Development of self-healing poly(γ-glutamic acid)/ chondroitin sulfate hydrogels with in situ mineralization ability

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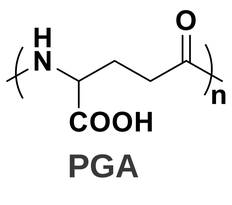
Introduction

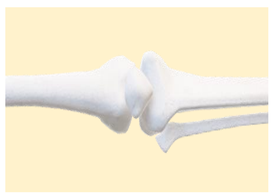
Poly(γ-glutamic acid)

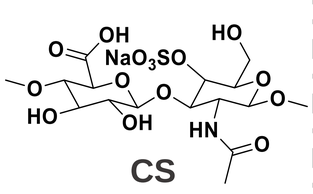


Park, S , et al. Prog. Polym. Sci. 2021, 113, 101341.
Sugino, A, et al. J. Mater. Sci. Mater. Med. 2008, 19, 2269–2274.

- Biodegradability
- Non-toxicity
- Excellent apatite-inducing ability

Chondroitin sulfate

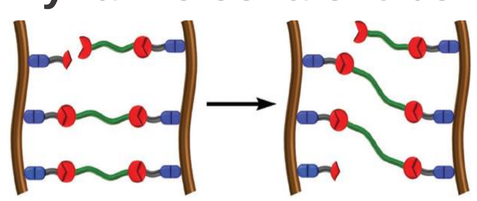




Kim, H, et al. ACS Appl. Mater. Interfaces 2017, 9, 26, 21639–21650

- Anti-inflammatory activity
- Biocompatibility
- Good biomineralization

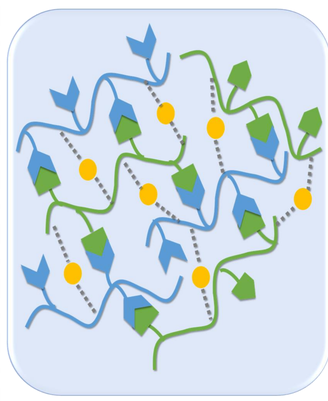
Dynamic covalent bond

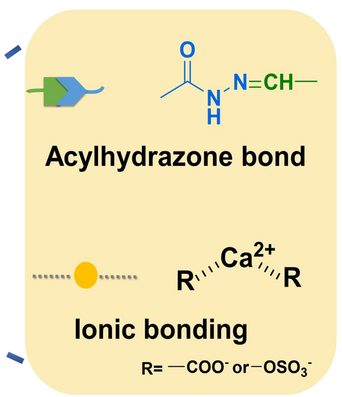


Yang, X, et al. Adv. Funct. Mater. 2017, 27, 1703174.

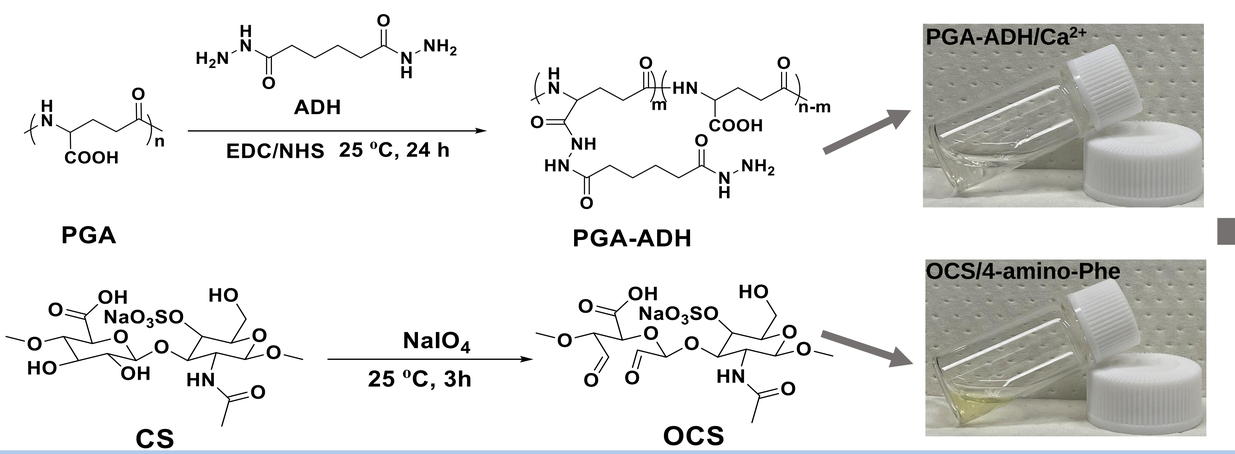
- Injectability
- Self-healing ability
- Matchable dynamic properties

This study





Experimental



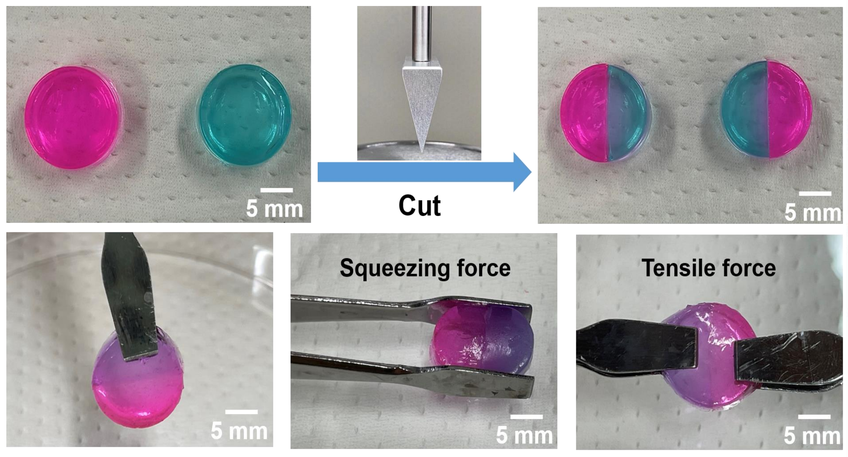
CS without oxidation to prepare hydrogel was used as the control hydrogel for comparison of the bio-adhesion property with hydrogel prepared by oxidized CS.

