

NOVEL AMPHIPATHIC POLYURETHANE BASED COLLOIDAL DISPERSIONS TO COMBAT GRAM-POSITIVE BACTERIA

Varela, P.^{1,2}; Purkayastha, S.¹; Boffito, M.¹; Marlinghaus, L.³; Sartori, S.¹; Viebahn, R.²; Ciardelli, G.¹; Salber, J.²

Introduction: The Gram-positive bacteria *Staphylococcus aureus* and *Staphylococcus epidermidis* are two of the most common causes of medical device-associated infections. Biofilm formation and presence of multi-drug resistant pathogenic bacteria or fungi are the root causes of chronic infections. Hence, it is urgent to develop new strategies to combat such bacteria. The rationale underpinning the design of the polyurethane based colloidal particles is to bypass the complex structure of antimicrobial peptides and obtain Janus particles. In theory, the electrostatic interactions stemming from the charged quaternary ammonium of the hydrophilic segment allows to interact with the anionic bacterial cytoplasmic membrane, while the hydrophobic domains of polyurethane grafted poly(N-isopropylacrylamide-b-hydrophilic ionic liquid) based system segments form pores and consequently disintegrate the cell membrane of the pathogenic gram positive bacteria. **Objective:** Herein, we are developing novel amphipathic thermoresponsive polyurethane grafted poly(N-isopropylacrylamide-b-hydrophilic ionic liquid) (NHP407-g-p(NIPAM-b-HPIL) based colloidal dispersions which are meant to target gram-positive bacteria. **Material & methods:** N-isopropylacrylamide monomer was grafted from a polyurethane backbone via redox initiated aqueous heterophase polymerization. Further, a hydrophilic ionic liquid monomer was sequentially added and polymerized to the polyurethane grafted poly(N-isopropylacrylamide) block. For characterization, NMR, electron micrographs and zeta potential were performed. Antimicrobial susceptibility was determined by the broth microdilution method and cytocompatibility evaluation was done on the fibroblast L929 cell line by the Multiplex assay. **Results:** Antimicrobial studies on *S. aureus* and *S. epidermidis* confirmed the excellent bactericidal property of the designed aqueous colloidal dispersion. Minimum Bactericidal Concentration (MBC) were as low as 64 µg/mL and 16 µg/mL, respectively. Interestingly, approximately 99% of *S. aureus* is killed just within 90 minutes by half of the concentration correspondent to the MBC value. Preliminary tests on fibroblasts showed that the system is cytocompatible with concentrations around the MBC values. **Conclusion:** The developed amphipathic polyurethane system is inducing bactericidal effect against staphylococci bacteria. Further experiments are in progress to elucidate its mode of action.