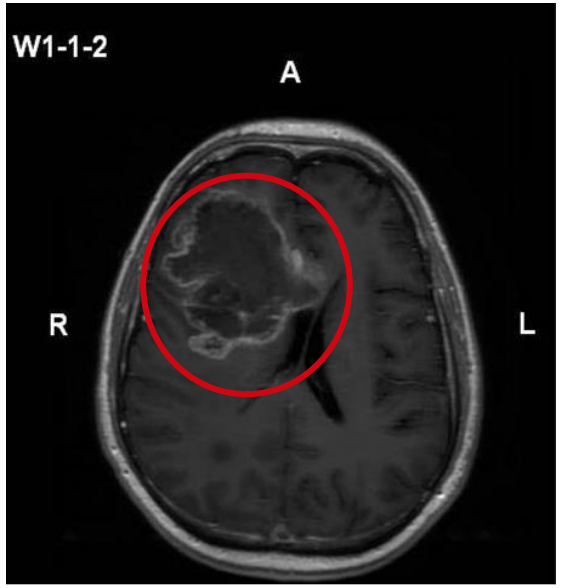
6th Annual International Congress of Doctoral Students
5th- 6th FEB 2026

Photoactive polymeric nanofiber-based delivery systems for photodynamic therapy against glioblastoma

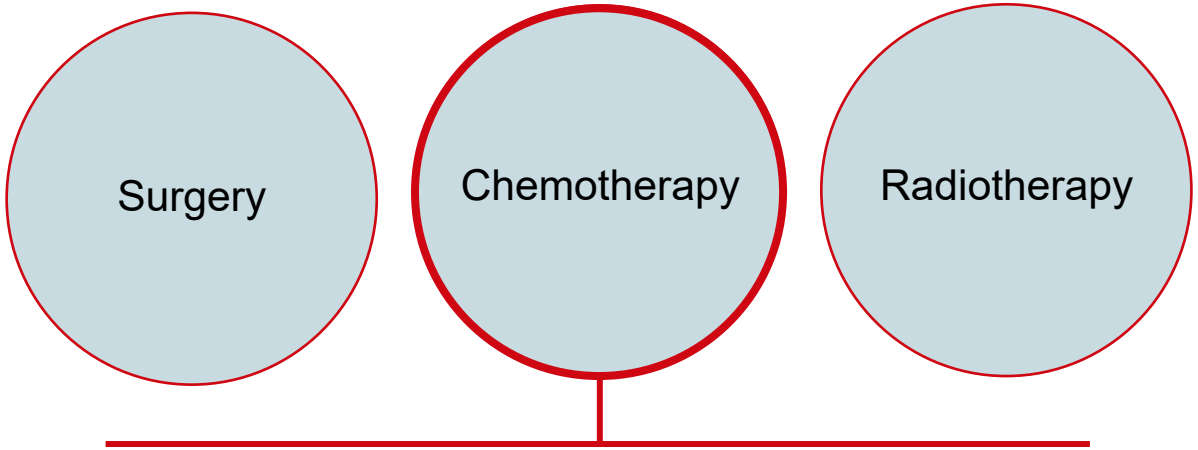
Pedro Valentín Badía Hernández

Grupo de diseño y validación de nanobiomateriales

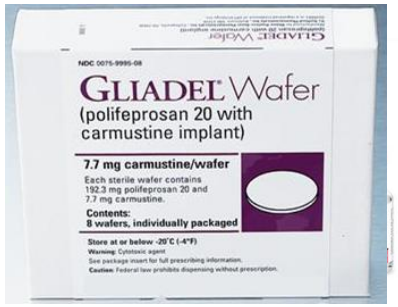
Glioblastoma and curren treatment



80% mortality rate



Temozolomide (TMZ)



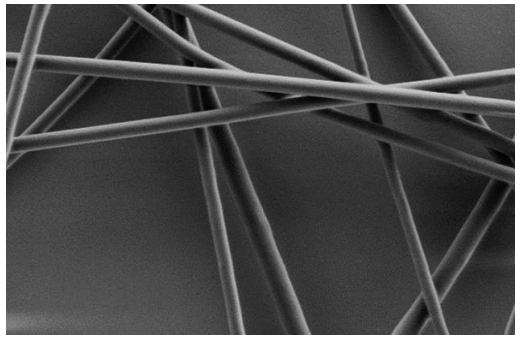
Carmustina (BCNU)

Doxorubicin (DOX)

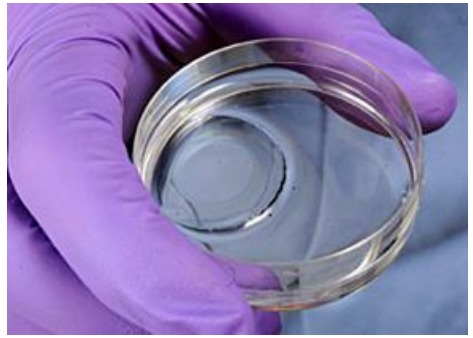
Biomaterials for local treatment

- Macrostructured
- Nanostructured

Nanofibers

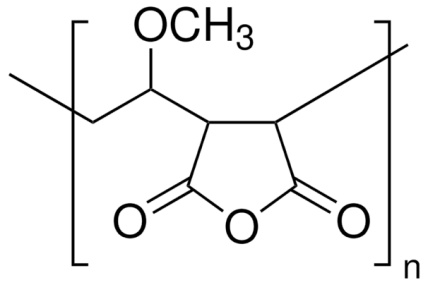


Hydrogels

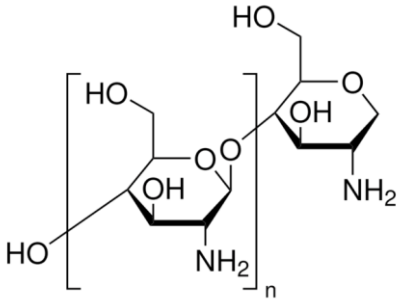


Malleable
Easy to synthesize
Administration: local, oral, or topical
Low storage and transportation costs

Synthetics
Poly (methyl vinyl ether-alt-maleic) (PMVEMA)



