The Effects of a Short Self-Assembling Peptide on the Physical and Biological Properties of Biopolymer Hydrogels

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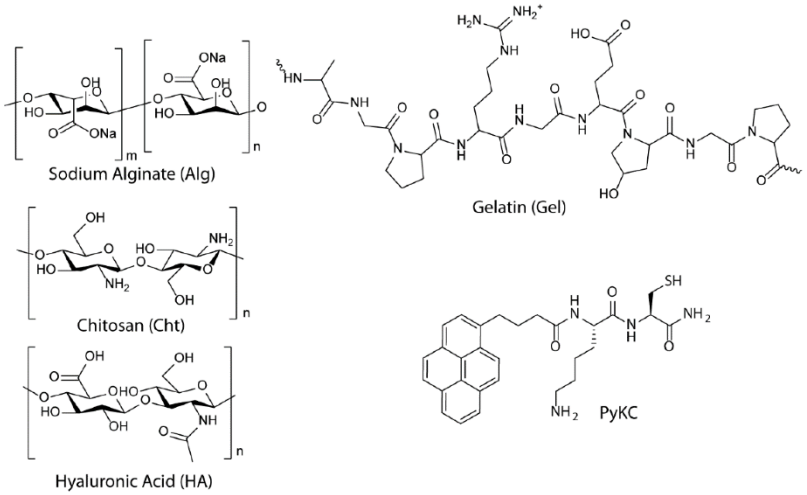
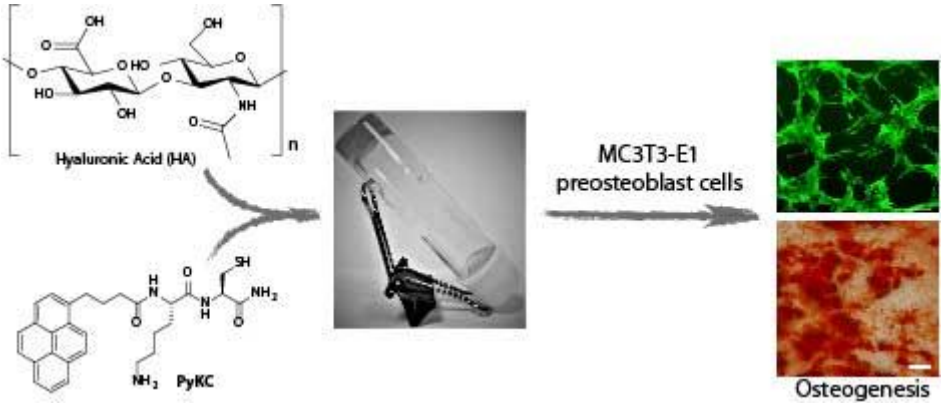
Tissue engineering (TE) is a rapidly growing discipline that helps repair, replace or regenerate tissues or organs. Scaffolds are materials that have been engineered to cause desired cellular interactions to contribute to the formation of new functional tissues for medical purposes. Cells are often cultured into these structures capable of supporting three-dimensional tissue formation. Hydrogel scaffold attracted much interest in this field in the last few years. The natural biopolymer-based hydrogel can serve this purpose, but they lack the required mechanical property. However, composite hydrogel by using biopolymer and peptide can serve this purpose. In this perspective, recently, we have developed a pyrene capped dipeptide, Pyrene-Lysine-Cysteine (PyKC), which can form a hydrogel with unusual confinement properties due to the tightly-packed network structure hydrogel state and remains insoluble



in water as well as in different buffer of pH (3-11). The hydrogelation occurs due to the dimerization of cysteine in the basic medium and the stacking of the pyrene unit. Based on the previous results, we anticipated that the presence of PyKC as a doping agent in the natural biopolymer-based hydrogel could enhance the strength and water content of the composite hydrogel and make it suitable for bone cell regeneration. For this purpose, we have used four biopolymers (Hyaluronic acid, Gelatin, Chitosan and Alginic acid) to prepare the composite hydrogels.

Initially, the Polymer/PyKC composition used for hydrogelation was 1:1 wt%. But the hydrogels were weak. The polymer PyKC ratio was then changed to 10:1 wt%. Hyaluronic acid and Alginic acid can form self-supporting composite hydrogels out of the four biopolymers. The presence of PyKC can considerably enhance the water content and strength of the hydrogel. The composite hydrogel of PyKC/HA fulfils the essential biocompatibility, hydrophilicity and capacity to store a high amount of water inside the long entangle network to serve as a scaffold that mimics the extracellular matrix. The material can support osteogenesis since MC3 T3-E1 osteoblast progenitor cells grown on the materials injectability and thixotropic behaviour of these composite hydrogels hold promise for their future utilization in artificial synovial fluid.



Keywords: composite hydrogel; peptide; hyaluronic acid; bone cell growth.

References:

1. Unusual confinement properties of a water insoluble small peptide hydrogel. *Chem. Sci.* **2019**, *10*, 5920–5928.