CTAB and a thermoresponsive bile acid derivative form catanionic tubules: sorting out an unexpected composition ratio

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Self-assembly catanionic nanotubes are an odd architecture with relevant applicative interests. Their formation is very rare and there is currently no clear understanding of their chemistry. Here we report the intriguing assembly of mixtures formed by CTAB (flexible surfactant) and a thermoresponsive bile salt derivative [1] (rigid surfactant, Tb or TBAC). The pure bile salt derivative aggregates into tubules at a temperature above 37°C. When catanionic mixtures are prepared, a peculiar phenomenon was observed: nanotubes form at a specific critical ratio, requiring a minimum portion of CTAB, namely bile salt derivative : CTAB = 9:1. Slightly different variations in CTAB amount, both up or below the critical ratio, create unfavorable conditions for the tubules homogeneity and stability. UV, Circular dichroism, SAXS and microscopy data suggest a molecular packing where the bile acid derivative creates the scaffold of the tubule's bilayer whereas CTAB co-adjuvates in screening the charged heads. Moreover, this system enables for a temperature induced tubule-tubule interconversion: indeed, by increasing the temperature on the catanionic tubules, the catanionic tubules break up and the pure Tb tubules form. The data highlight an innovative case within the narrow umbrella of catanionic nanotubes and encourage further exploration of the possibility offered by the catanionic combination of rigid molecules and flexible surfactants.

References

[1] Luciano G., Claudia L., Aida J. Soft Matter, 2009, 5, 3018-3025.