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Biocompatible Surfaces for Biomedical Devices Base on the Intermediate Water Concept

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Abstract

Water molecules play a crucial role in bio-interfacial interactions, including protein adsorption/desorption and cell adhesion behavior. To understand the role of water in the interaction of proteins and cells at biological interfaces, it is important to compare the states of hydration water with various physicochemical properties of hydrated polymeric biomaterials. Herein, we present the fundamental concepts for determining the interactions of proteins and cells with hydrated polymers along with selected examples corresponding to our recent studies, for example, poly(2-methoxyethyl acrylate) (PMEA), PMEA derivatives, zwitterionic polymers, poly(ethylene glycol), poly(*N*-vinyl-2-pyrroridone), and poly(2-oxazoline)s, and other polymers including biopolymers (DNA, RNA, proteins, and polysaccharides). The states of water were analyzed by differential scanning calorimetry, **in situ** attenuated total reflection infrared spectroscopy, soft X-ray emission spectroscopy, surface force measurements, and wide variety of analytical techniques. We found that intermediate water which is loosely bound to a polymer, is a useful indicator of the biocompatibility of polymer surfaces. This finding on intermediate water provides novel insights and helps develop novel experimental models for understanding protein adsorption/cell adhesion in a wide range of polymers, such as those used in biomedical applications.

References

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