Synopsis of Original Research Paper

Development of temperature-responsive gels through the rational design of elastin-like polypeptides

Ayae Sugawara-Narutaki

Department of Materials Chemistry, Graduate School of Engineering, Nagoya University

Elastin-like polypeptides (ELPs) are functional polymers that show elasticity and lower critical solution temperature (LCST) as native elastin. We have developed a novel class of "double-hydrophobic" block ELPs named GPG and its derivatives with added functional motifs. A series of GPG comprises proline-rich $(VPGXG)_{25}$ and glycine-rich $(VGGVG)_5$, both of which dehydrate at higher temperature but form distinct secondary structures, β-turn and β-sheet respectively. GPG initially assembles into nanoparticles, which further connect into beaded nanofibers. In this study, a new derivative GPPG, where (VPGXG)25 is repeated twice via a short linker sequence, has been constructed for the purpose of obtaining a physical gel of ELP. The longer proline-rich sequence of GPPG might bent more freely than that of GPG, resulting in the formation of branching nanofibers. GPPG (20 μM, 0.034 wt%) assembled into nanoparticles and aggregates of nanoparticles while GPG (20 μM, 0.055 wt%) organized into nanofibers in water at 37 ºC. When the concentration of polypeptides was increased to 0.3 wt%, both GPG and GPPG precipitated from aqueous solution. However, when GPG and GPPG was mixed at 9:1 weight ratio the mixture formed a physical gel at the polypeptide concentration of 0.3 wt%. The gel formation at such a low concentration is unprecedented in the field of ELP. The homogeneous nanofiber formation with suitable branching might be responsible for the gelation. This work will open up the possibility of ELPs for use in the cosmetology and biomedical research fields.