

Structure-Property Relationships in Multicomponent Polysaccharide-Peptide Hydrogels

Ronit Bitton

¹Department of Chemical Engineering, ²Ilse Katz Institute for Nanoscale Science & Technology, Ben Gurion University of the Negev, P.O.B. 653, Beer-Sheva 84105, Israel.

Abstract

Over the past two decades, the potential of polysaccharide hydrogels as scaffolds for tissue regeneration has been widely explored. To better emulate the functionality of the natural ECM, current effort in the engineering of synthetic extracellular matrixes has focused on installing molecular features (proteins and bio-interactive polymers) within insoluble scaffolds, either by self-assembly or through covalent modifications of polymer or biopolymer networks.

Combining polysaccharides and peptides for creating hydrogels for tissue engineering is of particular interest, due to the complementary properties of both molecules: Bio-functionality of the peptides on one hand and similarity to the natural ECM of the polysaccharides on the other. Apart from their direct role in cell interaction, peptide sequences may affect the hierarchical structural organization and mechanical properties of the resulting hydrogel, thus indirectly affecting the cellular response. The research in my laboratory aims to develop a fundamental understanding of the structure-mechanical properties relations of multicomponent polysaccharide hydrogels used in tissue engineering applications

Here we present a systematic investigation of the effect of RGD-containing peptides on the hierarchical structure of polysaccharide-peptide hybrids (solutions and gels). Polysaccharide type, ligand incorporation method (covalently attached or self-assembled) as well as peptide nanostructure and amount were tested using advanced tools including small angle X-ray scattering (SAXS), electron microscopy and rheology. Our results show that the peptide's sequence plays a significant role in determining the spatial organization of the polysaccharide and the mechanical properties of the polysaccharide /peptide hybrid hydrogels. Indicating the importance of possible intermolecular interactions between the peptide and the polymer in determining the hydrogel's properties.