



Synthesis and Characterization of Crosslinked Electrospun Fiber Mats from Allyl-functionalized Polysuccinimide

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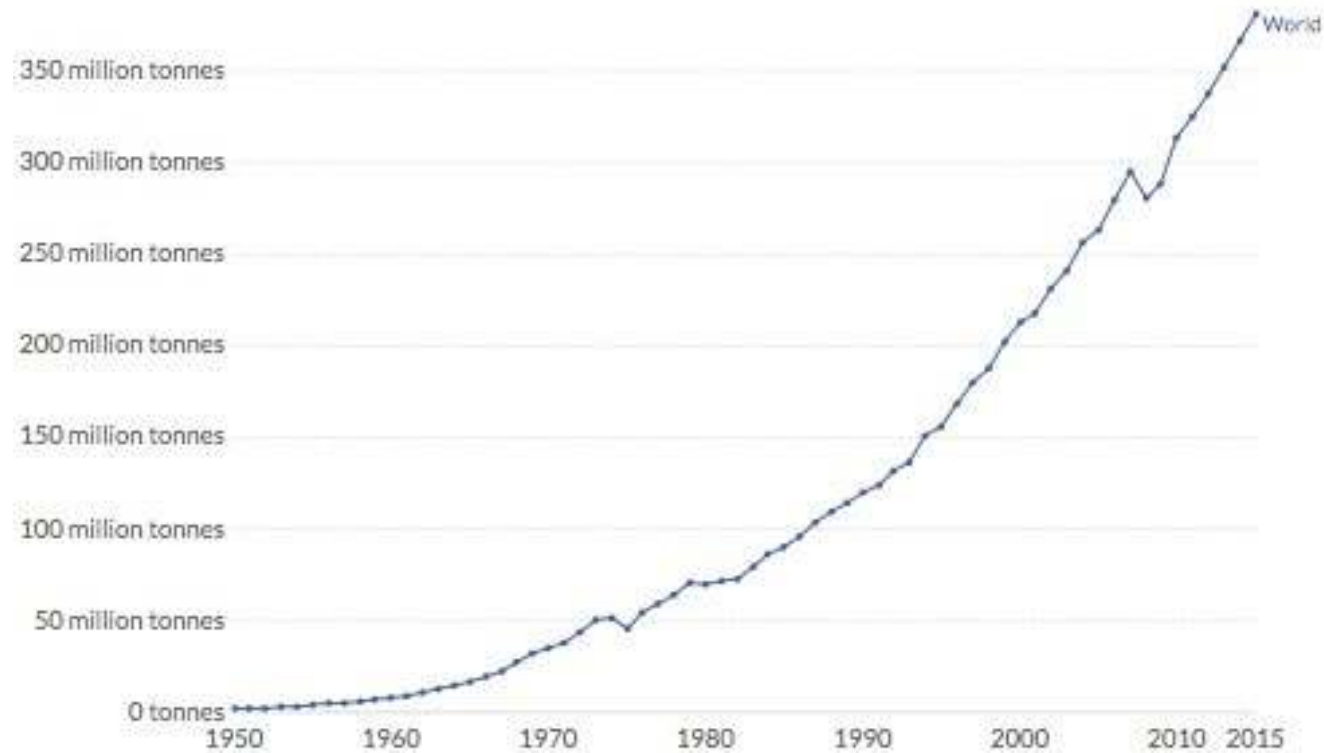
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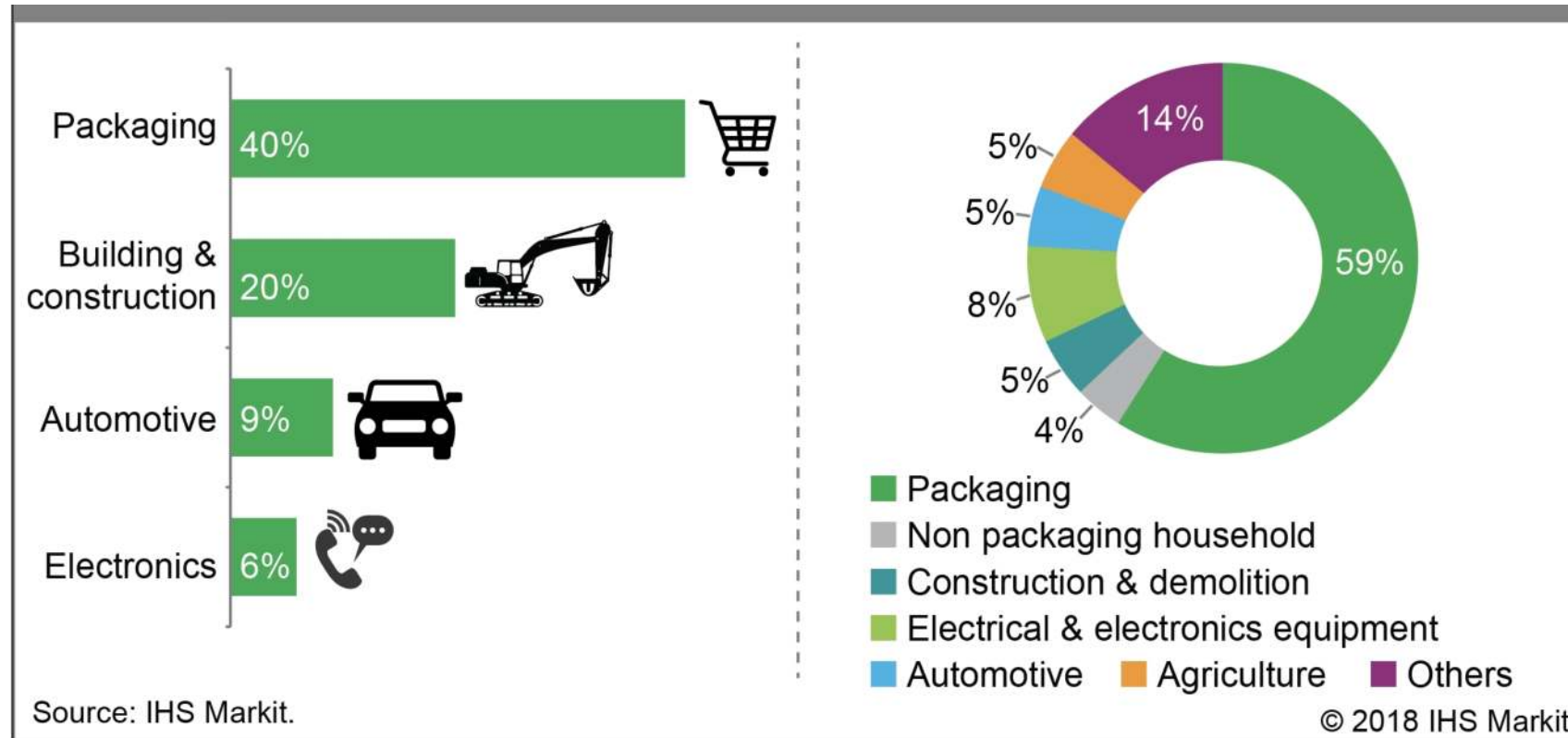
World Production of Plastics



The world has produced (by 2015), 7.8 billion tons of plastic more than 1 ton for every person alive today!

