Biomedical Applications of Natural Polymers

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Natural polymers are composed of polysaccharides, proteins, and nucleic acids, and have some remarkable advantages over synthetic polymers, that is, their excellent physiological properties such as cell adhesion, biocompatibility, and biodegradability although they have several disadvantages such as risk of viral infection, antigenicity, instability, deterioration, and limited versatility for biomedical applications. Silk protein has been studied as wound dressing thanks to biocompatibility, biodegradability and minimal inflammation. However, it has disadvantages like poor mechanical properties in sponge form. In our study, silk protein/poly (ethylene glycol) semi-interpenetrating polymer networks was prepared to increase mechanical properties of SF itself. It was found that its tensile strength was 41-fold increased. Chitosan has been considered to be a good gene carrier candidate since it is known as a biocompatible, biodegradable and low toxic material with high cationic potential. However, low cell specificity and low transfection efficiency must be overcome for use in clinical trials. In our studies, galactose and mannose were coupled with chitosan for targeting liver and antigen presenting cells, respectively. Also low molecular weight polyethylenimine was grafted into chitosan to enhance transfection efficiency.