Natural
Chitosan



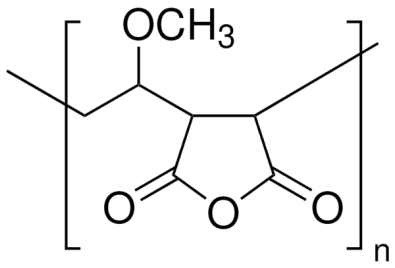
Functionalized polymers for combined therapy

Macrostructured

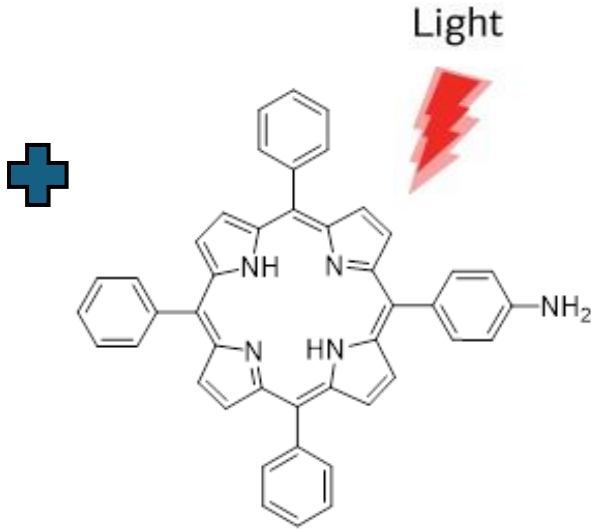
Nanostructured

Photosensitizer conjugation

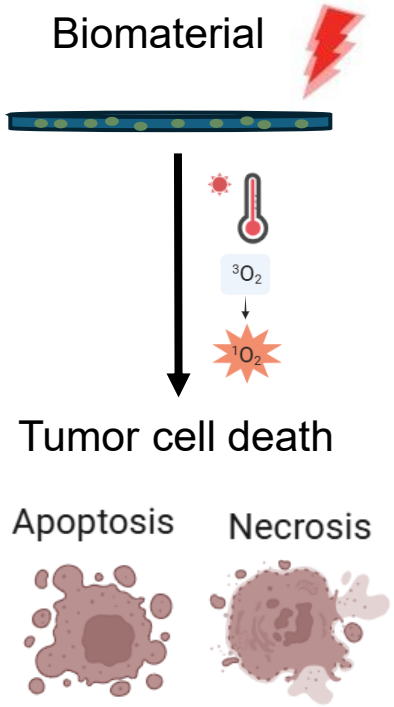
Photodynamic therapy (PDT)



PMVEMA



5-(4-Aminophenyl)-10,15,20-triphenylporphyrin (TPP/NH2)



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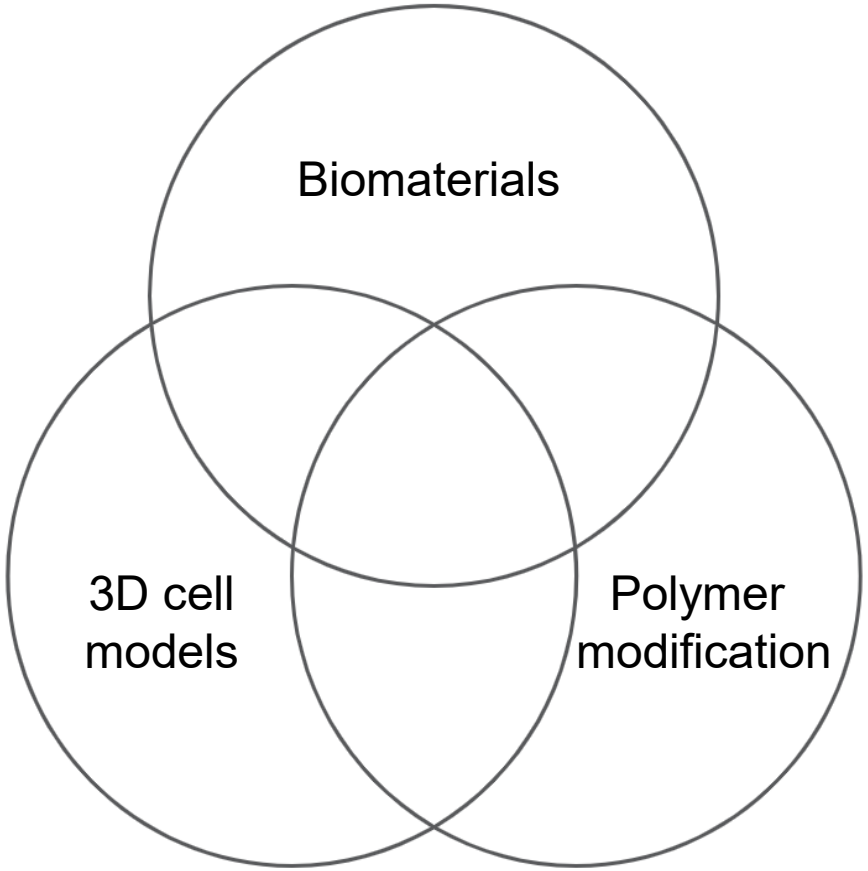
Main aim

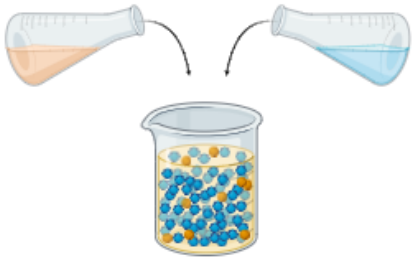
Developing photoactive delivery systems based on biopolymers for the administration of glioblastoma treatments

- Development and characterization of electrospun PMVEMA nanofibers as drug deliver systems for antineoplastic DOX and BCNU.
- Evaluation of their effect in cell models.
- Development of 3D cell models of glioblastoma.
- Functionalization of PMVEMA with porphyrins for PDT.

