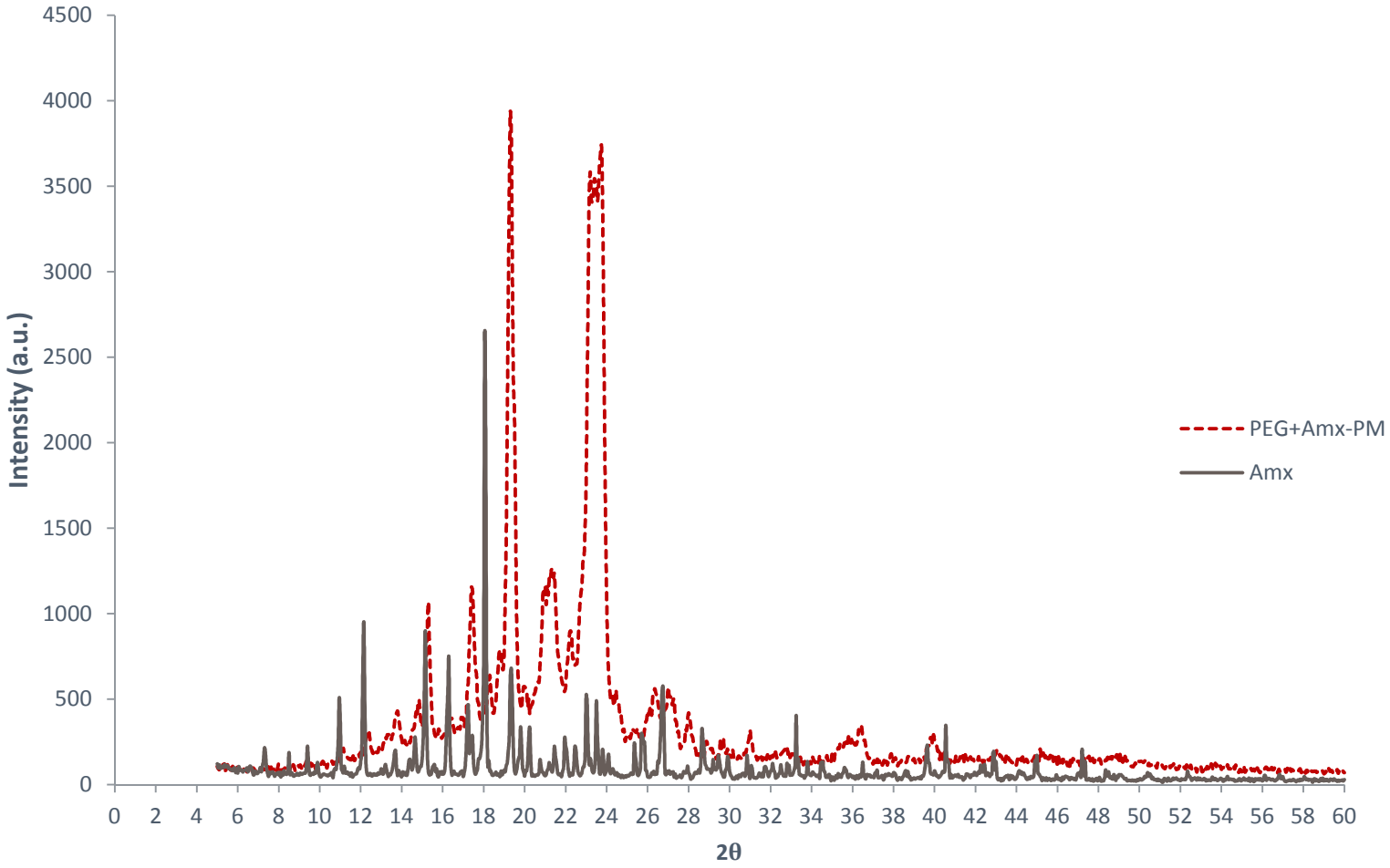
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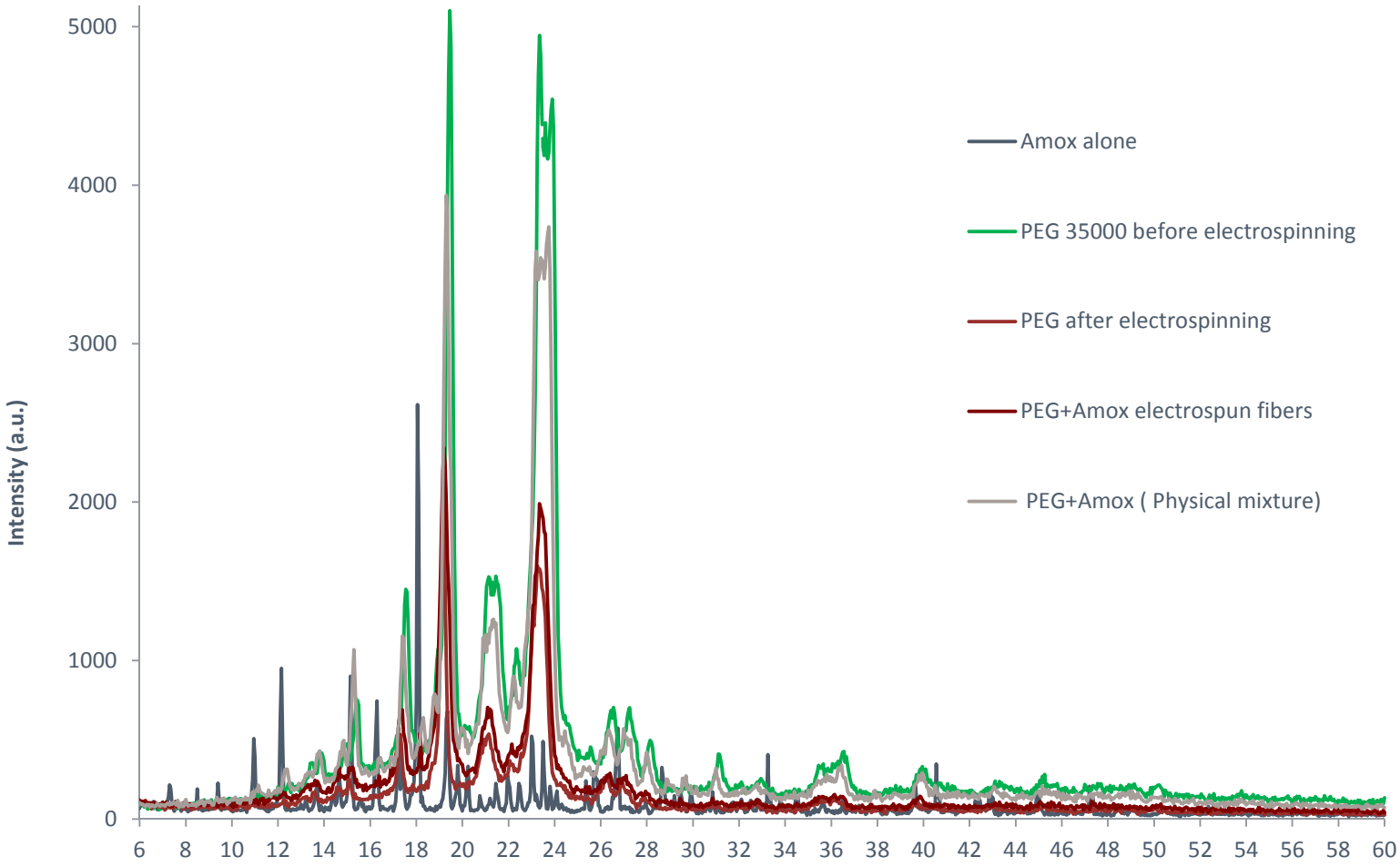
35% PEG solution, electrospinning parameters which include a voltage of 14 KV, flow rate of 1ml/h and distance of 15 cm between the needle and the collector



