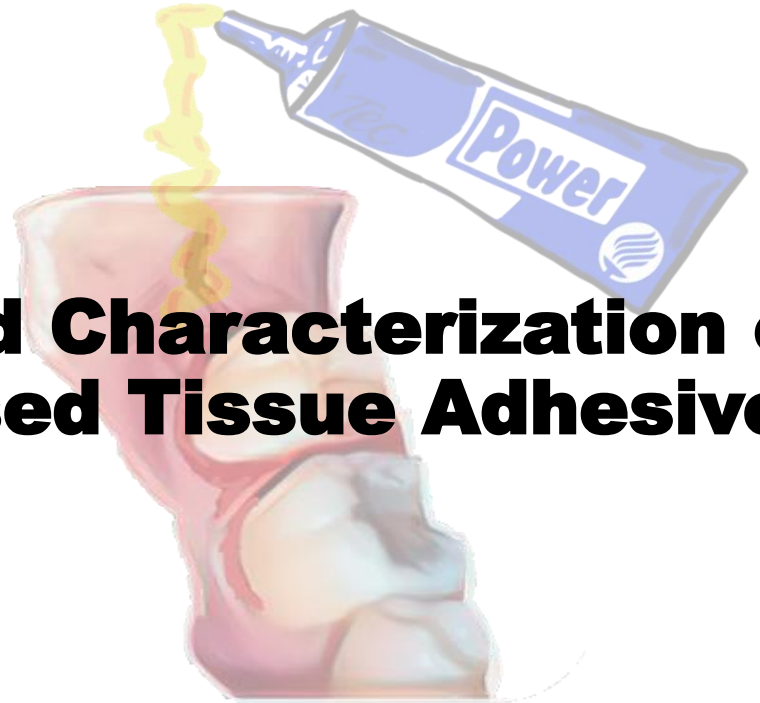
Tecnológico de Monterrey



Development and Characterization of Tunable zein-based Tissue Adhesives

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Advisors:

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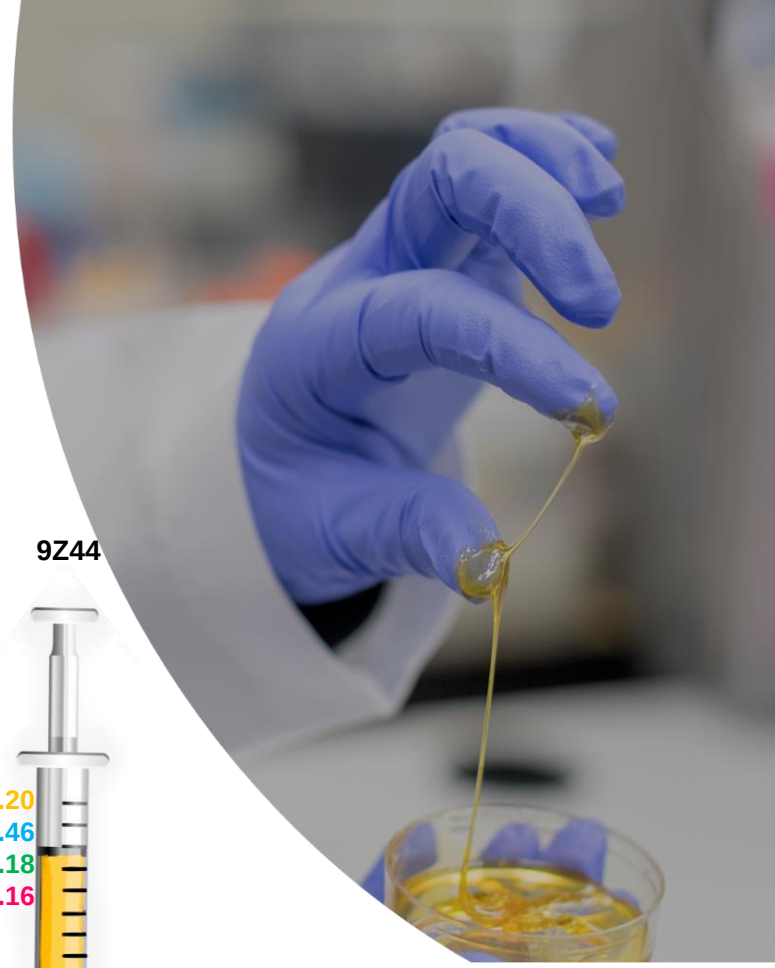
Dr. Mario Moisés Álvarez

Introduction

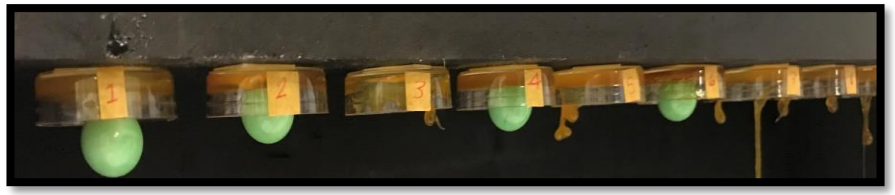
Sutures

- ✓ **Join tissues**
- ✓ **Specialized techniques**
- ✓ **Tissue manipulation**

What we made?

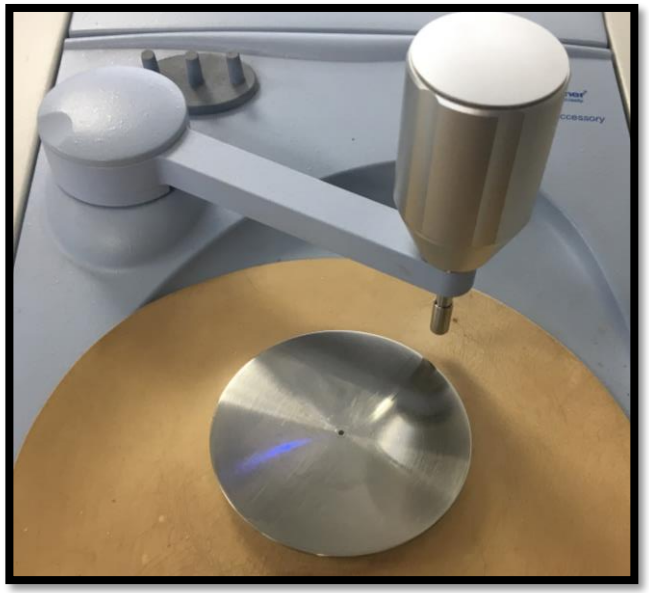


Sample	1Z00	2Z20	3Z40	4Z02	5Z04	6Z22	7Z24	8Z42	9Z44
Zein	0.30	0.26	0.23	0.26	0.24	0.24	0.21	0.21	0.20
Ethanol	0.70	0.62	0.55	0.63	0.56	0.56	0.51	0.50	0.46
PEG 400	0	0.12	0.21	0	0	0.10	0.10	0.20	0.18
Acetic acid	0	0	0	0.11	0.20	0.10	0.18	0.09	0.16
Time (s)	>2000	>2000	7	>2000	3	>2000	5	4	3



