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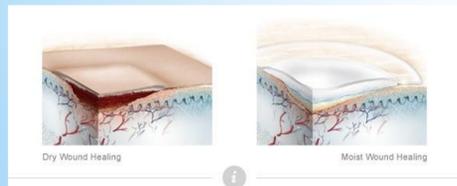
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The application of (2-Hydroxyethyl Methacrylate) HEMA hydrogel for wound healing

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Introduction

Chronic wound care has been gaining momentum due to drug delivery with the use of growth factors. Proteins such as Keratinocyte Growth Factor, KGF, leads to wound healing in the epithelial cells, and has also proven to promote wound closure. Hydrogels, serve as a vehicle that delivers the desired substance into the exact location needed for wound healing. Hydrogels aqueous nature allows the material to accommodate various therapeutic factors. 2-Hydroxyethyl Methacrylate, HEMA, hydrogel is optimal because of its ability to achieve different characteristics without significant change to the polymer.



Background

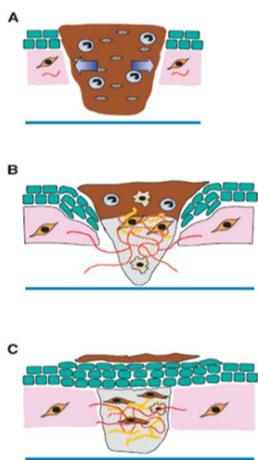
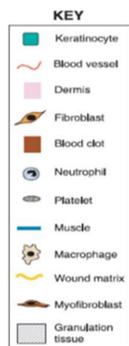


Fig 2: Wound Healing Process for Epithelial Cells



Step A Inflammation: Neutrophils take away initial debris within the clot. Macrophages release growth factors which take over and make room for wound to be prepared for new tissue.

Step B Tissue Formation: Reepithelization occurs and begins with the release of growth factors such as KGF. Epithelial cells are stimulated by KGF, restoring and delivery of oxygen to form granulated tissues.

Step C Tissue Remodeling: Begins with the new formation of the granulation tissue.

Example of thermoresponsive hydrogel assisting in the wound healing process. Its job is to keep the wound moist.

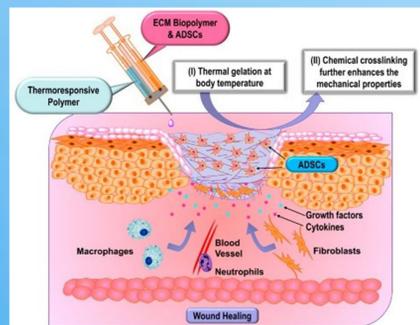


Fig 3: Schematic of hydrogel assisted wound healing



Fig 7: How fluoresces works on the fluorimeter

Results

Swelling Procedure:

- Dried out gel
 - Soaked gel in PBS (buffer)
 - Masses were taken at various times to see hydrogels ability to absorb water
- Perfluoropolyether, PFPE, surface modification, barrier layer