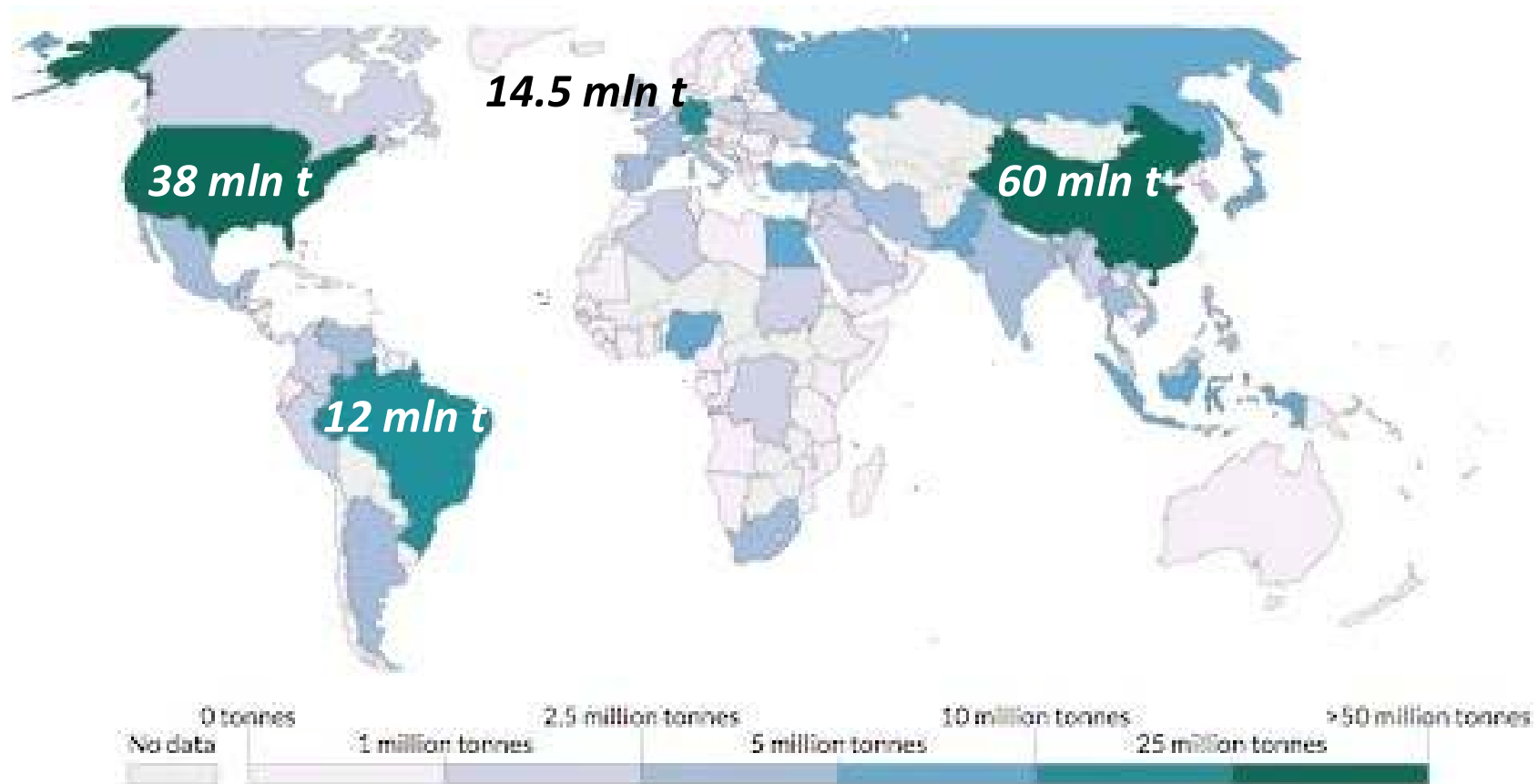


Global Plastics Usage and Waste Generation





Plastics Waste Generation

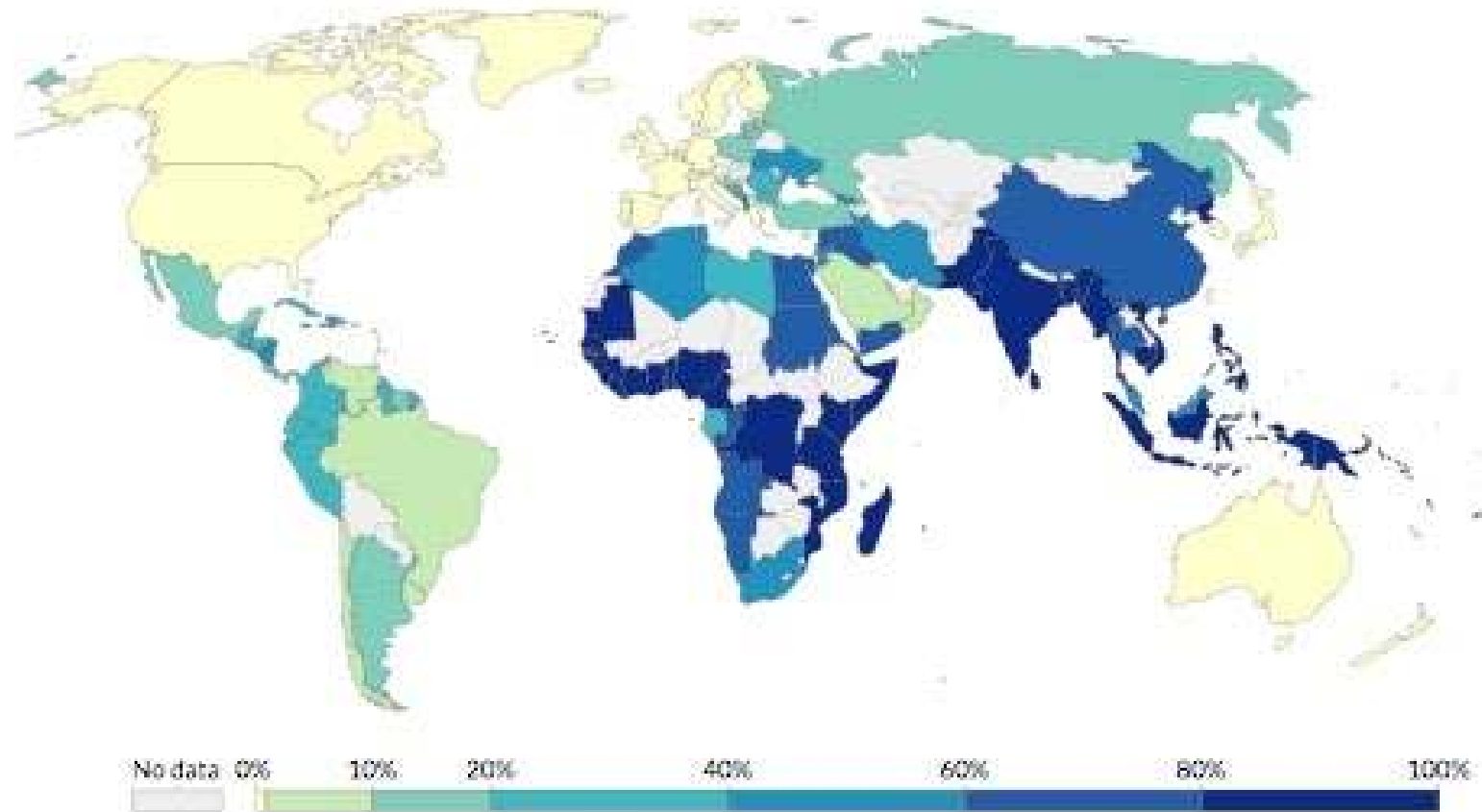


Source: OWID based on Jambeck et al. (2015) & World Bank.