Characterizations we used

FTIR Analysis

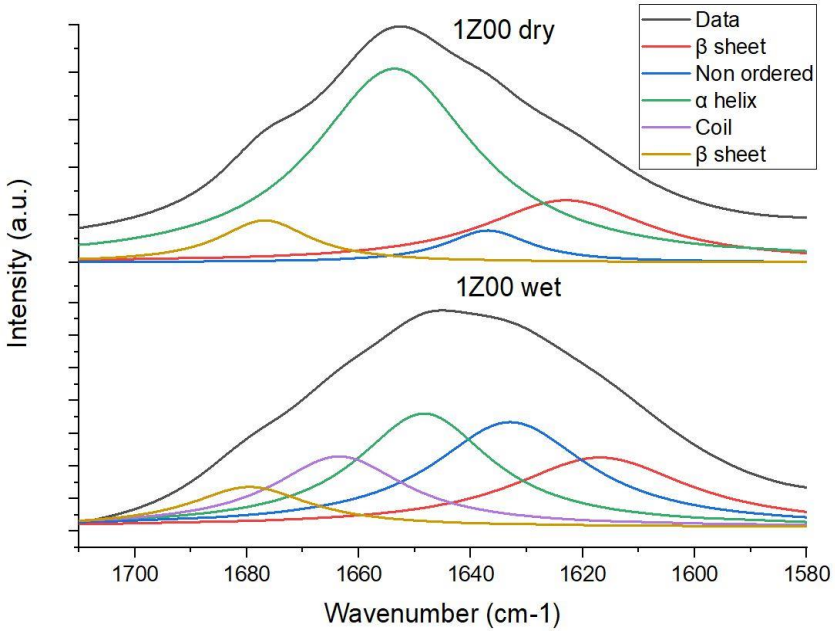


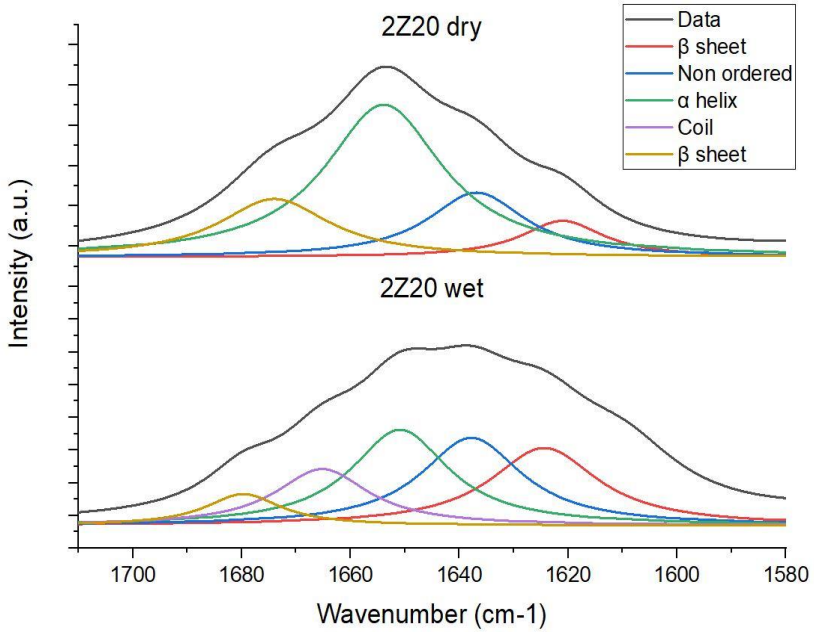
1Z00, 2Z20, 4Z02 y 6Z22
Adhesives

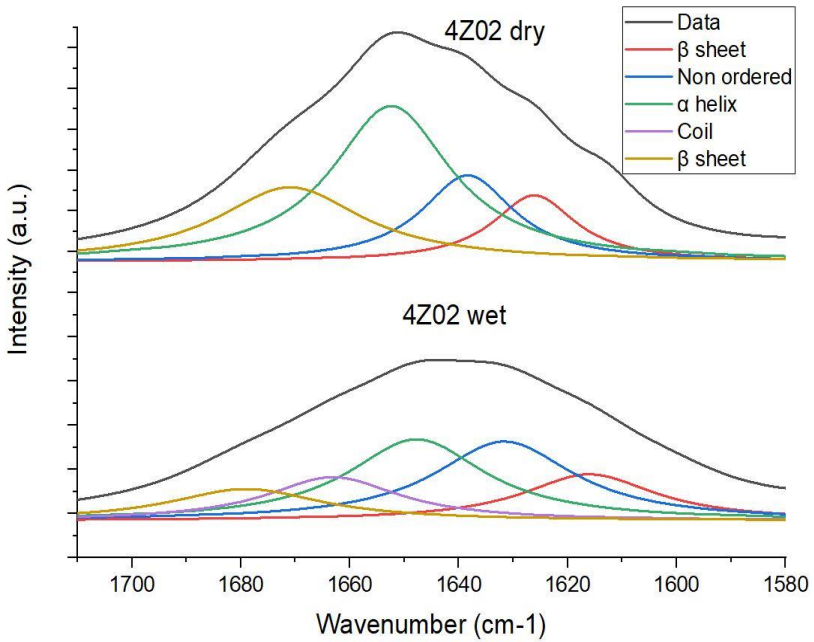
1Z00, 2Z20, 4Z02 y 6Z22
Adhesives + water

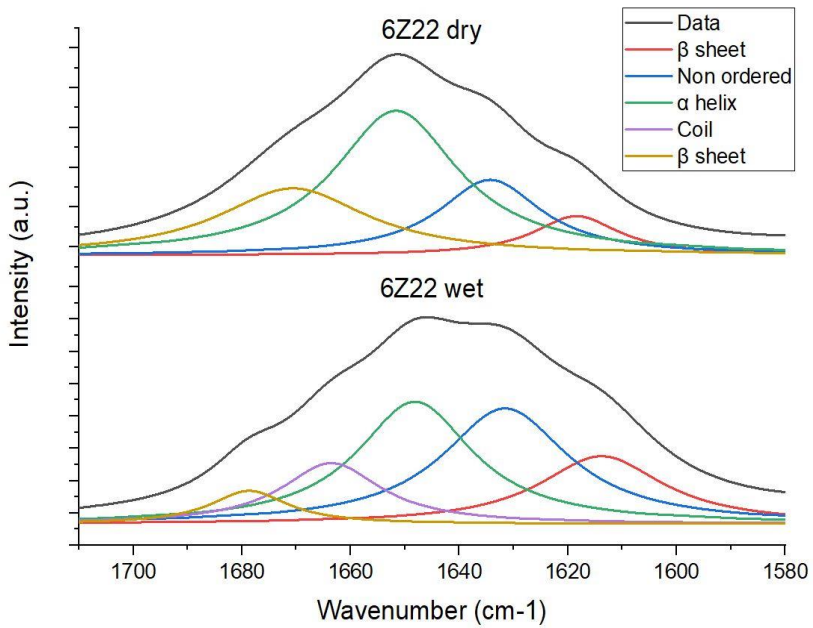
Spectra Analysis

- FTIR Perkin-Elmer, Specrum 400
- No special sample preparation was required
- 64 scans at 4 cm−1 resolution
- The amide group was identified
- We made a DECOMBOLUTION
- Different structures were observed[5]