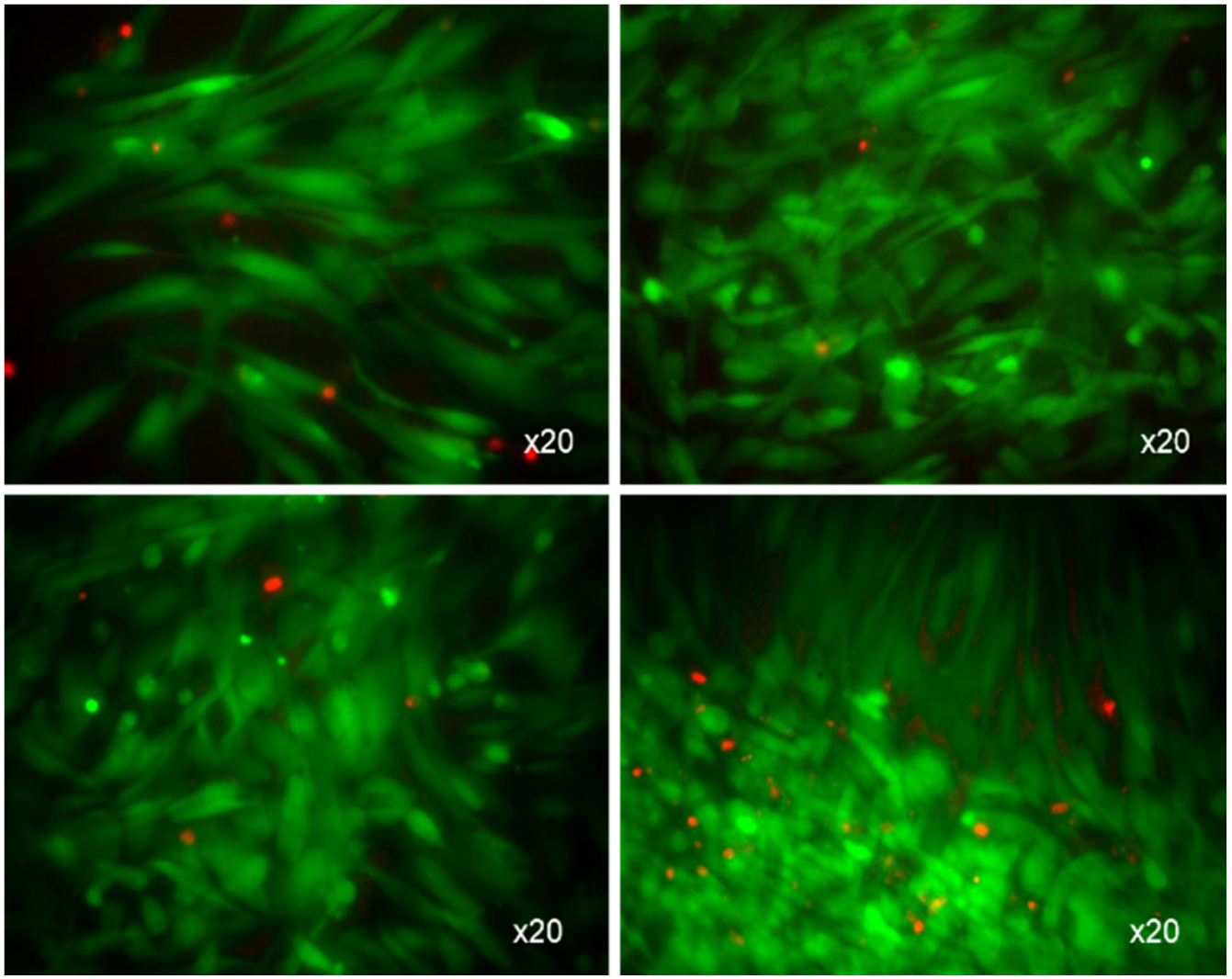
DSC Analysis



XRD Analysis


5000
4000
3000
2000
1000
0
Intensity (a.u.)
6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
2θ
Amox alone
PEG 35000 before electrospinning
PEG after electrospinning
PEG+Amox electrospun fibers
PEG+Amox (Physical mixture)

XRD AII



Cytocompatibility Studies

Current Research..

- In vitro degradation studies
- Copolymerization of PEG with hydrophobic polymer to increase degradation time and mechanical strength.
- Testing on an injured animal model

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» Ms. Sandi Ali Adib, MSc
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» Ms. Shiji Molma, MSc

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Pharmaceutics & Polymeric Drug Delivery Research lab

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PPDDRL Team



Questions!