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Mismanaged Plastic Waste



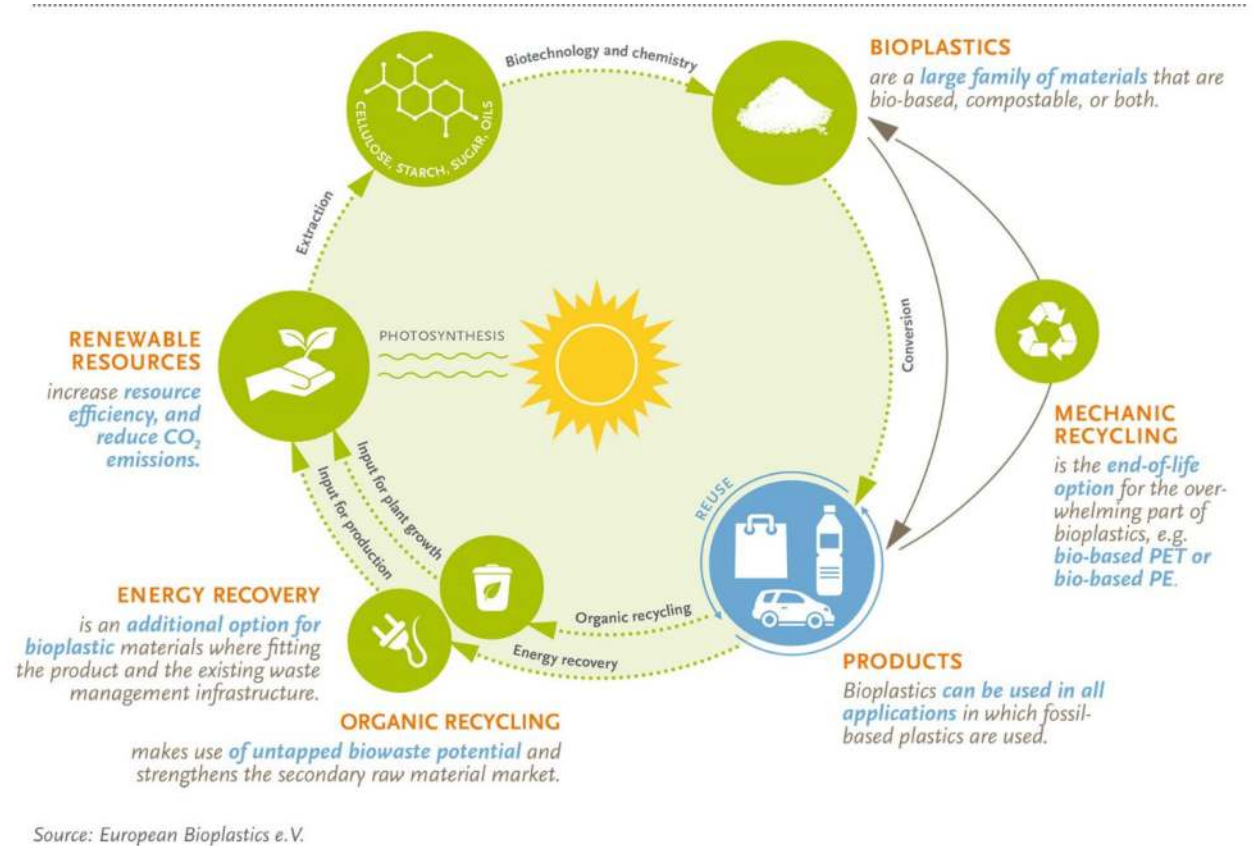
Source: Jambeck et al. (2015)