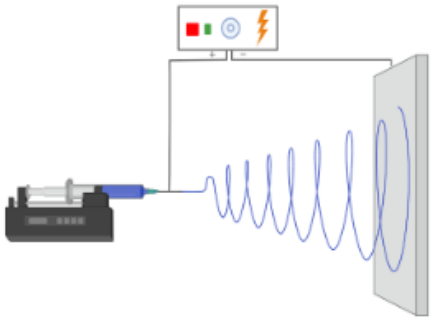


Material and Methods

Doxorubicine (DOX) or Carmustine (BCNU)



PMVEMA disoluttion
Antineoplastic drug (% w/w)



Synthesis by
Electrospinning

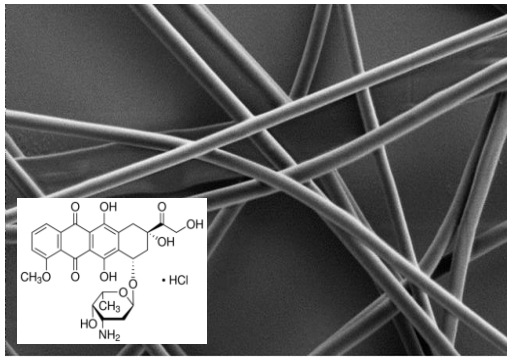
Characterization of nanofibers

- Scanning electron microscopy (FESEM) Confocal mircoscopy
  - Morphology and composition
- Liquid chromatography (HPLC-UV)
  - Encapsulation efficiency and release kinetics
  - Cell viability assay (MTT)
- Effect on gliobastoma patient cell lines from the Hospital General Universitario de Elche (HGUE-GB) and 3D model development

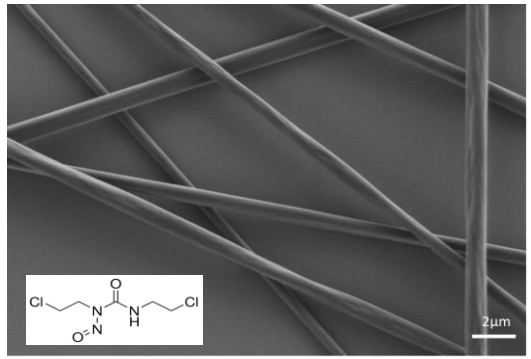
PMVEMA dissolutions (w/w):
- PMVEMA-Ac at 20 % in water
- PMVEMA-Es at 25 % in ethanol

Parameters considered:
- Voltage (kV)
- Distance (cm)
- Flow (mL/h)

