‘SMART’AND PROMISING ANTIBACTERIAL FOOD-PACKAGING MATERIAL

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With the growing public health awareness of disease transmissions and cross-infection caused by microorganisms, use of antimicrobial materials has increased in many application areas. The perspective one is antibacterial packaging material that can improve product quality and keep it free from microbial adhesion. Such antimicrobial packaging materials maybe produced by introducing metallic nanoparticlesinto polymer matrixes.

Polymer brushes are special macromolecular structures with polymer chains densely tethered to solid via a stable covalent or noncovalent bond linkage. They have a great potential as a matrix for preservation of silver NPs.

Poly(4-vinylpyridine) grafted polymer brushes were fabricated in three-step process via Surface Initiated Activators ReGenerated by Electron Transfer Atom Transfer Radical Polymerization (SI-ARGET ATRP). After that Ag-NPs were incorporated onto grafted polymer brushes.

The presence of Ag-NPs was confirmed by Time of Flight-Secondary IonMass Spectrometry (ToF-SIMStechnique). Two peaks characteristic for Ag-NPs, i.e. $^{107}Ag^{+}$ and $^{109}Ag^{+}$ were observed in spectra.The detailed analysis of nanoparticles, performed with The Scanning Electron Microscopy measurements in Low Vacuummode (LVSEM) as well as Atomic Force Microscopy (AFM) topography and phase contrast imaging, depicted a spherical or sphere-like shape of NPswith a diameter of 20–60 nm for P4VP coatings.

Temperature-induced transitions expressed in changes of the water contact angles determined for grafted brush coatings with Ag-NPs proved the temperature-responsive properties of the coatings.

Temperature-switched killing of bacteria was tested against *Escherichia coli ATCC 25922* and *Staphylococcus aureus ATCC 25923*at 4 and 37 °C. At 4 °C there is no significant differencebetween the amounts of bacteria seeded on grafted brush coatings and the control sample. In contrast, at 37 °C almost no bacteria were visible for temperature-responsive brushes coating with Ag-NPs. However, in this case the `pure` P4VP brushes show also strong temperature dependent antibacterial properties. The amount of bacteria is reduced with temperature increase by three orders of magnitude for a Gram-positive S. aureus and do not change for Gram-negative E. coli.

We expect that our coatings will be able to prevent the biofilm formation of bacteria as well as to reduce the number of bacteria in the volume of the product, thus, prolong the shelf life of the product and improve its quality.