“Green” Polymer Chemistry



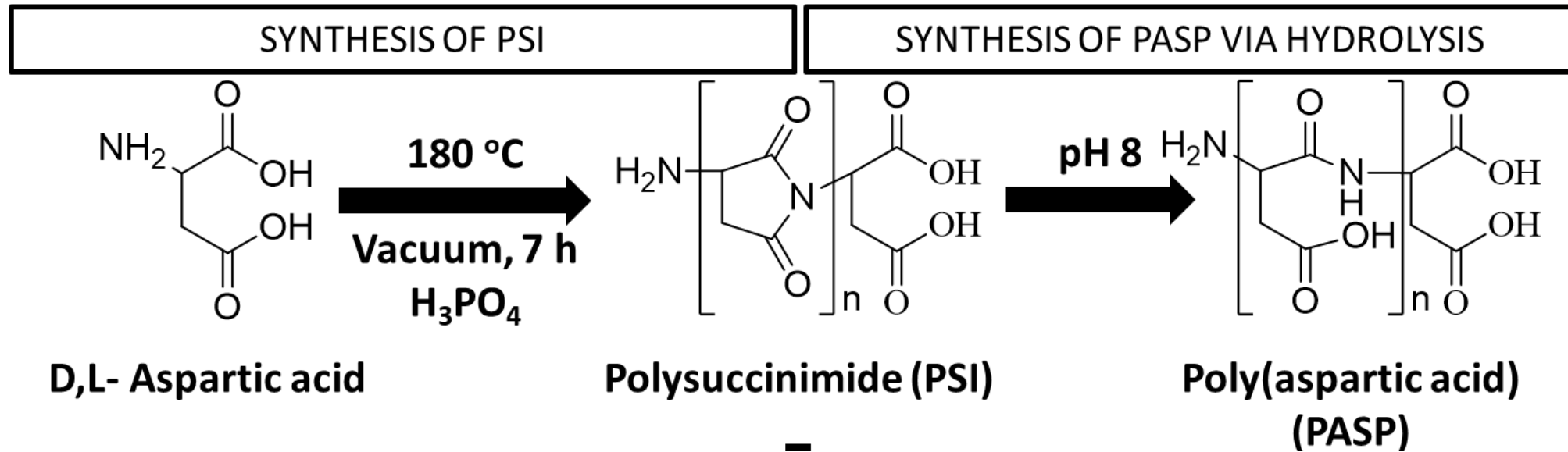
Plastic waste



Bioplastics: Closing the Loop



Polymers from Renewable Resources



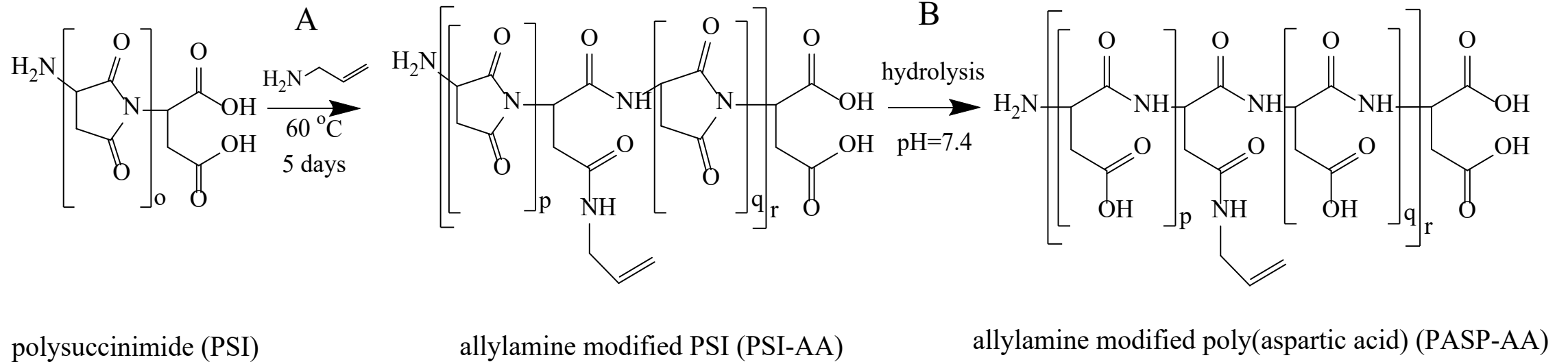
Commercial production: fermentation



Crosslinked Swollen Hydrogel



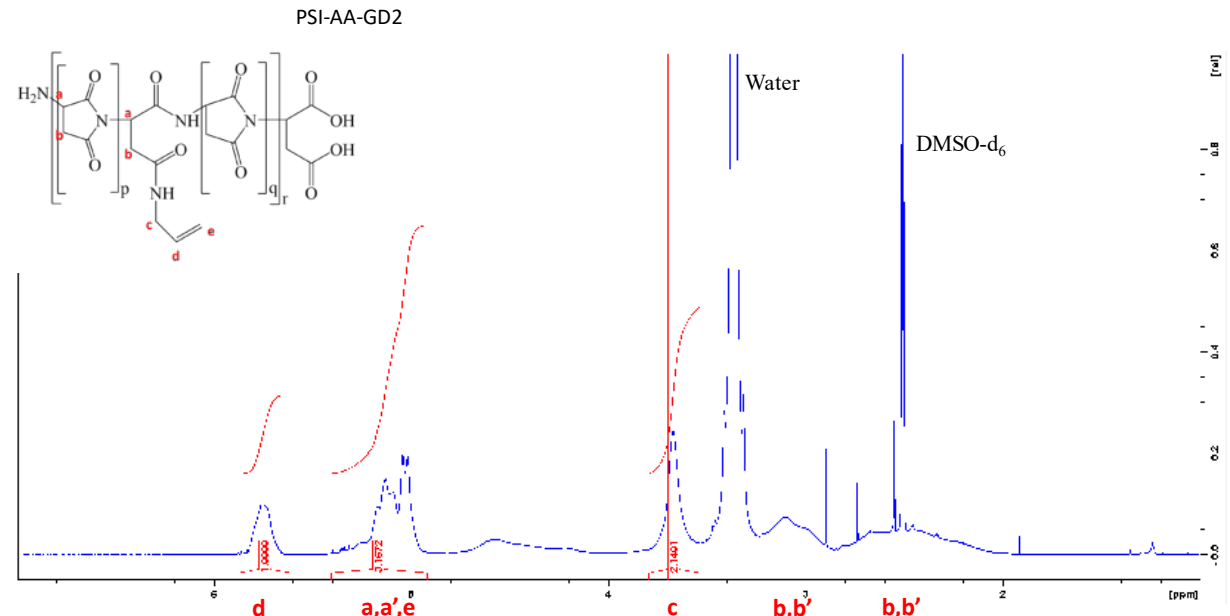
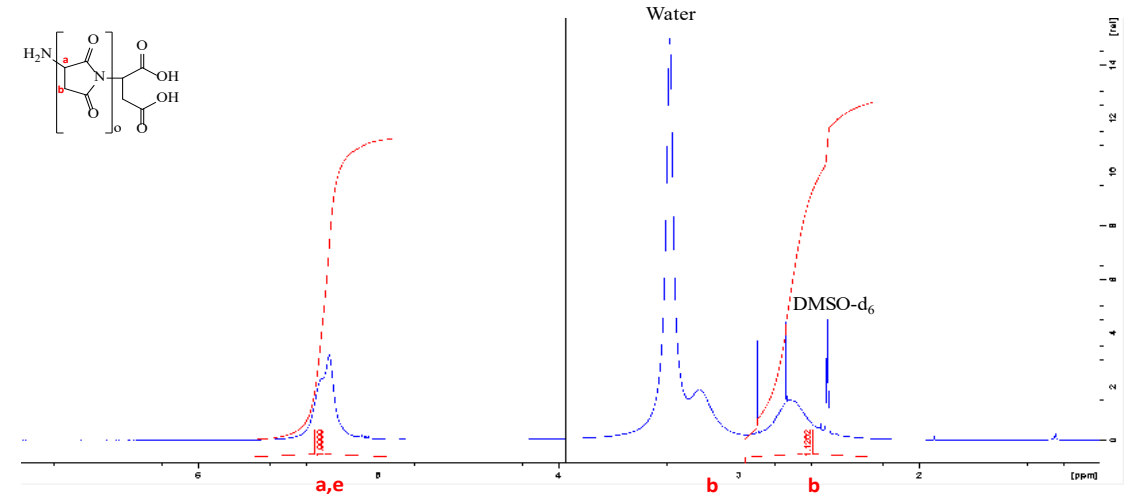
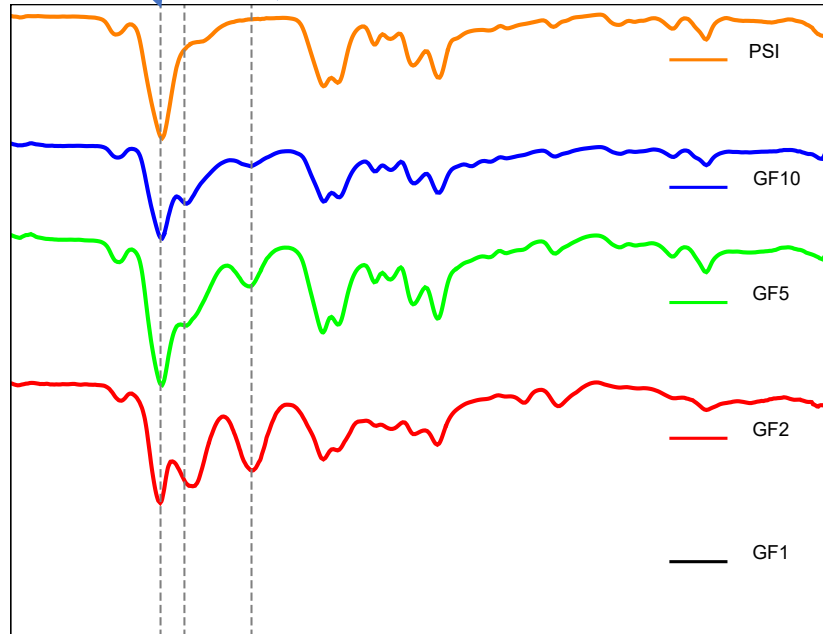
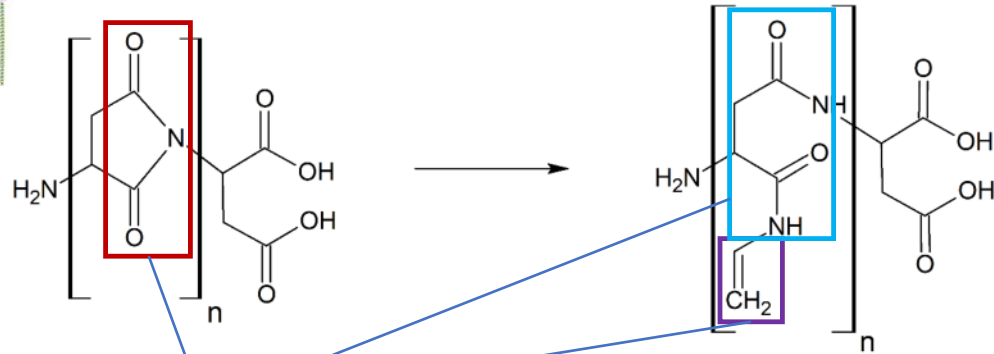
Modification of PSI