1Z00 dry
1Z00 wet
Data
β sheet
Non ordered
α helix
Coil
β sheet
Intensity (a.u.)
1700
1680
1660
1640
1620
1600
1580
Wavenumber (cm-1)


2Z20 dry
2Z20 wet
Data
β sheet
Non ordered
α helix
Coil
β sheet
Intensity (a.u.)
1700
1680
1660
1640
1620
1600
1580
Wavenumber (cm-1)

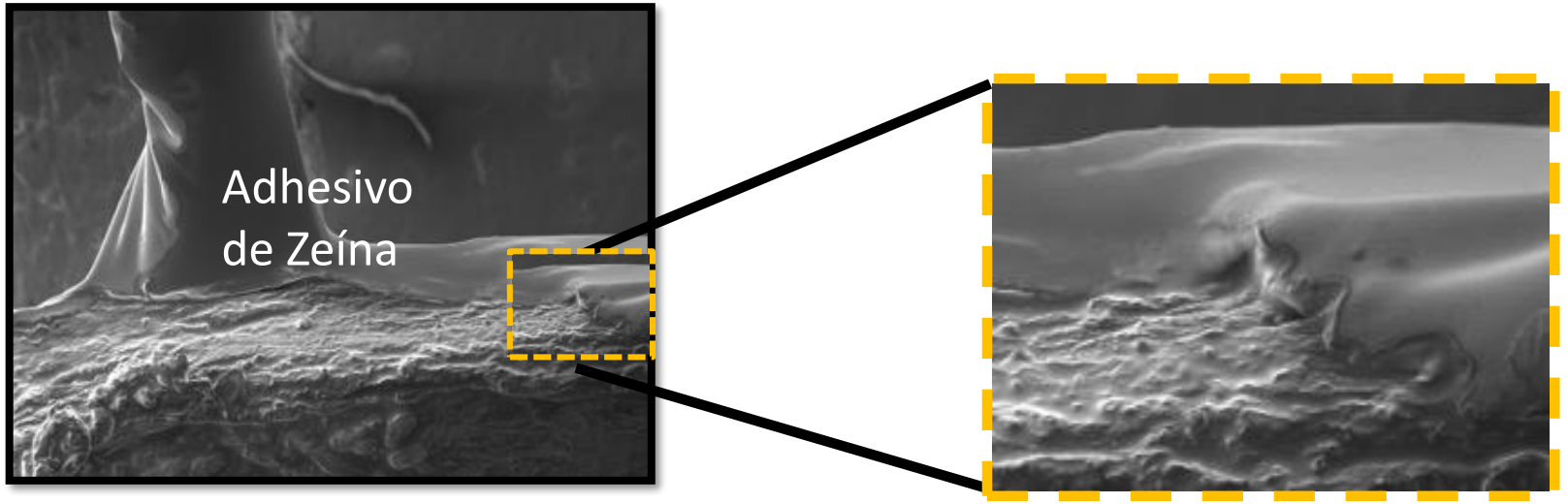

4Z02 dry
4Z02 wet
Data
β sheet
Non ordered
α helix
Coil
β sheet
Intensity (a.u.)
1700
1680
1660
1640
1620
1600
1580
Wavenumber (cm-1)


6Z22 dry
6Z22 wet
Data
β sheet
Non ordered
α helix
Coil
β sheet
Intensity (a.u.)
1700
1680
1660
1640
1620
1600
1580
Wavenumber (cm-1)

SEM

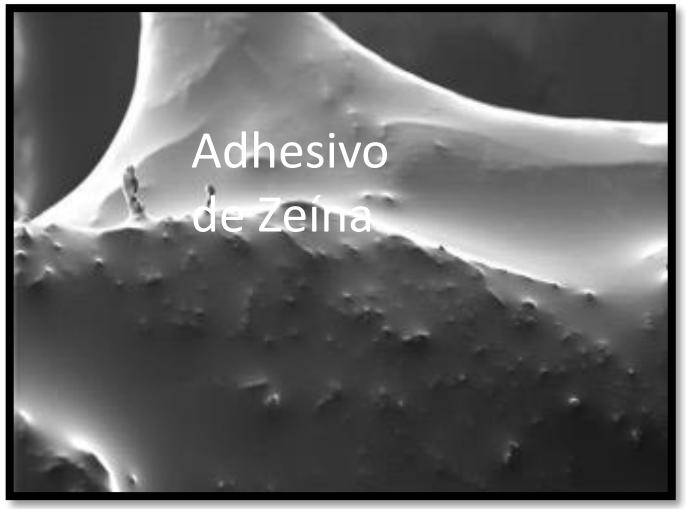
Scanning Electron Microscopy captures images with electrons that come from the surface.

1Z00



Why?
Because we want to know the shape of this samples.

6Z22



- ✓ Equipment: SEM Zeiss EVO MA25 at 20µm at 300X
- ✓ Porcine skin with adhesive
- ✓ Desiccator for 24 h
- ✓ Gold coating