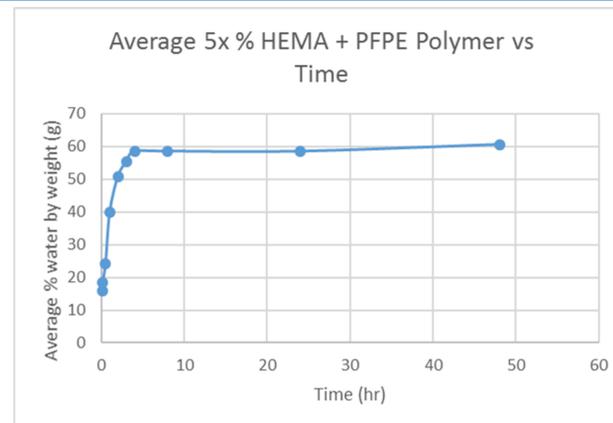


Fig 4: Graph of HEMA +PFPE swelling experiment

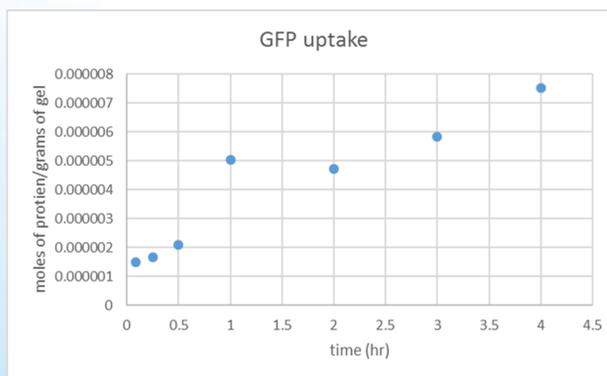


Fig 5: Graph of GFP uptake

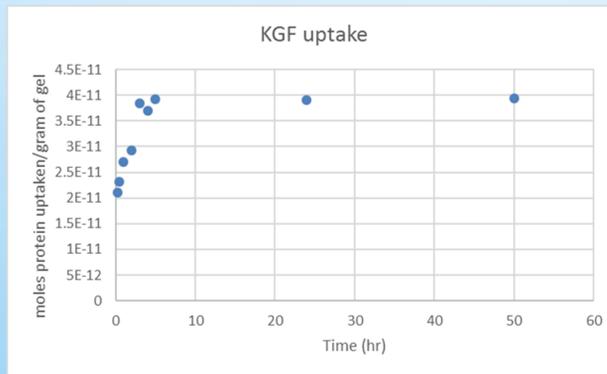


Fig 6: Graph of KGF uptake

Uptake/Release Procedure:

- Gel soaked in protein solution
- Fluorescence taken at various times to determine how much protein is loaded onto the gel through diffusion

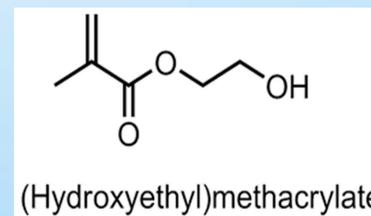


Fig 1: Organic Structure of HEMA

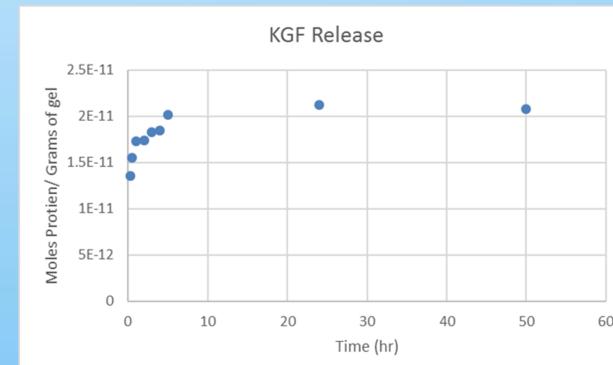


Fig 8: Graph of KGF release

Conclusion

HEMA is an optimal hydrogel for up taking various proteins to accelerate the wound healing process.

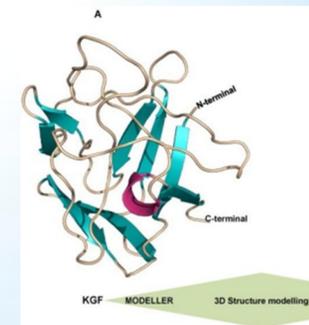


Fig 9: Keratinocyte Growth Factor Protein

Future Direction

What ideal crosslinking, TMPTMA, percentage will uptake the most protein?
What pore size fits what protein?

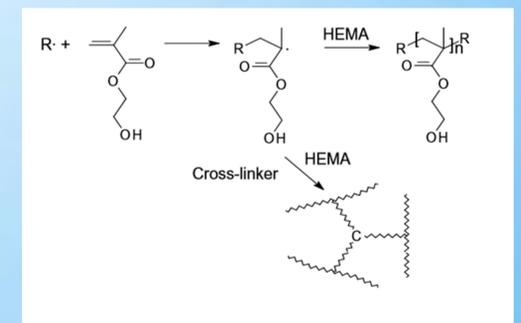


Fig 10: Organic structure of a cross linker and HEMA interaction

References

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- Burns, S. A.; Gardella, J. A., Quantitative ToF-SIMS Studies of Protein Drug Release from Biodegradable Polymer Drug Delivery Membranes. Appl. Surf. Sci. 2008, 255 (4), 1170-1173.
- Toselli, M.; Gardella, J. A.; Messori, M.; Hawkrige, A. M.; Pilati, F.; Tonelli, C., Surface chemical analysis of poly(epsilon-caprolactone)-perfluoropolyether-poly(epsilon-caprolactone) triblock copolymers by X-ray photoelectron spectroscopy. Polym. Int. 2003, 52 (8), 1262-1274.

Acknowledgements

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