Grafting Frequency: GF1, GF2, GF5, GF10

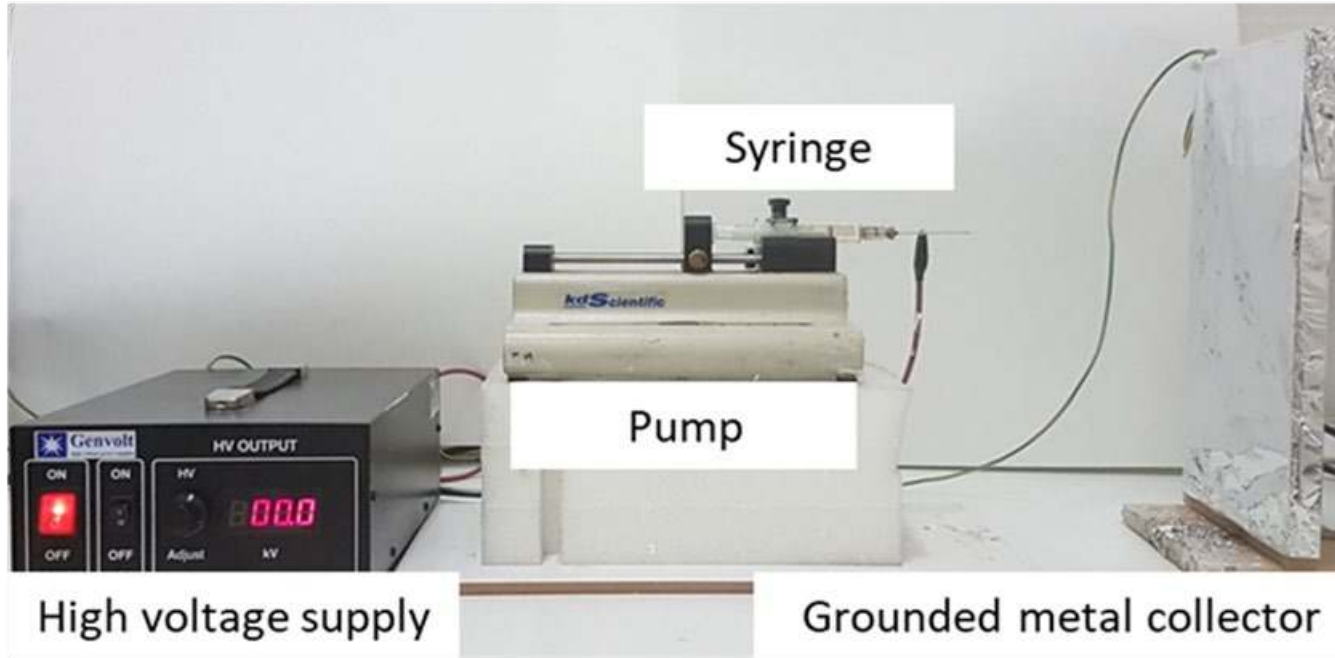


FTIR and NMR

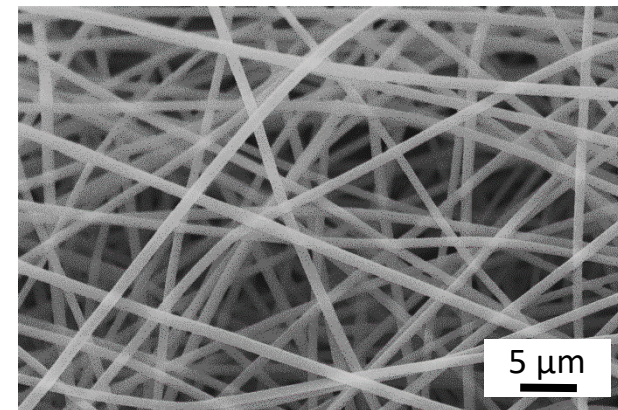
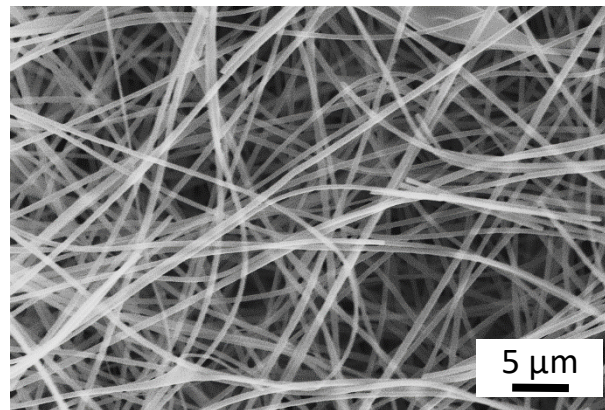
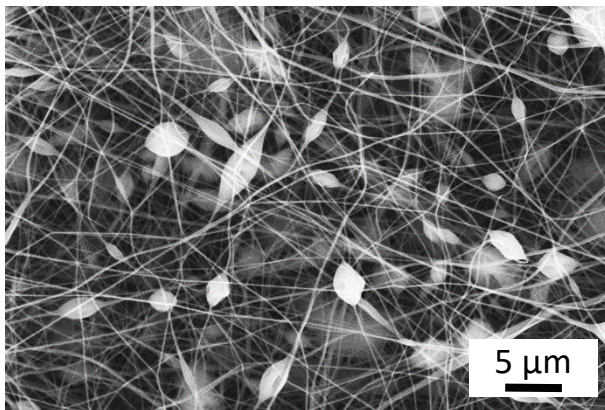




Electrospinning



| |
|----------------------|
| $Q = 1 \text{ ml/h}$ |
| $V = 1 \text{ ml}$ |
| Distance = 15 [cm] |
| 15 |



Polymer concentration: 35 wt%

40 wt%

45 wt%



Plasma Treatment

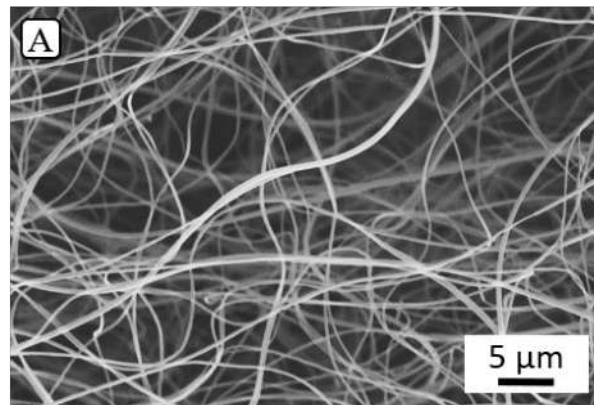


Low pressure air
13 minutes, 25 W

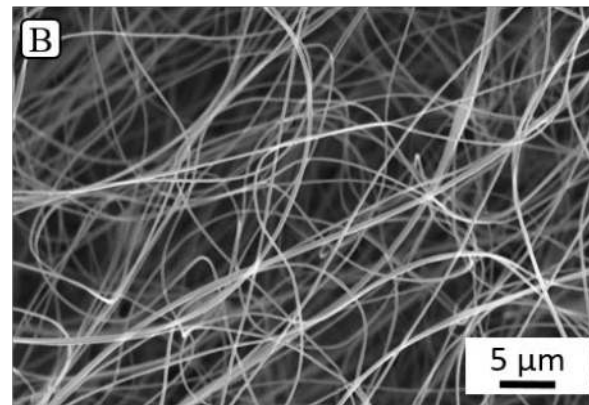


Before

After



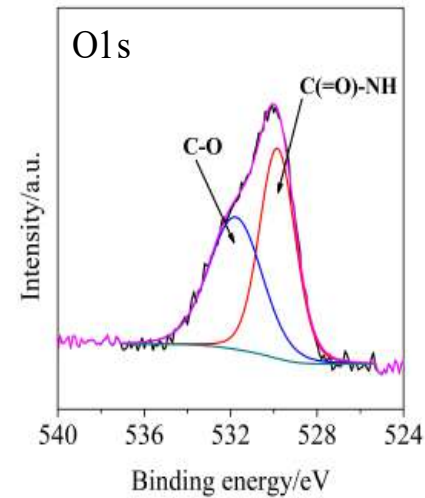
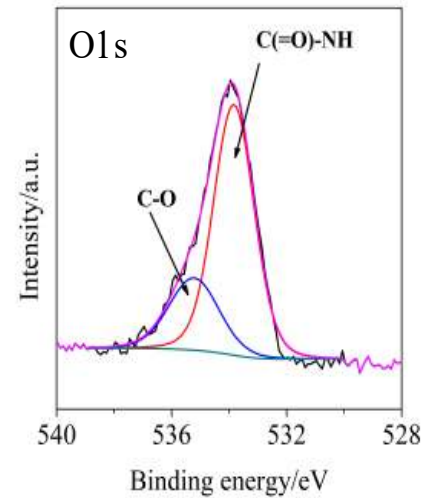
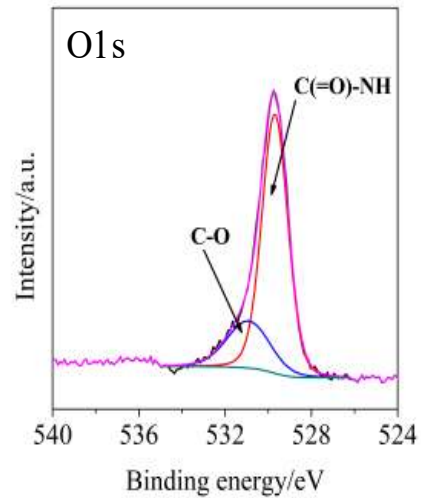
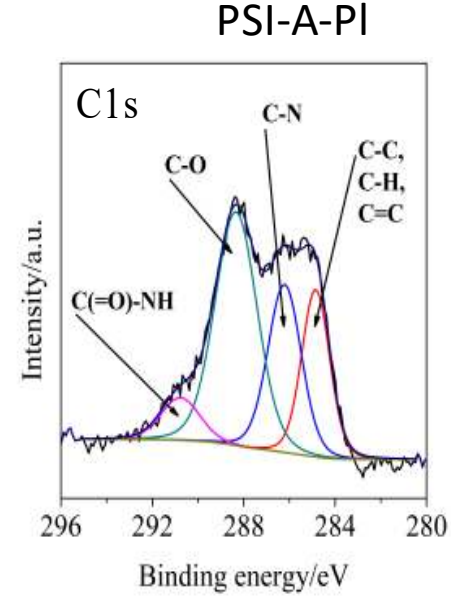
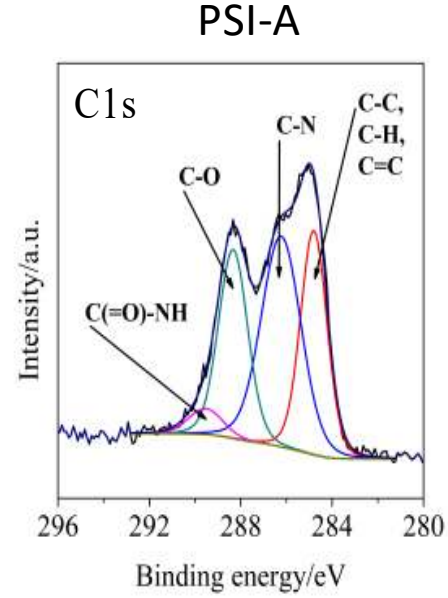
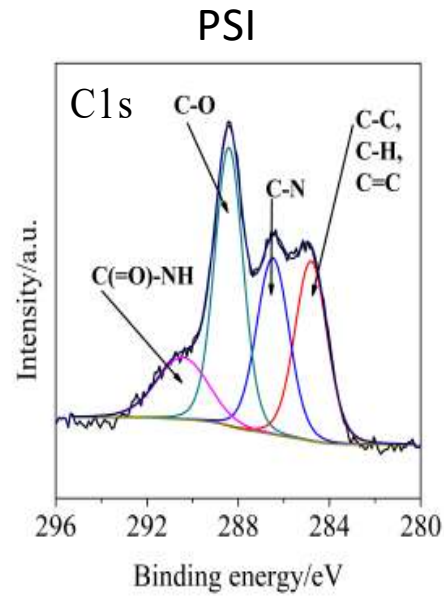
Soluble