Optical microscopy

Sample preparation

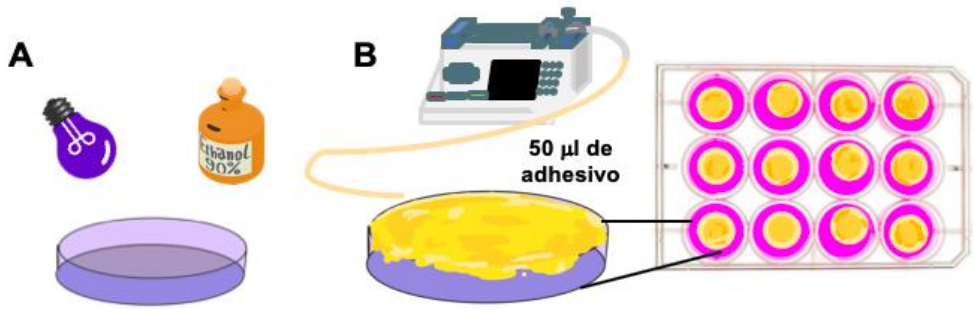
Acrilic disc cuted using a laser

Sterilized acrilic discs
UV+ Ethanol

Adhesives + discs
50 µL

Seed BJ cells
$1x10^5$

Hoechst staining



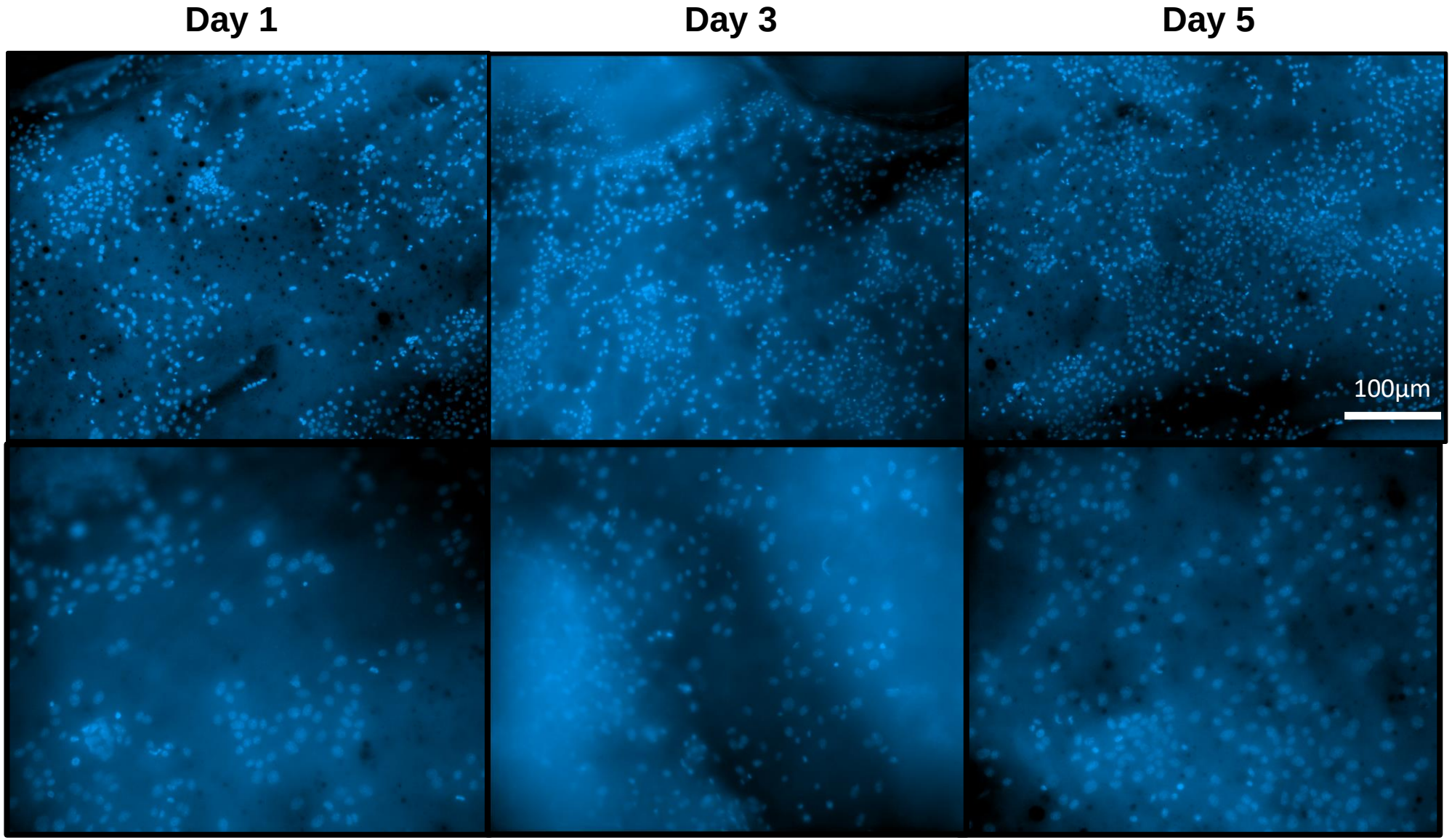
Remove DMEM/F12

Cover the sample with Hoechst

Let incubate 5 -10 min

PBS wash