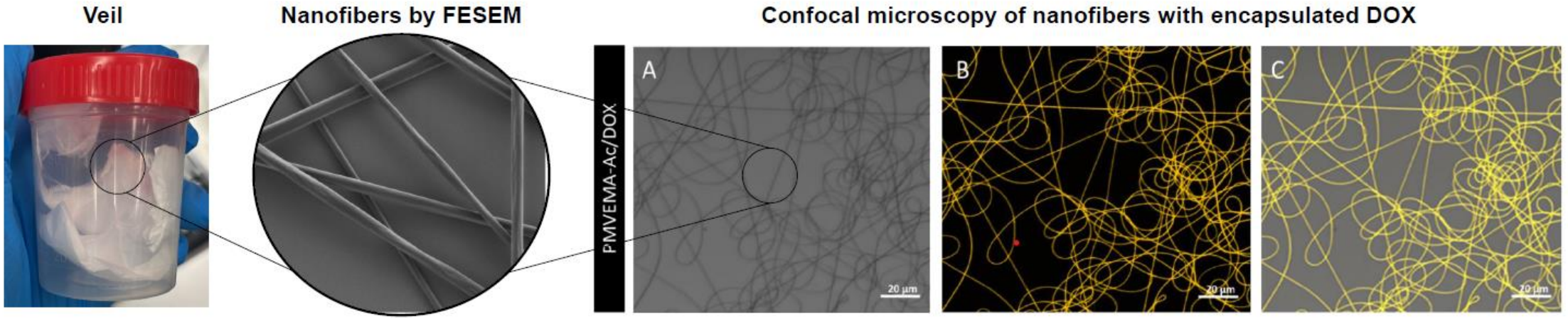
Loaded nanofibers characterization



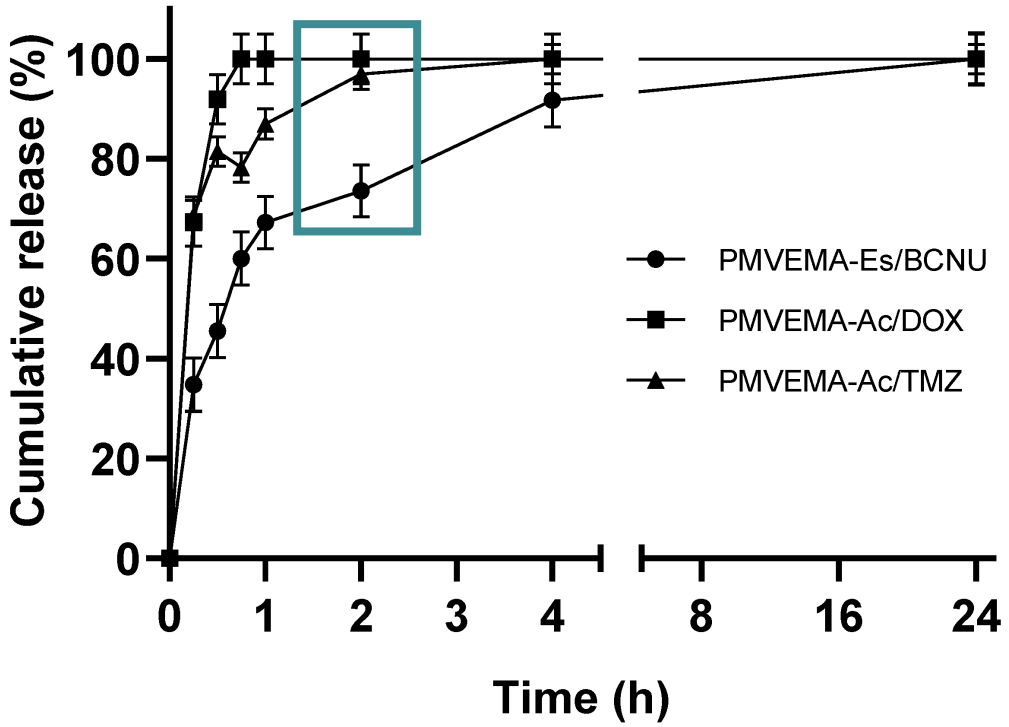
PMVEMA-Ac/DOX 1 %



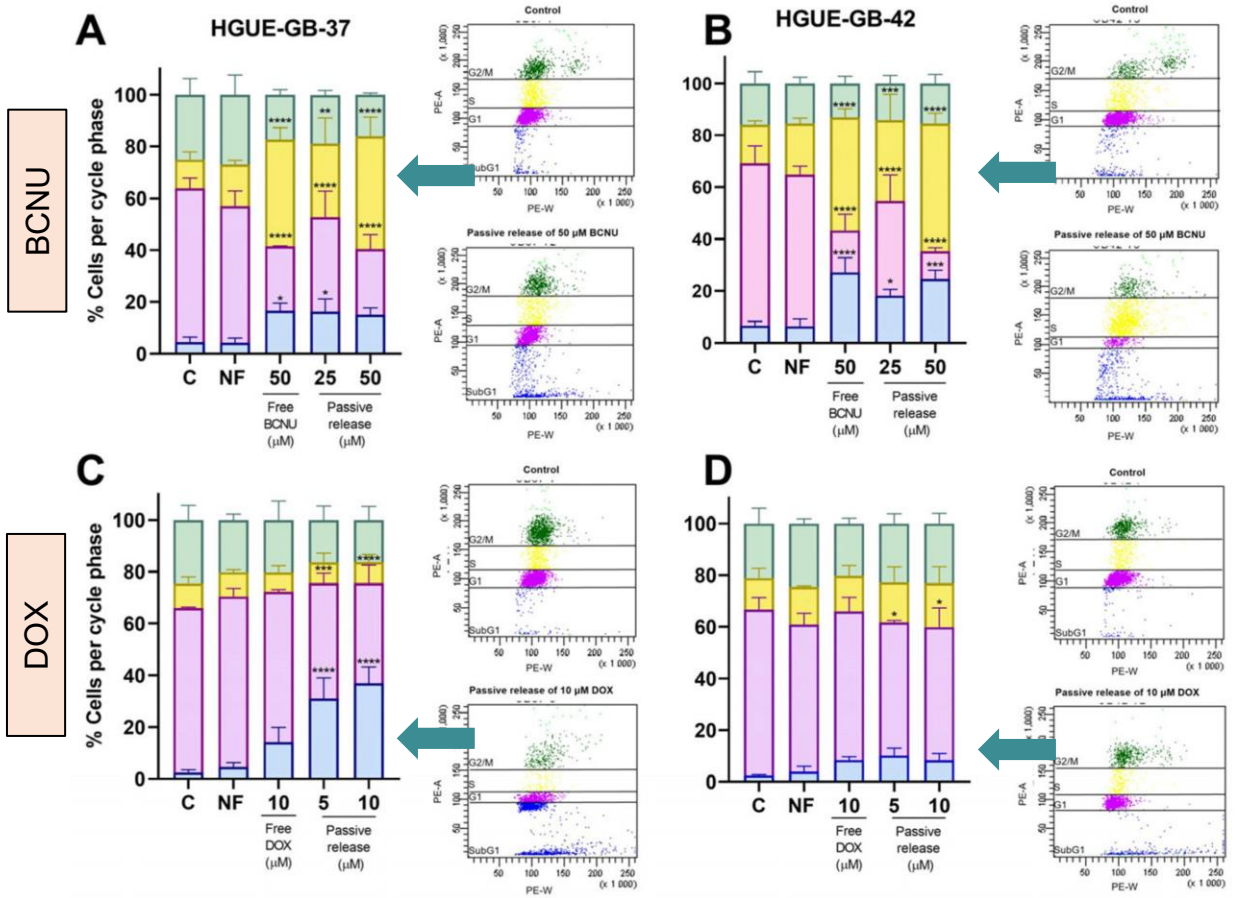
PMVEMA-Es/BCNU 8 %



Kinetic release and effect on cell cycle



Conditions: 37°; PBS; pH 7.4