Insoluble

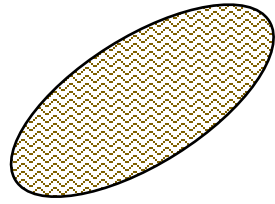


XPS

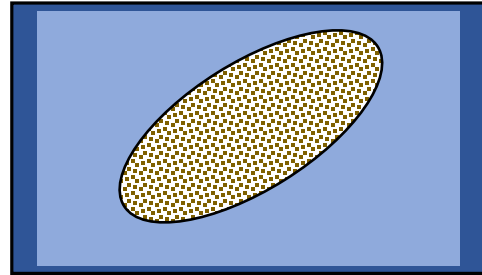




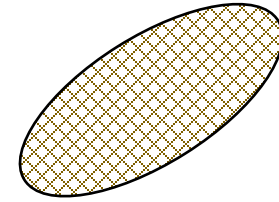
Hydrolysis



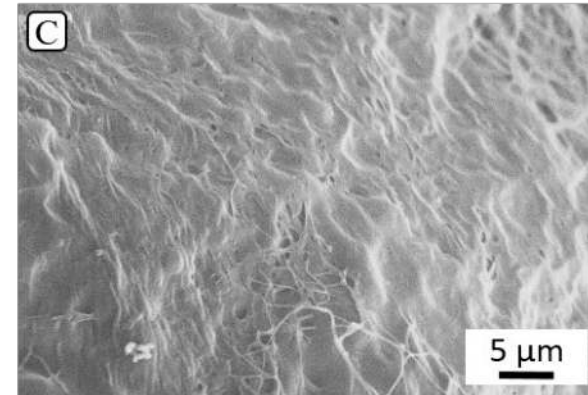
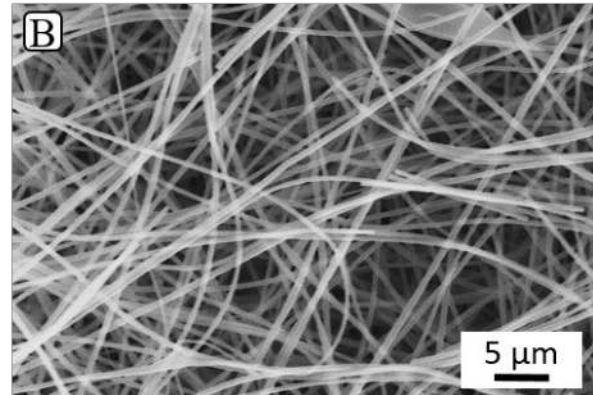
**Plasma treated
mat**



Hydrolysis, pH 7,4



**Wash (MilliQ),
Liofilization**

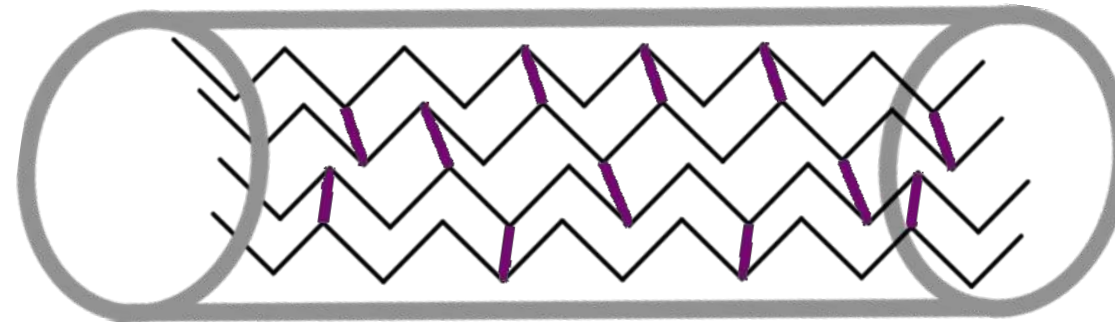
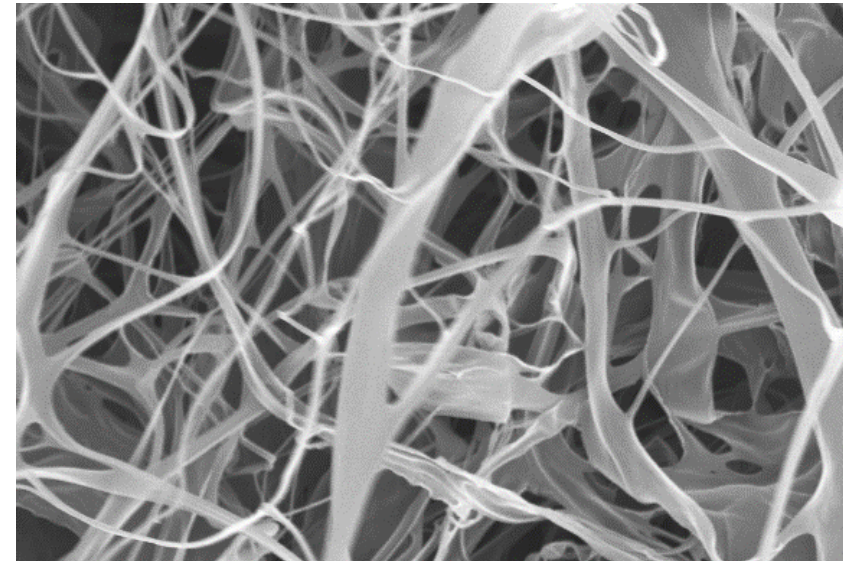
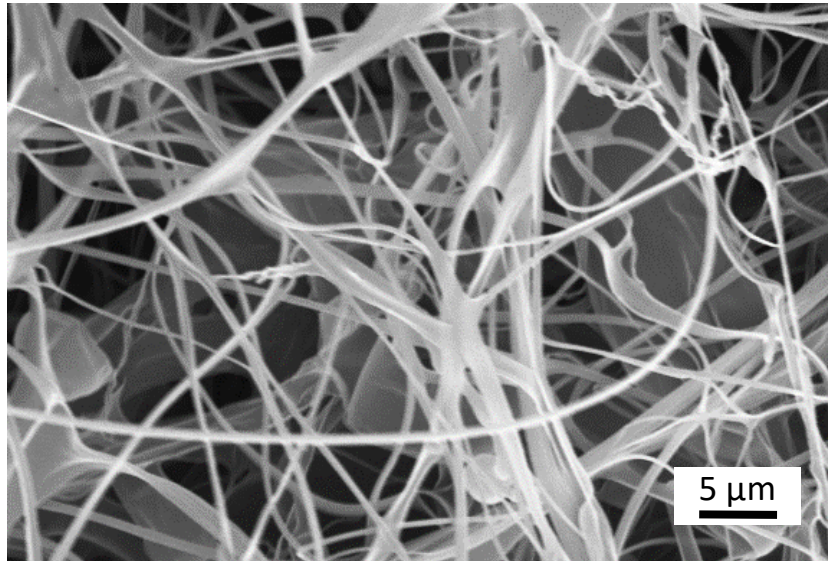