Excitation 460 – 490 nm

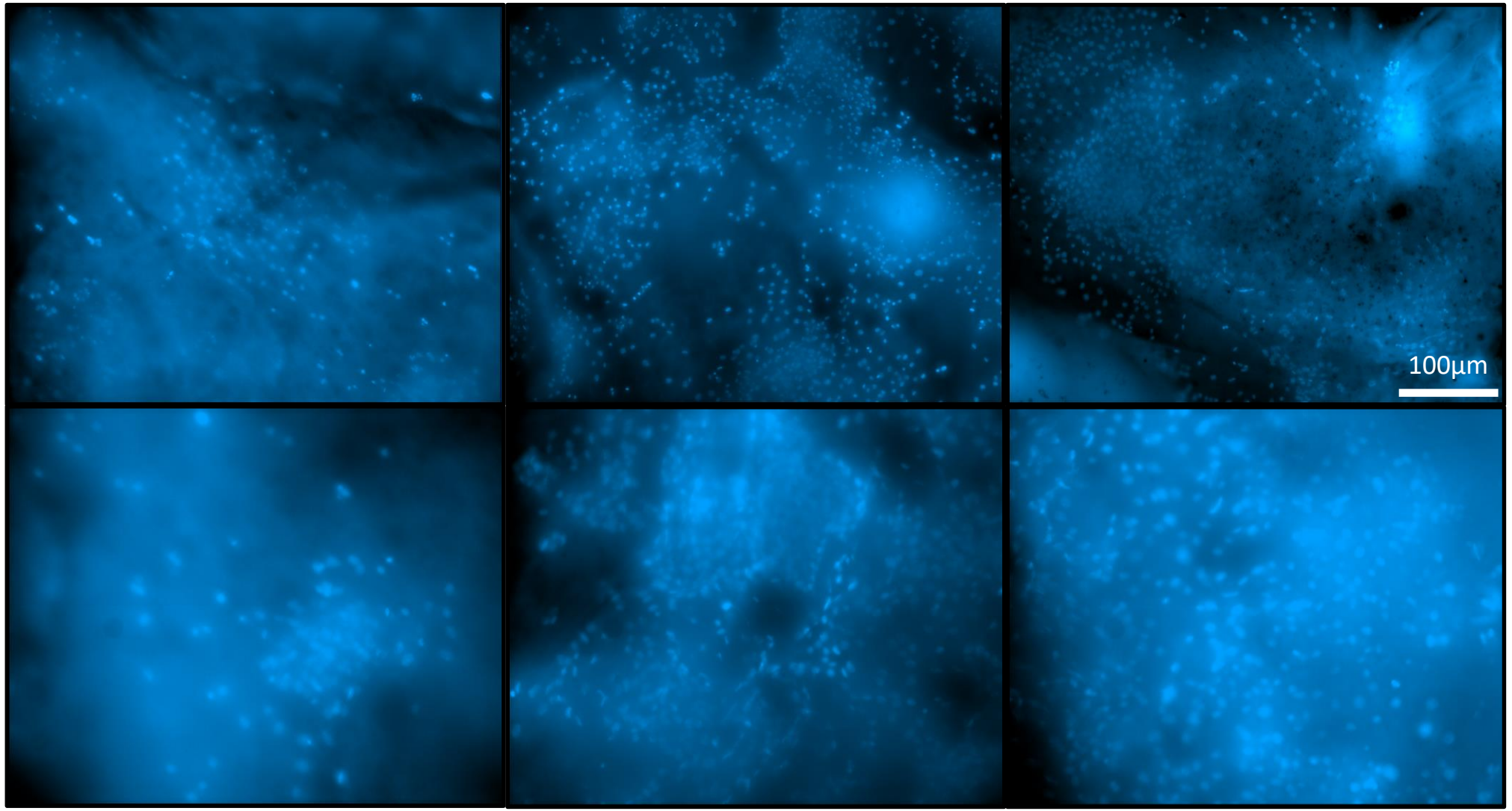

Day 1
Day 3
Day 5
1Z00
100µm

Day 1

Day 3

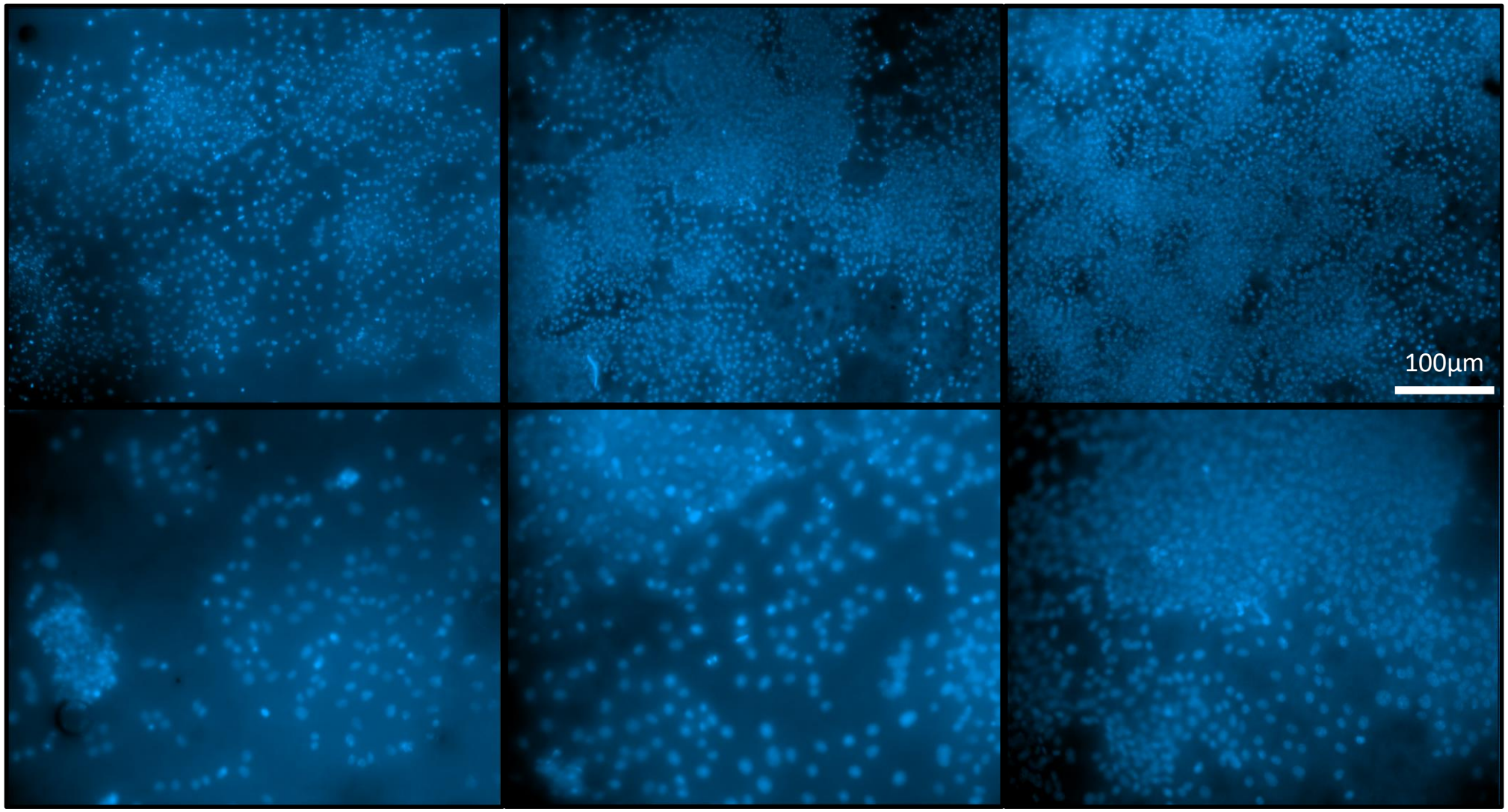
Day 5

2Z20



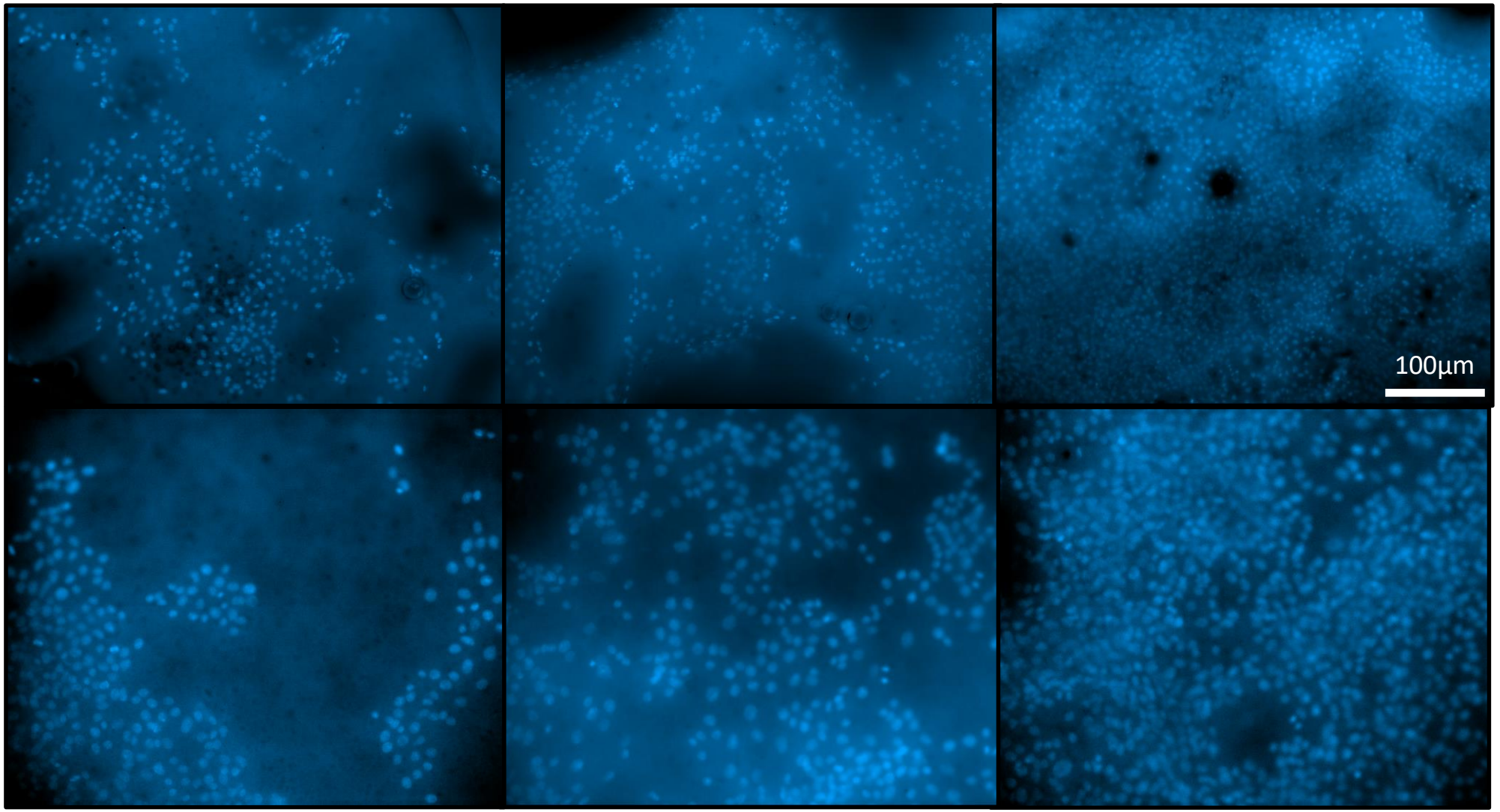
Day 1 Day 3 Day 5

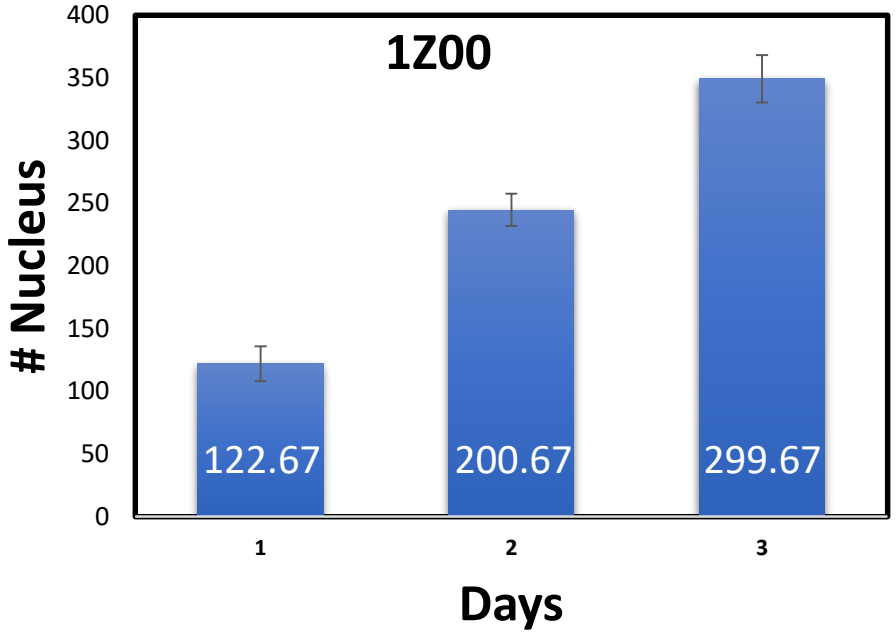
4Z02

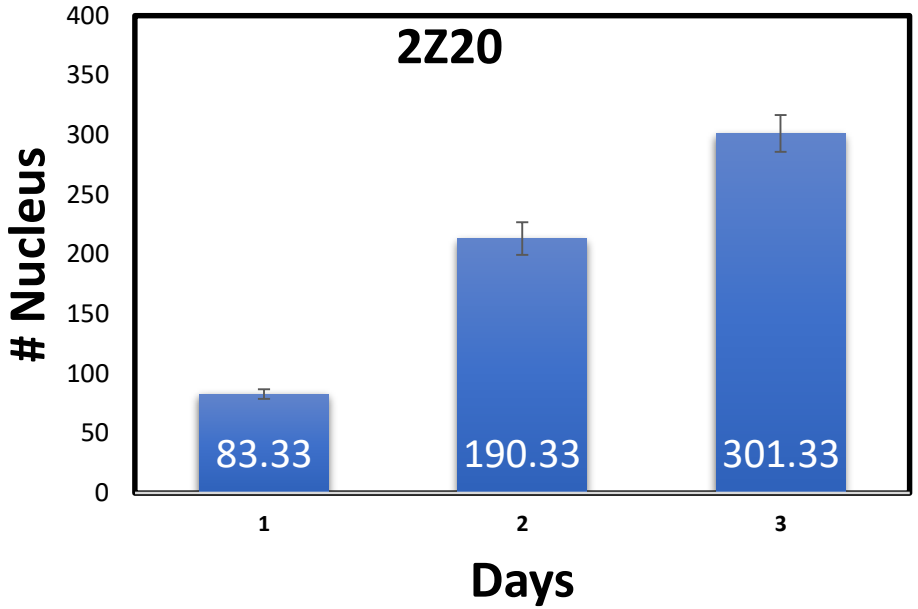


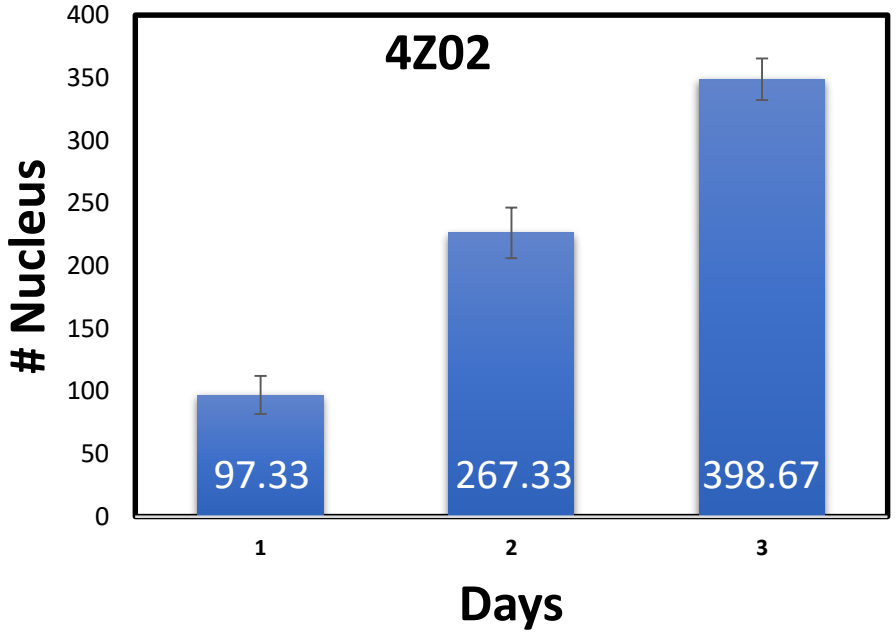
