

CARTILAGE BIOPOLYMERS AND THEIR ASSEMBLIES

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Aggrecan is a bottlebrush shaped polyelectrolyte that forms supermolecular complexes with linear hyaluronic acid chains. In cartilage aggrecan-hyaluronic acid complexes are interspersed in the collagen matrix and provide the compressive resistance to deswelling under external load. We investigate the self-assembly of aggrecan and its complexation with hyaluronic acid in near physiological salt solutions using an array of complementary experimental techniques (small angle neutron scattering, small angle X-ray scattering, dynamic light scattering, neutron spin-echo and osmotic swelling pressure measurements) to probe the structure and interactions over a wide range of length and time scales. We attempt to bridge the submicroscopic properties of aggrecan-hyaluronic acid complexes probed by scattering techniques to their macroscopic properties. We believe this approach provides insight into the relationship between the structure and function of the main components of cartilage extracellular matrix and may help to tailor the physical characteristics (e.g., osmotic, mechanical and transport properties) of engineered tissue implants to match those of the replaced tissue.

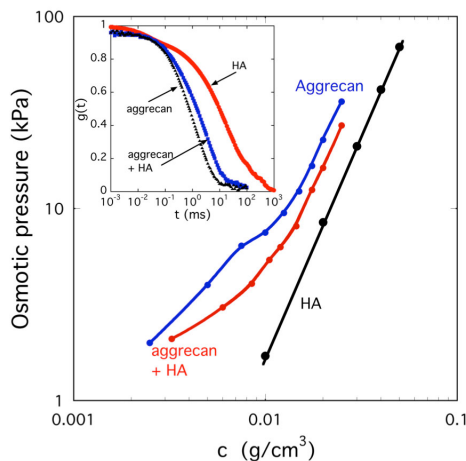


Figure 1. Variation of the osmotic pressure of solutions of aggrecan, hyaluronic acid and aggrecan-hyaluronic acid complex in 100 mM NaCl. The inset shows the dynamic light scattering correlation functions $g(t)$ of these solutions measured at 90° .

