

## Structure of coacervate from polycations and oppositely charged mixed micelles

(<sup>1</sup>*Skin Science Lab, School of Pharmacy, Kitasato University*, <sup>2</sup>*Skincare Lab, Mandom Corporation*) ○Hikari Kamo,<sup>1</sup> Katsunori Yoshida,<sup>1</sup> Toshihiro Mori<sup>2</sup>

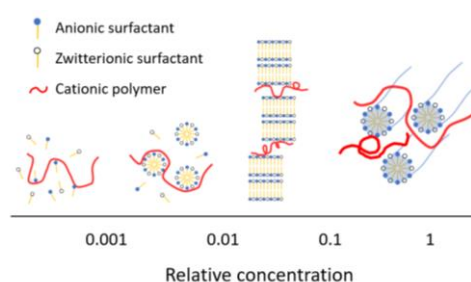
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Polyelectrolytes and oppositely charged surfactant micelles interact strongly via electrostatic forces in aqueous solutions, leading to phase separation into either solid-liquid or liquid-liquid systems. The latter results in a concentrated phase (coacervate) and a dilute phase, a phenomenon known as coacervation.<sup>1)</sup> Coacervation has been applied in various technologies, including shampoos, food processing, water treatment, drug delivery for water-soluble anticancer agents, and DNA transfection into cells.<sup>2)</sup>

Typical shampoo formulations include cationic polymers as conditioning agents and anionic and amphoteric surfactants as cleansing agents. These components interact upon dilution during shampoo use, inducing phase separation and forming water-insoluble coacervates. This study investigated the physicochemical properties and structural changes of coacervates during the dilution process, using a commercially available non-sulfate shampoo as a representative example.

Turbidity measurements revealed a sharp increase in turbidity around a relative concentration of 0.4, indicating liquid-liquid phase separation and coacervation. Furthermore, the coacervates became increasingly elastic as dilution progressed, and SAXS measurements and polarized light microscopy confirmed the formation of a lamellar structure. Additionally, fluorescence probe measurements identified the critical aggregation concentration (CAC) of surfactants at a relative concentration of approximately 0.001. The results suggested that, with further dilution, the micelles disassemble, transitioning to a monodispersed state.

These findings demonstrated that the structural changes in coacervates are influenced by the interactions between polycations and micelles.



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