Day 1 Day 3 Dya 5

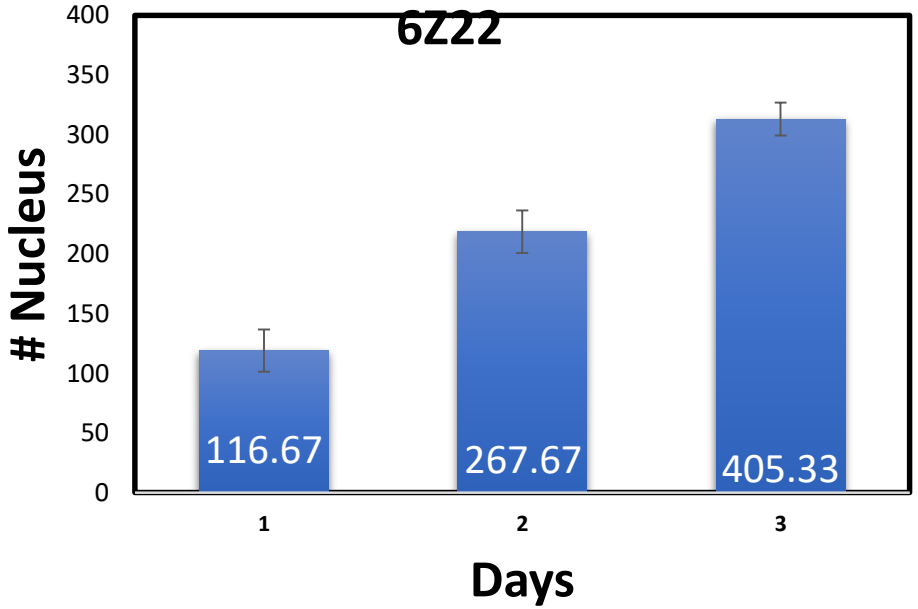
6Z22




1Z00
Nucleus
400
350
300
250
200
150
100
50
0
122.67
200.67
299.67
1
2
3
Days


2Z20
Nucleus
400
350
300
250
200
150
100
50
0
83.33
190.33
301.33
1
2
3
Days


4Z02
Nucleus
400
350
300
250
200
150
100
50
0
97.33
267.33
398.67
1
2
3
Days

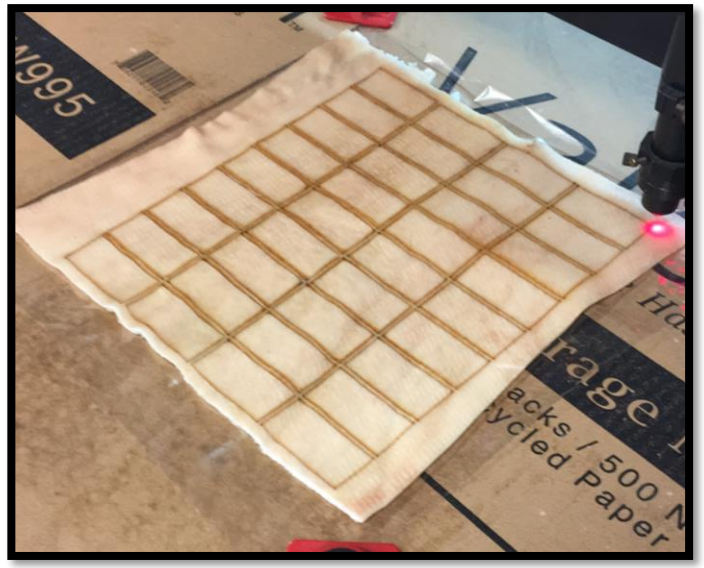

