OB 2 - Preparation and Characterization of Chitosan-Based Coatings for Prevention of Bacterial Adhesion

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Silicone-based and polyolefin materials have been extensively used for development of biomedical devices, vascular and urinary catheters and many other implants. Despite good mechanical properties of these materials, their usage is associated with high adhesion of pathogenic bacteria and biofilm formation that leads to infectious complications, limited term of functioning and worsening of the life of quality of the patients. Prevention of bacterial adhesion to the surfaces of biomedical devices remains a challenging task in bioengineering and can be potentially solved via development of functional coatings based on polysaccharides. Here we report on formation, characterization and investigation of bacterial adhesion to surfaces modified with chitosan and chitosan-carrageenan multilayers.

Coatings of chitosan on glass were formed via direct physical adsorption or covalent grafting to pre-immobilized reactive layers of poly(ethylene-alt-maleic anhydride) – PEMAh and poly(glycidylmethacrylate) – PGMA. Chitosan/k-carrageenan multilayers were formed by self-assembly at pH=5. Preliminary experiments have shown that despite high hydrophilicity and negative surface potential of the glass, the isoelectric point (IEP) after physical adsorption of chitosan from 0.1-1.0 M KCl solutions was around pH 3.5-4.8, which is significantly lower than expected for homogeneous chitosan coatings. Covalent binding of chitosan to PGMA and PEMAh sub-layers, containing epoxy and anhydride groups, respectively, allowed significant improvement of coating quality and yielded, according to XPS and streaming potential data, highly aminated surfaces with IEP between pH 6-7.

The kinetics of adhesion of *Enterococcus faecalis* BS385 (isolated from clogged biliary stents) to chitosan-based coatings on glass was investigated in a parallel-plate flow chamber, followed by quantification of the number of dead/live bacteria after Baclight staining and using a confocal laser scanning microscope. It was found that both chitosan and chitosan/k-carrageenan coatings profoundly decreased enterococcal adhesion, with a moderate effect on bacterial viability.