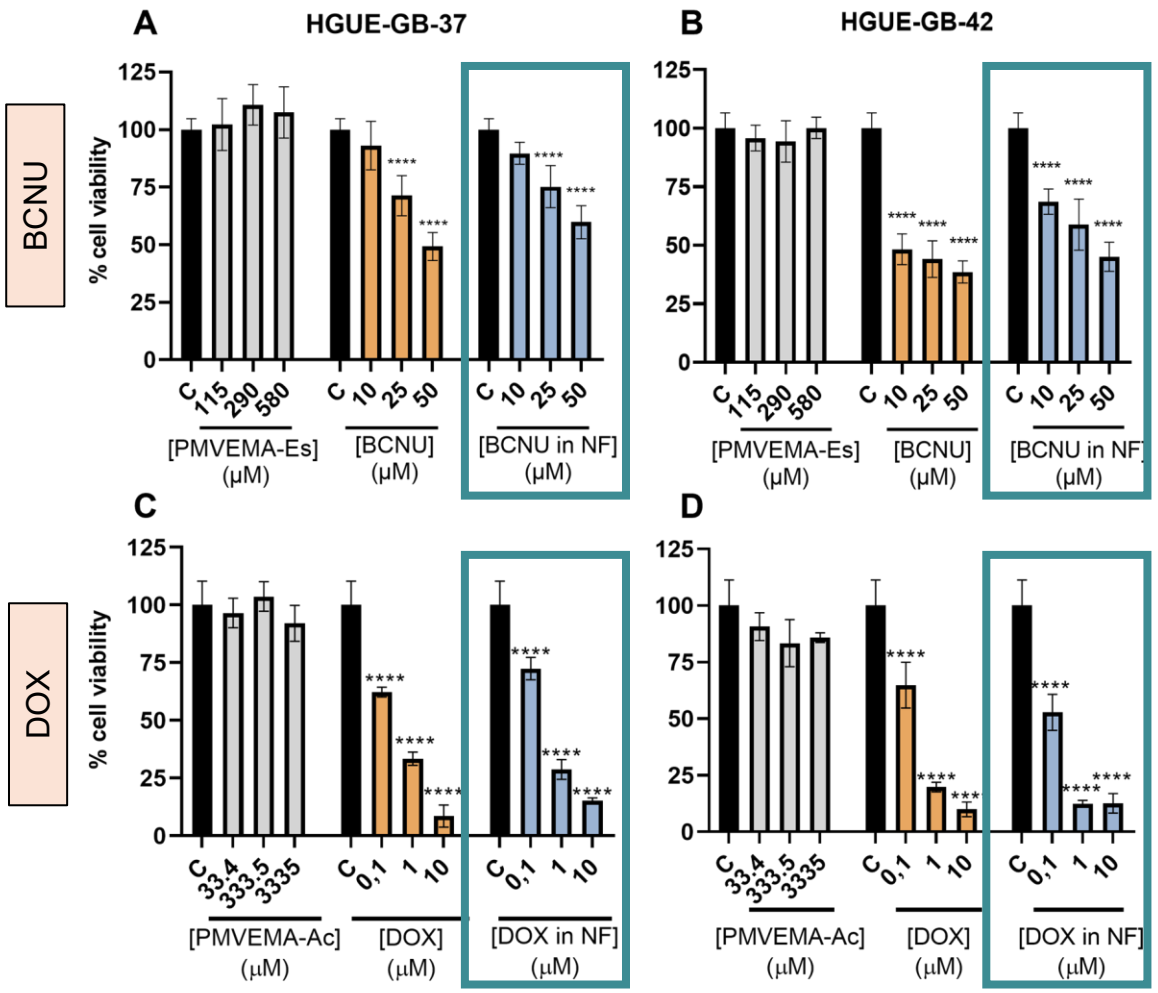


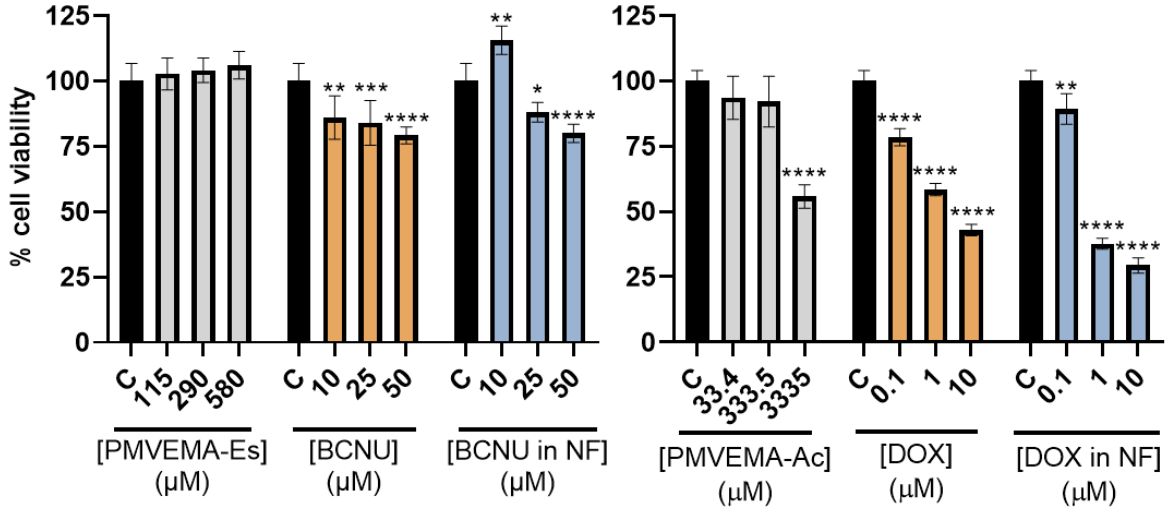
S phase – Cytostasis

SubG1 phase – Cytotoxic

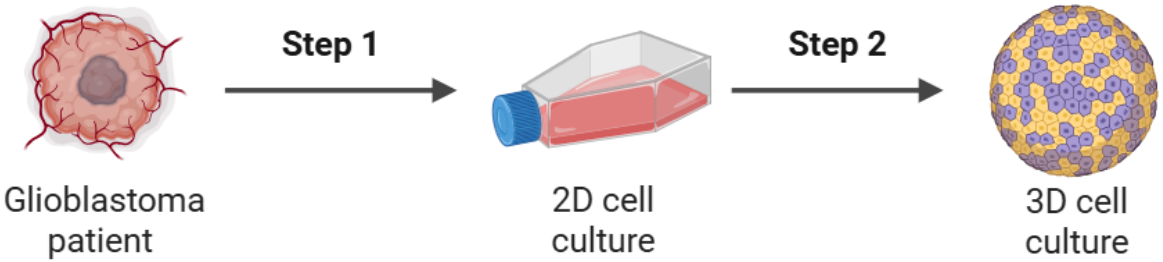
Cell models testing and developing

Results



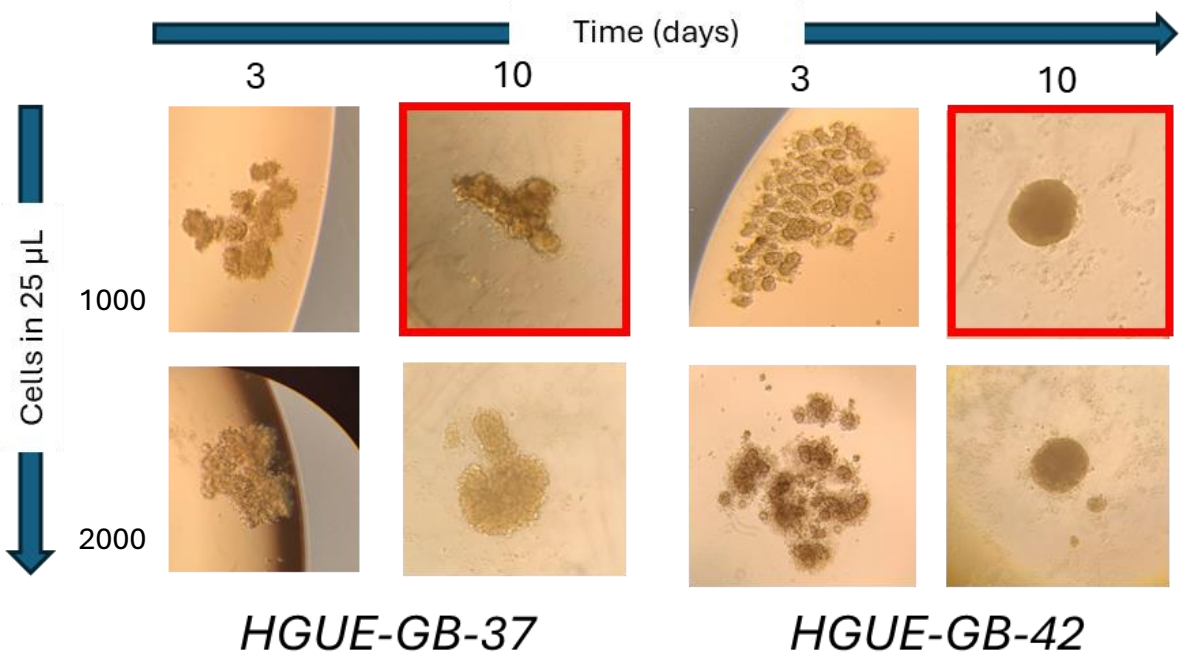


In vitro glioblastoma model

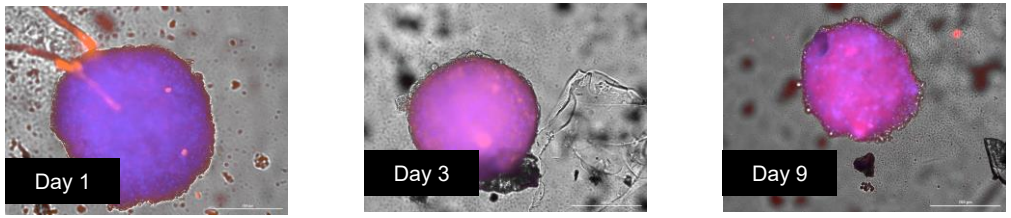