6Z22
Nucleus
400
350
300
250
200
150
100
50
0
116.67
267.67
405.33
1
2
3
Days

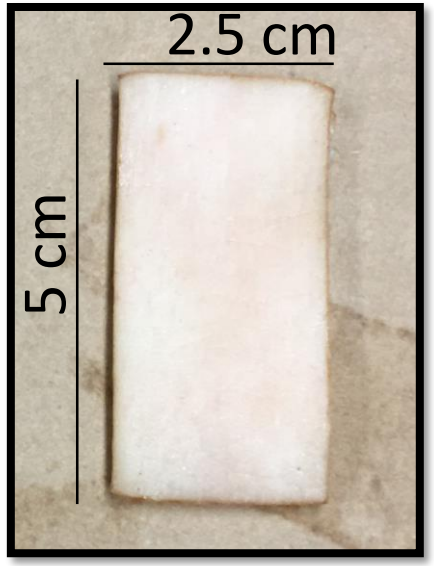
* Mechanical Test

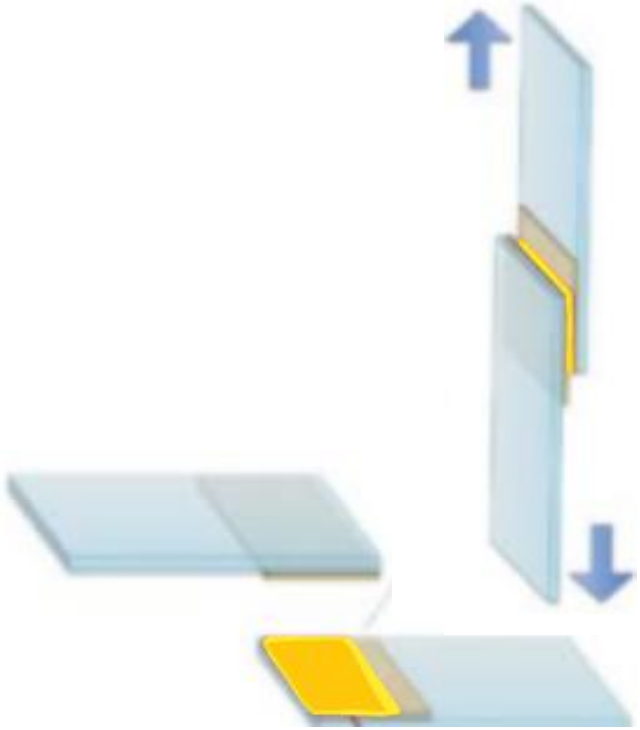
Test tube preparation

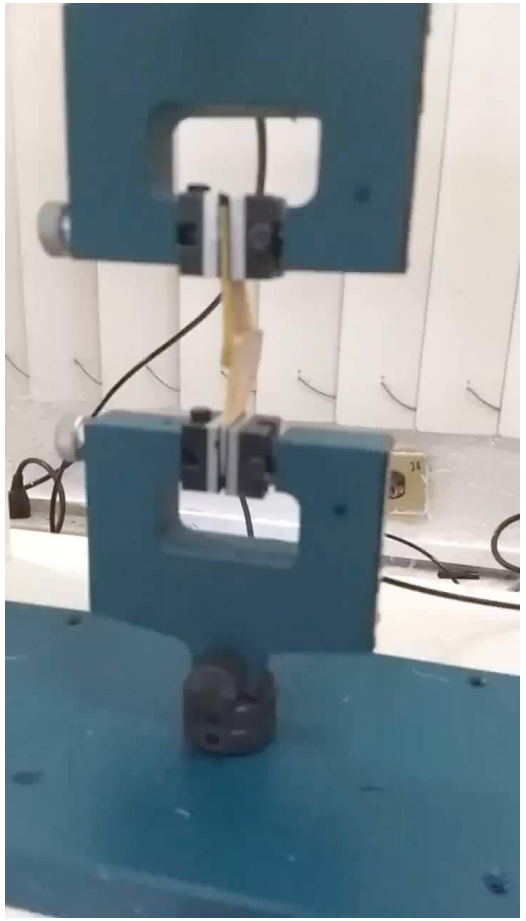
Standard Test Method for Strength Properties of Tissue Adhesives in Lap-Shear by Tension Loading[1]