Optimization of Plasma Treatment

Plasma **100W 17 minutes**

Hydrolysis



Crosslinked and sterilized mat



Sterility Test



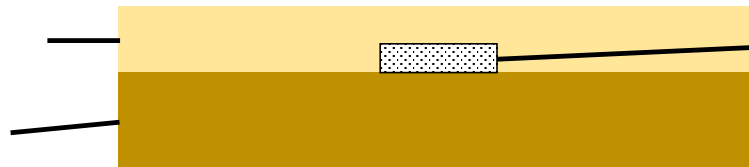
24 hours

Incubation at 37 °C, CO₂
moisture

48 hours

Soft agarose gel + buffer

Hard agarose gel



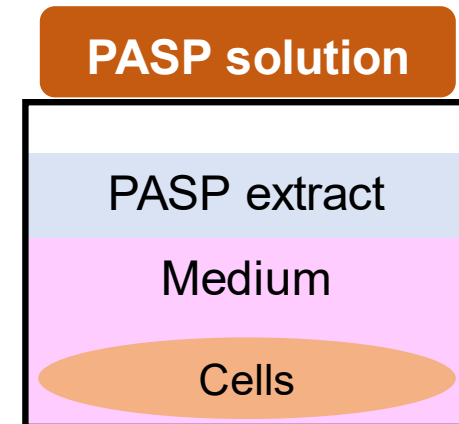
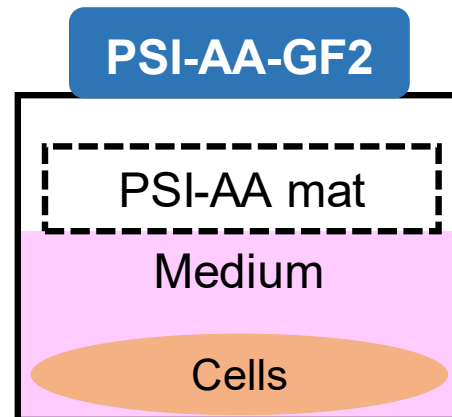
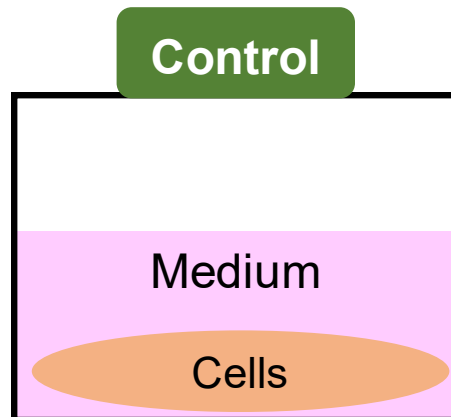
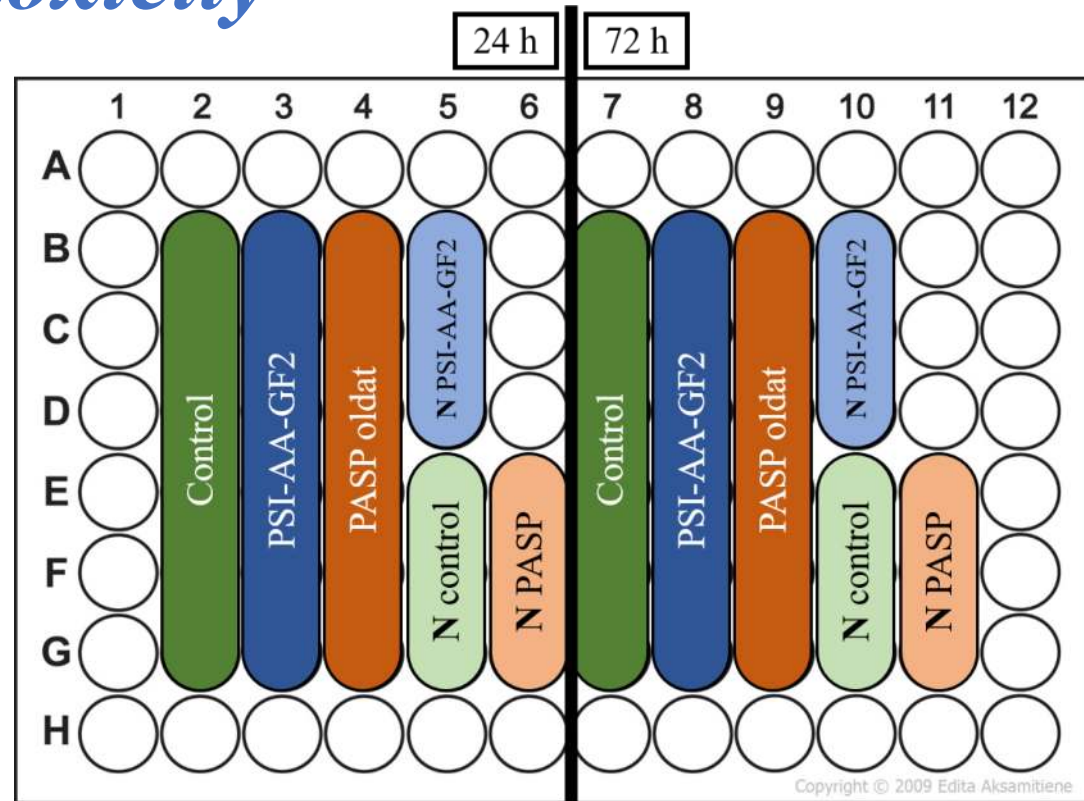
Sample



Cytotoxicity



MG63 osteosarcoma cell line
3700 cell/well
96 well plate
WST-1 reagents, 24h, 72h

