TEMPERATURE-RESPONSIVE GRAFTED POLYMER BRUSHES AS PACKAGING MATERIALS FOR FOOD INDUSTRY

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In recent years, considerable efforts have been focused on developing polymeric temperature-responsive materials. Such materials are suitable for the development of materials that have unique properties and can potentially be used as packaging materials.

For example, grafted poly(butyl methacrylate) and poly(butyl acrylate) brushes were synthesized, their physicochemical properties and temperature-induced changes in surface morphology and wetting contact angles were studied.

For PBMA coatings, the increase in temperature leads to an increase in hydrophobicity with a pronounced maximum at 15-16 °C with a subsequent decrease in wetting angles with a further increase in temperature. In turn, for PBA coatings, a slow and almost linear increase in wetting angles with increasing temperature is shown. It can be assumed that this phenomenon strongly depends on the increase in the mobility of the polymer segments at temperatures above T_g.

The adsorption of protein on the surface modified with poly(butyl methacrylate) polymer brushes was studied for the first time. Proteins adsorption behavior is largely controlled by surface characteristics. This means that surface modification plays a vital role in the effectiveness of activated materials. A strong temperature dependence of adsorption was shown, which almost doubles with increasing temperature. Whereas temperature dependence of protein adsorption was not visible for PBA coatings. Different orientation of bovine serum albumin adsorbed on PBMA coating at different temperatures was studied. The influence of polymer brush thickness on cell behavior was shown for the first time.

It consists in the possibility of temperature control of the orientation of the mobilized proteins and cell growth, which allows to use these materials after finishing as packaging materials for food industry.

Keywords: stimuli-responsive polymer coatings; packaging materials; grafted polymer brushes; glass transition temperature; wettability; orientation of the proteins; cells.