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Polyester textile functionalisation through incorporation of pH/thermo-responsive microgels. Part I: Microgel preparation and characterisation

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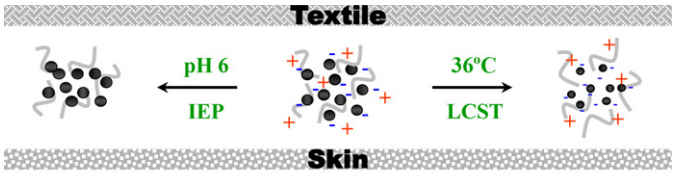
HIGHLIGHTS

- Stimuli-responsive microgels are prepared with polyelectrolyte complexes suspended.
- Responsiveness is engineered to appear within physiological pH/temperature ranges.
- The complexes complete their volume/phase transition in ca. 15 min at 40 °C.
- The higher the pH and temperature is, the more polydisperse become the microgels.
- An application scope is synthetic textile functionalisation by biopolymer microgels.

GRAPHICAL ABSTRACT



Poly(*N*-isopropylacrylamide-*co*-acrylic acid) / Chitosan polyelectrolyte complexes

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ABSTRACT

The present study aims at investigating the properties of pH/thermo-responsive polyelectrolyte microgels intended for surface functionalisation of textiles. Microgels were prepared to have their pH/thermo-responsiveness expressed within the physiological pH and temperature range. They consisted of pH/thermo-responsive microparticles of poly(*N*-isopropylacrylamide-*co*-acrylic acid) either alone or complexed with the pH-responsive natural polysaccharide chitosan. Basic characterisation included observation of the microgel morphology and determination of the polyelectrolyte isoelectric points and of the lower critical solution temperatures of the microgels. The analyses were performed by means of scanning electron microscopy, potentiometric titration and differential scanning calorimetry, respectively. Further physicochemical characterisation was conducted using bulk rheology, UV–vis spectroscopy, dynamic light scattering and electrophoresis. These analyses revealed that the studied thermo-responsive microparticles and their complexes with chitosan undergo a volume-phase transition from swollen and hydrophilic to de-swollen and hydrophobic at temperatures close to the average human body temperature. Kinetics measurements showed that this transition is completed in approximately 15 min. Furthermore, the polyelectrolyte complexes exhibit a change of surface charge from positive to negative values at pH 6, i.e. within the physiological pH range. It was, therefore, confirmed that the polyelectrolyte microgels investigated in this study were successfully prepared to have pH/thermo-responsive properties suitable for textile functionalisation.

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