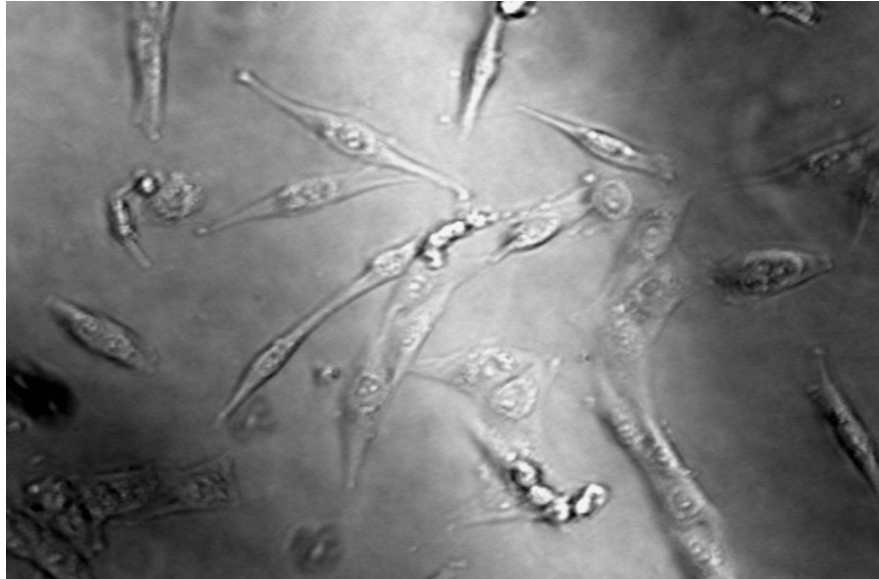




Cytotoxicity

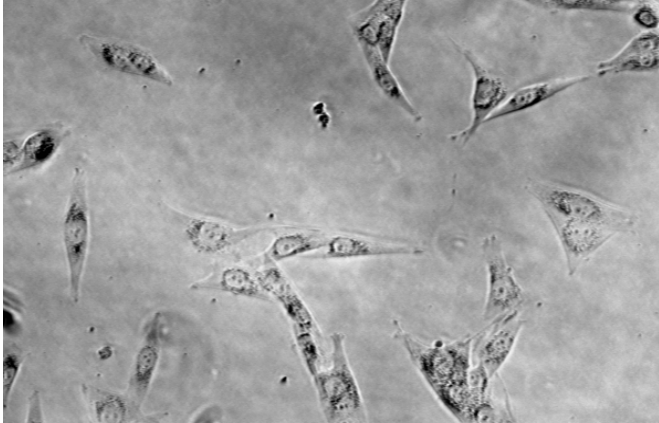


Control

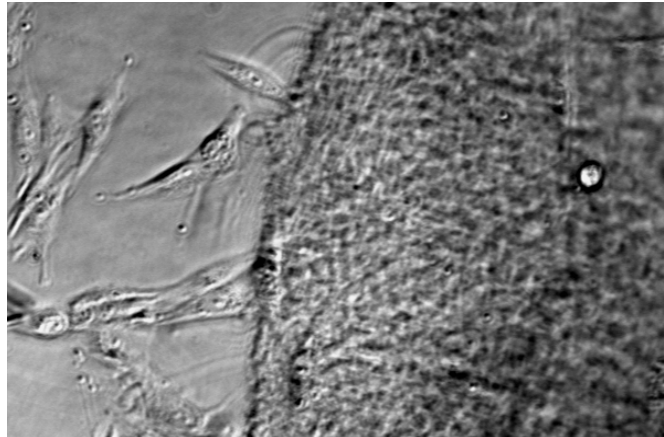


24 hrs

PASP solution



PSI-AA mat

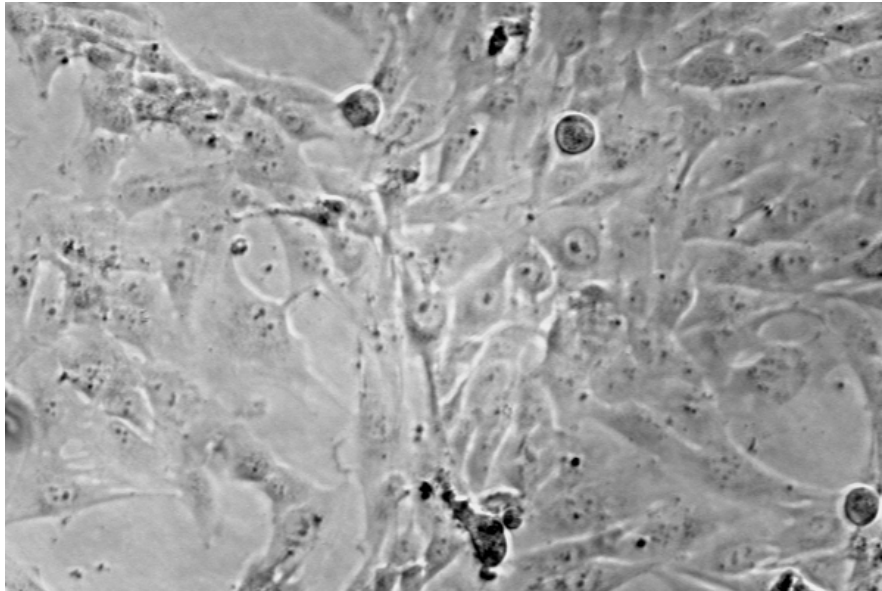




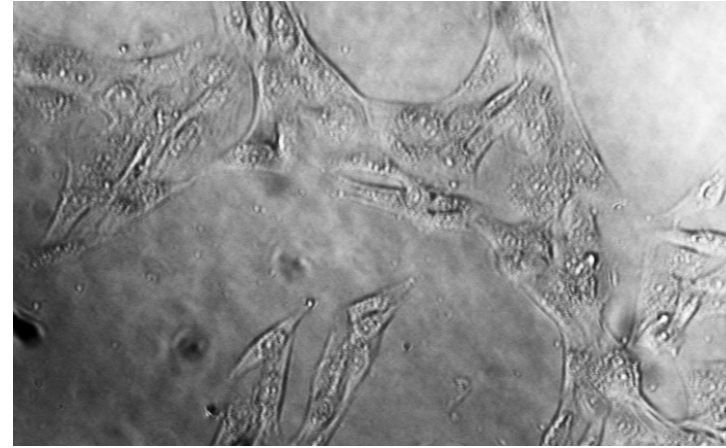
Cytotoxicity



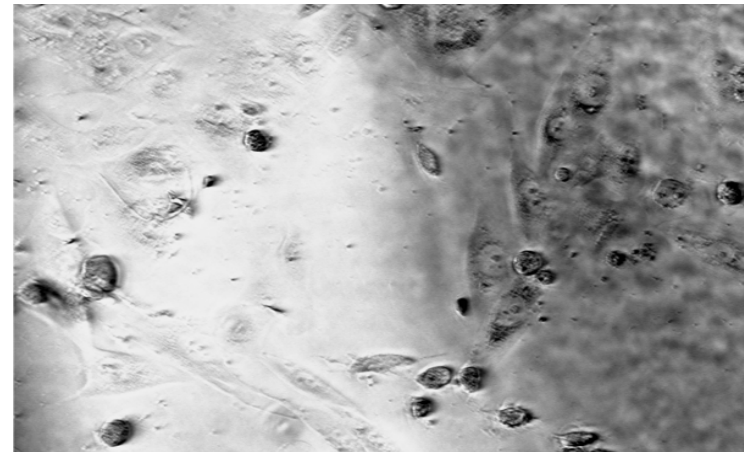
Control



PASP solution



PSI-AA mat

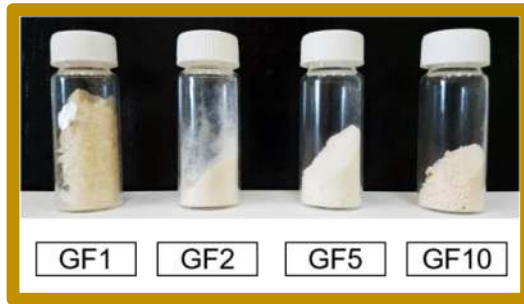


72 hrs

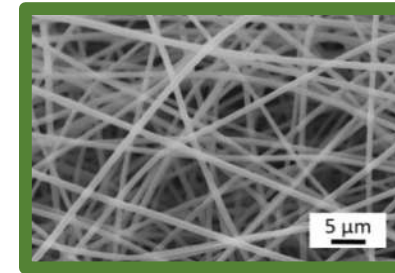
Summary



Polimer synthesis from renewable resources;
Allyl grafting

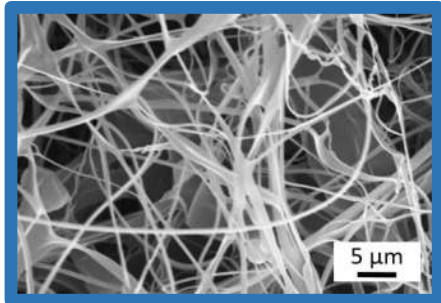


Electrospinning



Hydrolysis

Plasma treatment



Steril, crosslinked mats with no
cytotoxicity





2017 Charles Goodyear Gold Medal





Extended Current Puskas Group



Adel Halasa



Carin Helfer



Miroslawa El Fray



Gábor Kaszás

GREEN MAP Euro Project



Mauricio Azevedo



József Kántor



Enikő Krisch



Kristóf Molnár



Kolos Molnár



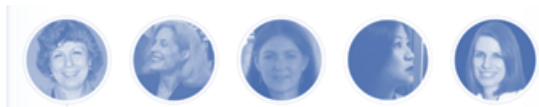
Andres Salgado



Geeta Aswati



Acknowledgements



Healthymagination Cancer Challenge Award 2012



International Center of Advanced Elastomers for Healthcare ICAEH



BREAST CANCER INNOVATION FOUNDATION



DMR #0509687
#0804878

NIH R15 AREA
Austen CRD

Special Creativity
Extension 2013

IUPAC

CHE #0616834
#1012636

DOE 2018

OSU 2019

SBIR I, II: 2012, 2014
AIR 2014

ERC Planning 2019

GREEN MAP

EURO 2019



OH Polymer



SUMMA Health System



Cleveland Clinic

PolyFiberMatrix LLC

EnzymeCatalyzedPolymers LLC



AKRON GENERAL MEDICAL CENTER



LANXESS
Energizing Chemistry
(Rubber Div., Bayer Inc.)



NSERC
CRSNG



Acknowledgements

The authors are grateful for the help of Surface Analysis Lab at The Ohio State University and NSF-DMR grant #0114098 for the XPS measurements. This work was funded by the National Research, Development and Innovation Office – NKFIH FK 124147, the János Bolyai Research Scholarship of the Hungarian Academy of Sciences (AJH) and by the ÚNKP-19-4-SE-04 new national excellence program of the Ministry for Innovation and Technology.

Financial support by the Start-up fund of The Ohio State University #11232011000-11-PUSKAS and the Breast Cancer Innovation Foundation is also acknowledged.



The authors also acknowledge the exchange program of GREEN-MAP (NOVEL GREEN POLYMERIC MATERIALS FOR MEDICAL PACKAGING AND DISPOSABLES TO IMPROVE HOSPITAL SUSTAINABILITY) H2020-MSCA-RISE-2019, European Commission, HORIZON 2020 Program



Puskas Group





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Wooster