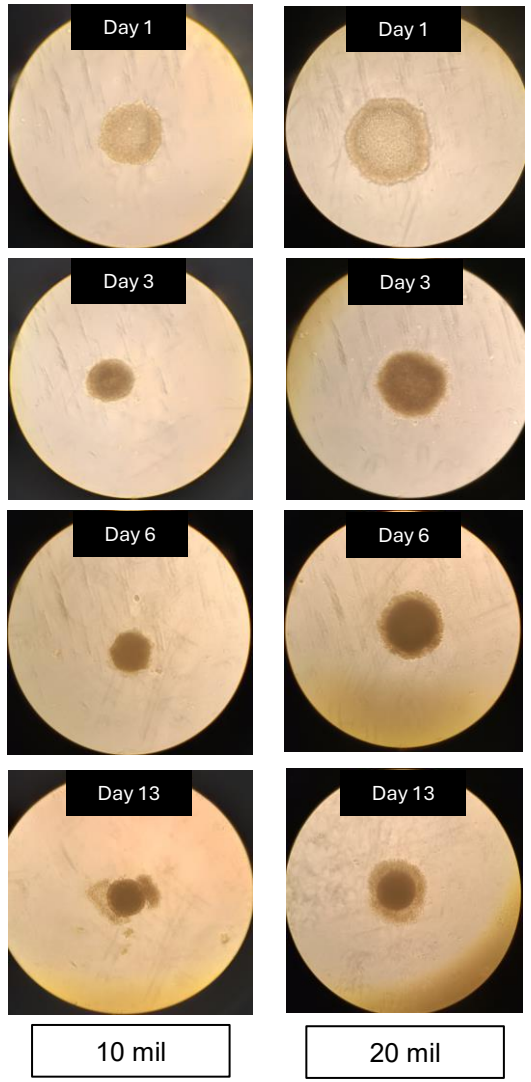
Development of 3D cell models of glioblastoma

Results

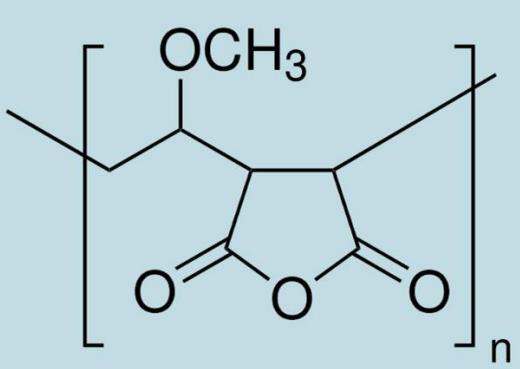


E-cadherin
Hoetch

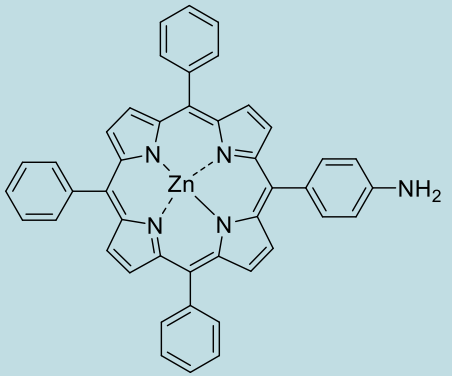




Functionalization of PMVEMA-TPP/NH2-Zn



PMVEMA-Anh



TPP/NH2-Zn

Synthesis:

Microwave reaction

- Molar ratio: 1:0.25

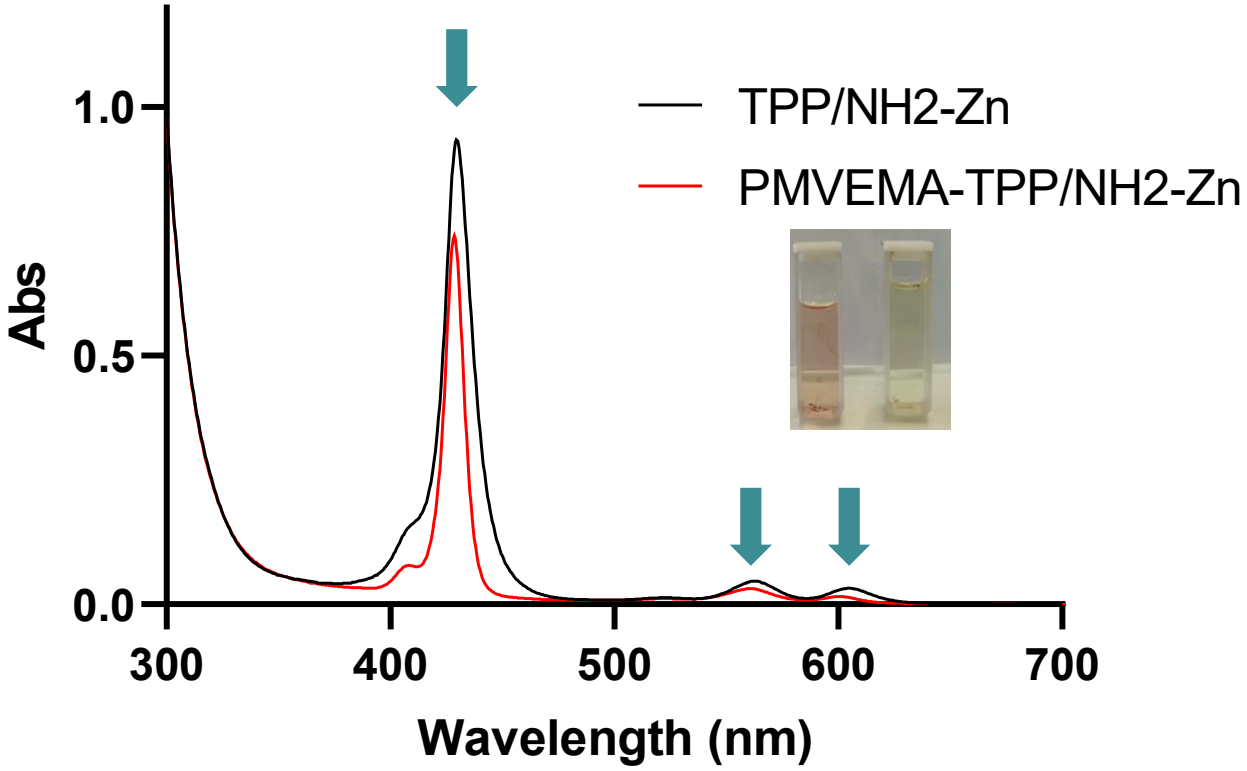
-Conditions:

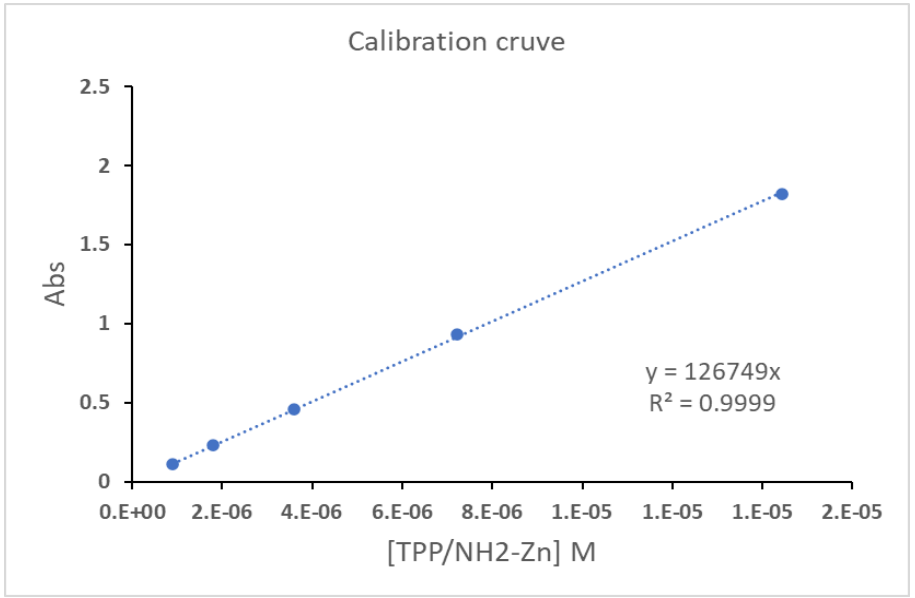
4 mL DMF, 175°C and 20 min

Characterization:

- UV
- FTIR
- NMR
- Cell viability

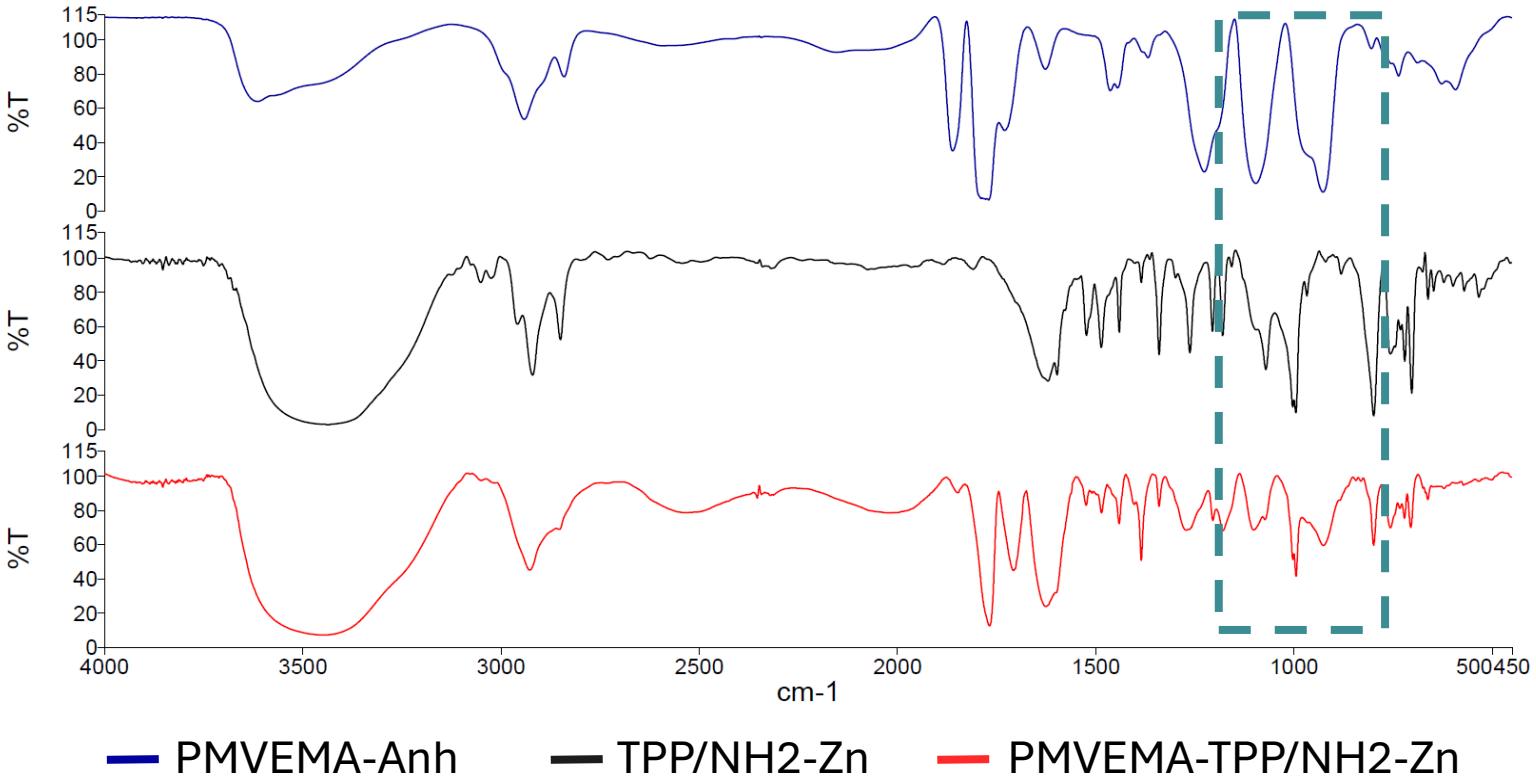
UV characterization of PMVEMA-TPP/NH2-Zn



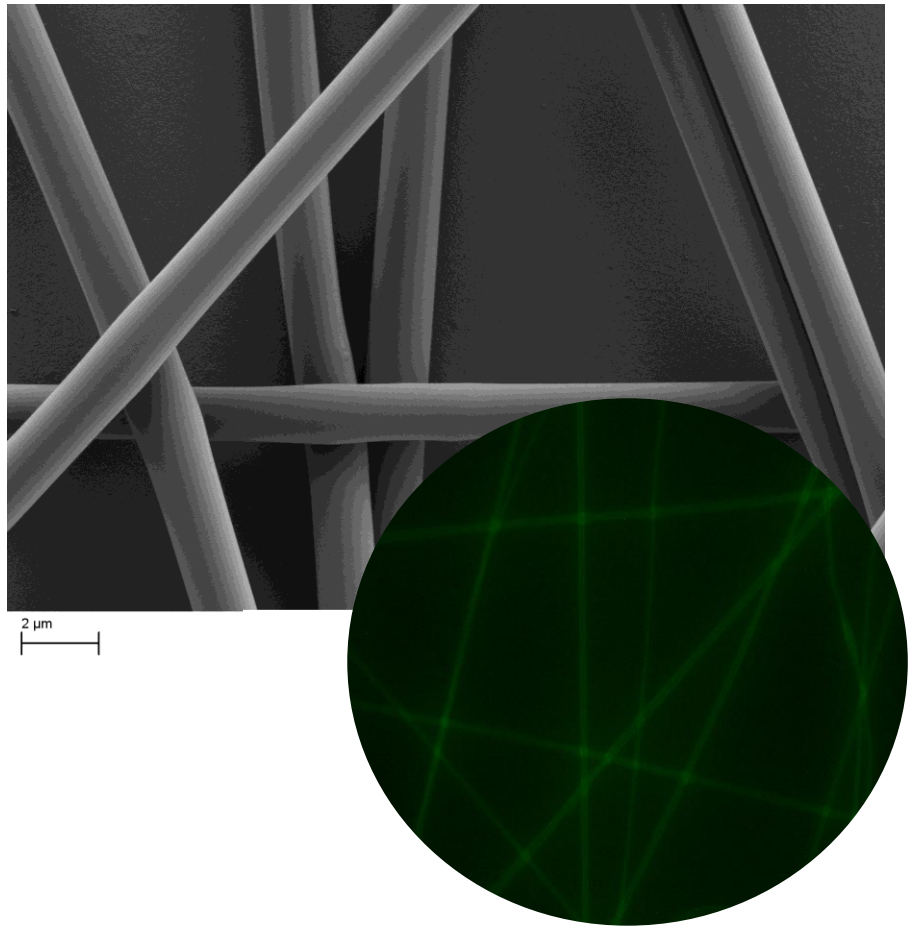


PMVEMA-TPP/NH2-Zn		
Abs 429.5	0.705	u.a.
[PM-TPP]	0.005	mg/mL
Ratio Porf/Polym	770.7	mgPorf/1g Polym
w/w	77.1	%

FTIR characterization of PMVEMA-TPP/NH2-Zn



PMVEMA-TPP/NH2-Zn as copolymer in NF synthesis



Conclutions

- Biomaterials

Electrospun PMVEMA-derivate nanofibers were able to encapsulate DOX and BCNU with a loading efficiency comparable to clinically approved versions of drug delivery systems.

- *In vitro* glioblastoma model

The loaded drugs keep their antitumor activity and reduces glioblastoma cell viability with minimum effects in human astrocytes.

HGUE-GB-42 cell line at a cell density of 20,000, it is proposed to establish a glioblastoma mixed cell model.

- Polymer modification

PMVEMA has been successfully functionalized, further characterization should be performed to use it for PDT treatment.

Acknowledgements

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