CaP: Calcium phosphate apatite

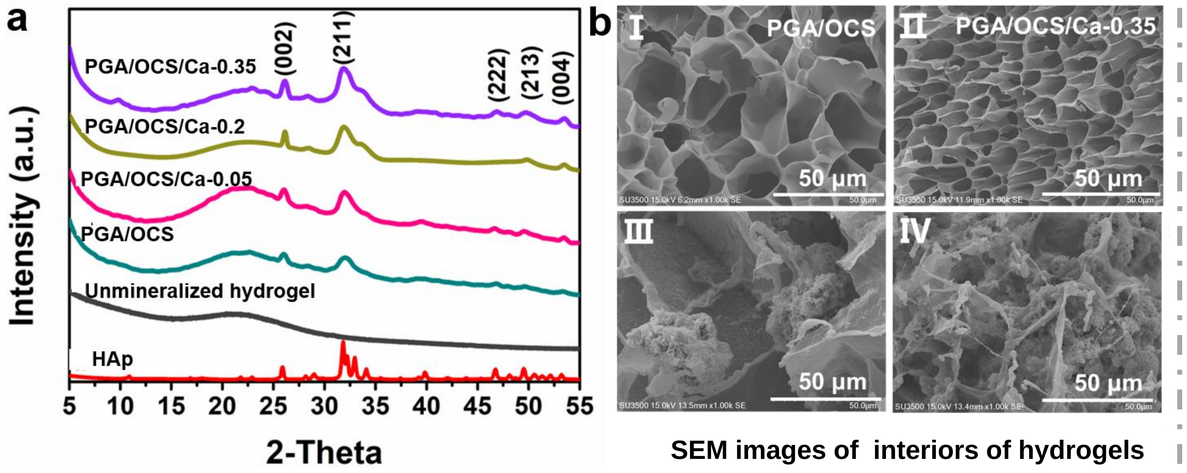
Kokubo, T, et al. Biomaterials 2006, 27, 2907–2915.
Miyazaki, T, et al. Biomed. Mater. Eng. 2013, 23, 339–347.

Results

Self-healing Ability

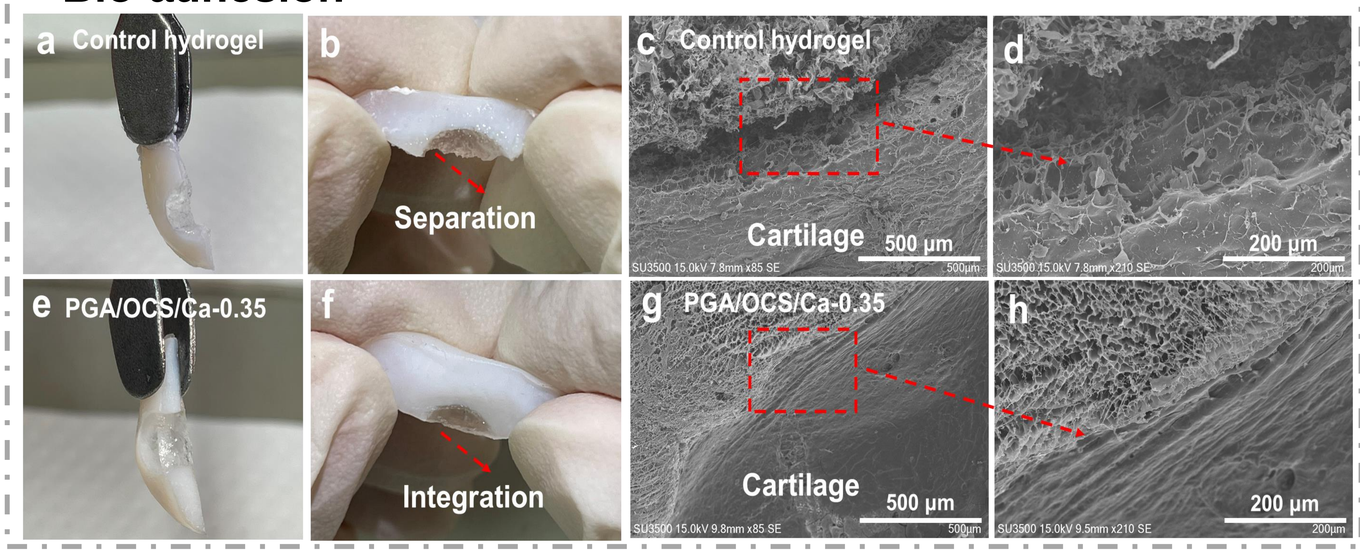


Biomineralization



SEM images of interiors of hydrogels

Bio-adhesion



Conclusion

- ✓ Hydrogels exhibited good self-healing capacity since the combination of acylhydrazone bonds and ionic bonding.
- ✓ The existence of Ca^{2+} ions promoted the formation of apatite in the hydrogels after immersing in SBF.
- ✓ Hydrogels displayed good tissue-adhesive property.

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