Gotta Catch 'EM ALL: PEG-based microgels for selective inhibition of pathogens

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Antibiotic resistance is a well-known problem of conventional antibiotics, which involves huge costs in clinical therapies and the development of new antibiotics. Many Pathogens bind to the sugar ligands of cell surfaces for tissue invasion [1]. Instead of promoting resistant species by outright killing most of the pathogens, the pathogen surface could be inhibited by presenting macromolecular carbohydrate ligand scaffolds [2] to prevent the pathogen interaction with the cell surface.
Clinical studies showed that the intake of monosaccharides reduced the chronical affection with pseudomonas aeruginosa [3]. To maximise this effect, our approach is to use biocompatible polyethylene glycol-based microgels with sugar ligands for inhibition of bacterial adhesion. This leads to maximized multivalent binding sites to deactivate the pathogens with a shielding effect (Fig. 1). With this approach, the pathogens will not be killed but hindered from infecting a healthy cell thus resistance towards the antibiotic is less likely.

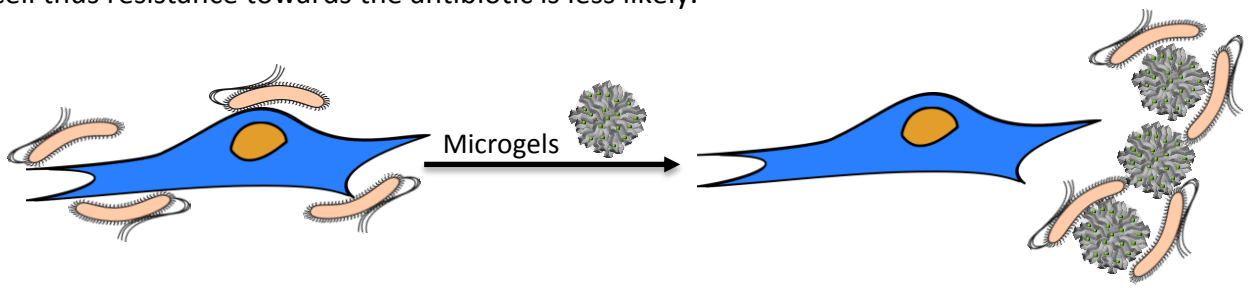

Figure 1. Schematics of the pathogens inhibition by biocompatible microgels presenting sugar ligands. Left: Active, non-bonded pathogens bind to the sugar on the cell surface to invade the cell; Right: Deactivated and bonded pathogens by the sugars on the microgel surface.

We established the synthesis of mannose- and galactose-presenting polyethylene glycol microgels with a high content of sugar in the microgel shell. This thermosensitive microgel with a particle size about 400 nm is monodisperse, which is important to produce well-ordered microgel films on surfaces [5]. The current focus is on binding studies between the lectin concanavalin A, which is a well-known model for carbohydrate interactions [6] that mimics the pathogen interactions, and the microgel-coated surfaces at different temperatures. The results so far indicate an increased mannose content at the microgel shell compared to the bulk and an increase of binding affinity at elevated temperature to the lectin owing to the microgels thermosensitive PEG network.
Overall, the synthesis for a biocompatible sugar ligand-containing microgel as a basis for pathogen inhibition is established and tested with the lectin receptor concanavalin A.

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