Abstract

Bacterial contamination and biofilm formation are major issues today. Forty-eight million illnesses and 3,000 deaths per year are caused by bacterially contaminated food in the United states alone. This is not only a burden to the patient and the health care system but also for the economy.

Antimicrobial surfaces in the forms of films or sachets in packaging or as part of a wound dressing and coatings are an alternative strategy to combat this problem. To do so, the enzymes cellobiose dehydrogenase (CDH) and glucose oxidase (GOX), which generate hydrogen peroxide once in contact with their substrate (cellooligomers or glucose), were used imparting antimicrobial activity to different biomaterials.

Within this thesis, CDH was non-covalently bound to nanofibrillated chitin (NFC) aerogels and GOX was non-covalently as well as covalently immobilized onto cellulose nanofibre (CNF) films. Both functionalized materials produced hydrogen peroxide above the previously defined threshold of 10 mM.

The films and aerogels were further proven to show an antimicrobial effect on gram-negative and gram-positive bacteria. The aerogels revealed anti-fungal activity on *Candida glabrata* after 24 hours.

The surface was characterised using scanning electron microscopy (SEM), atomic force microscopy (AFM) and confocal laser microscopy (CLSM). Moreover, their swelling and leaching properties, stress-strain and pressure-deformation behaviour, as well as anti-biofilm activities were investigated. A biocompatibility test of the CNF-films showed that they neither affect viability nor the growth and therefore did not inhibit or harm mouse fibroblasts.

The outcome of this study reveals great potential of the functionalized polysaccharide scaffolds for applications in the food and healthcare industry. The stimuli responsive activation of the antimicrobial activity constitutes a valuable alternative to conventionally used methods.