ASTM F2255

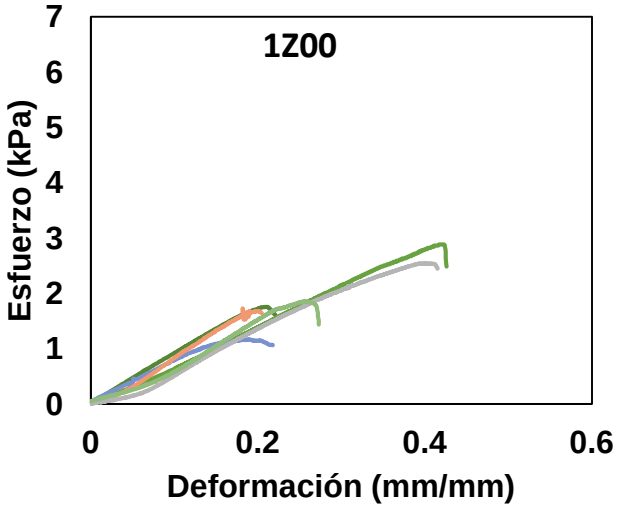


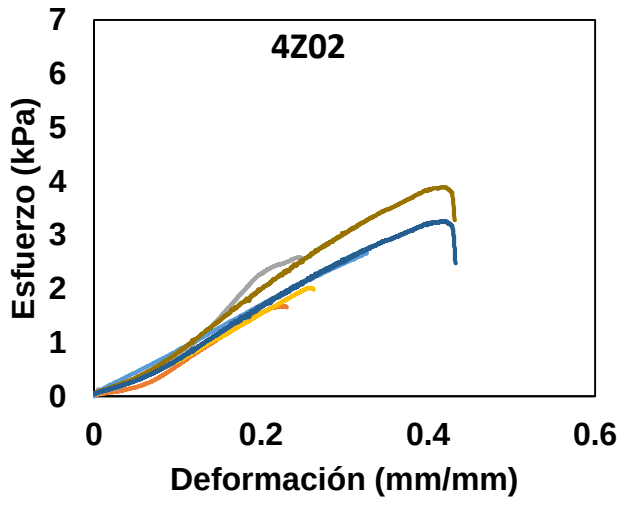


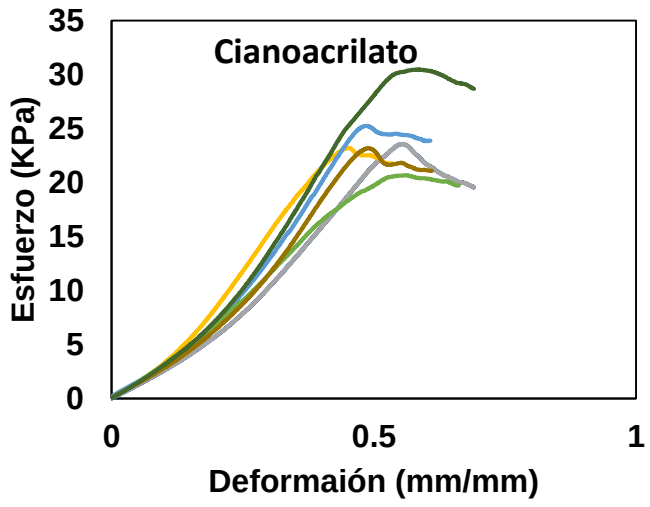


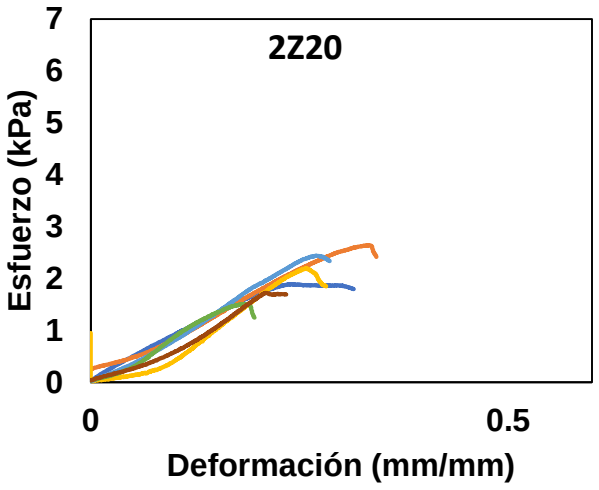


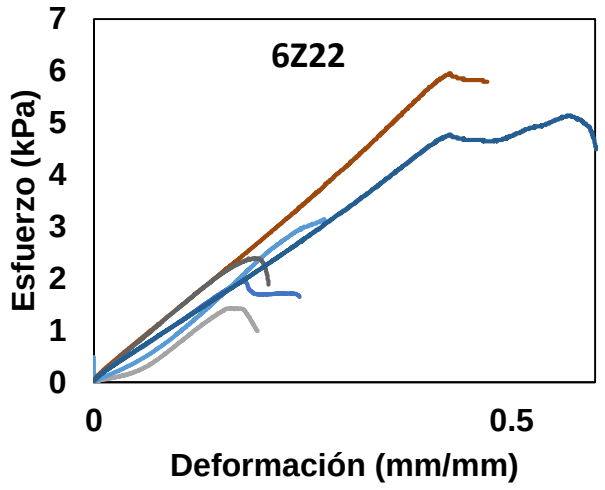
Mechanical results

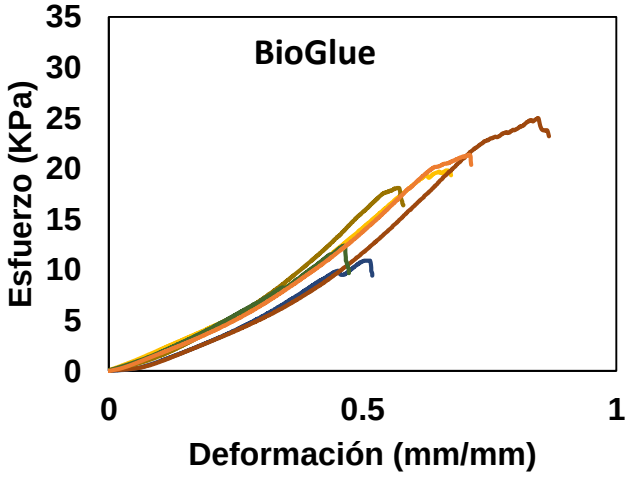












Other characterizations

To consider

- Transmission Electron Microscopy (TEM) → Capture images with electrons that go through a thin sample.
- DSC → To calculate the degree of crystallinity.