IMMOBILIZATION OF HEPARIN BY TERNARY POLYELECTROLYTE COMPLEXES: A PRELIMINARY STUDY

Federica Gioia, Eliana Leo and Eleonora Maretti*

Department of Life Sciences, University of Modena and Reggio Emilia
*eleonora.maretti@unimore.it

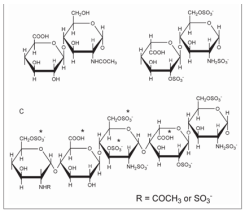
Wound

Skin wound refers to the break of normal anatomical structure and function of the skin

Wounds healing

Wound pH is critical in the healing process. In case of chronic wounds it is around 8 but during the healing the pH will reduce. Therefore, products that provide in the wound bed a slightly acidic environment may improve wound healing

Heparin

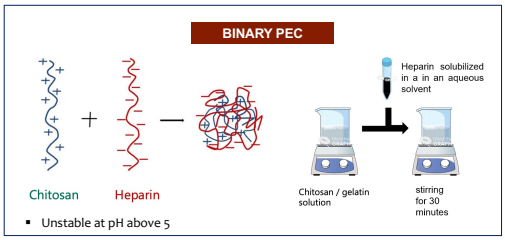


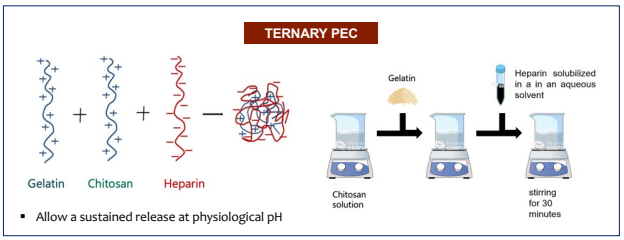
Highly sulphated glycosaminoglycan that is used in pharmaceutical field as an antithrombotic drug, but topically acts as a wound healing accelerator, increasing angiogenesis. To perform this action, it is necessary that heparin mantains the therapeutic concentration in the wound area for an extended period of time

AIM

The immobilization of heparin using a biodegradable carrier such as chitosan is an intriguing way to prolong residence time in situ of heparin

Polyelectrolyte complexes (PEC)



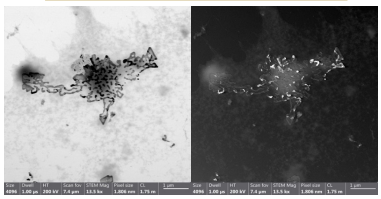


PEC in acetic acid 1%, v/v

Sample name	Chitosan (mg)	Gelatin (mg)	Final pH	Heparin (mg)	Heating during preparation	Size (nm)	PDI	Zeta potential (mV)	% complexed heparin	Macroscopic observation
Binary PEC	64	-	2.5	32	Yes	2741± 502	0.508 ± 0.040	+44.65 ± 1.18	100	Opalescent suspension with a macroscopic agglomerate
Ternary PEC	32	32	2.5	32	Yes	792.7 ± 18.4	0.651 ± 0.100	+22.56 ± 0.98	100	Opalescent suspension with a small amount of powdery precipitate

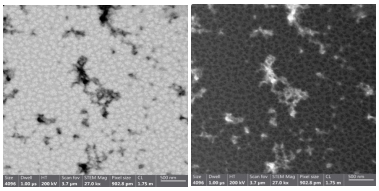
Morphology by STEM

Images of Binary PEC

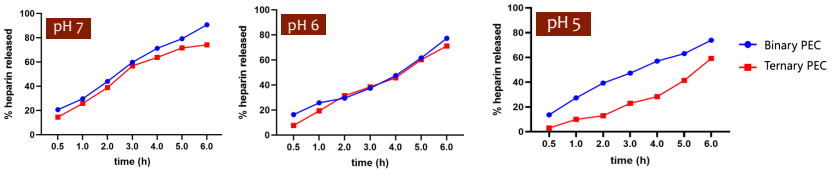


By comparing the images obtained from binary (chitosan and heparin) and ternary (chitosan, gelatin and heparin) PEC it can be see that gelatin places itself around the aggregates increasing the size

Images of Ternary PEC

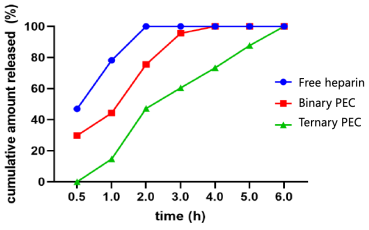


Heparin release at different pH



The release of heparin from binary and ternary PEC at different pHs showed a sustained release only in the case of ternary PEC

PEC inclusion in a Carbopol Ultrez 10 gel and permeation studies



The data obtained from permeation studies with Franz cells confirmed the behavior of the PEC observed in the release experiments, highlighting that their incorporation into the Carbopol gel at acidic conditions did not modify their properties keeping intact the sustained release features in the case of ternary PEC.
Heparin in solution passes completely through the cellulose membrane after only 2h because not complexed

Conclusions

Heparin immobilized in a ternary PEC and incorporated in a Carbopol gel in acidic environment may represent a valuable tool to be further investigated as wound healing accelerator