

Morphological changes in gemini surfactant's self-assembly induced by coordination with metallic salts

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Gemini surfactants are very interesting systems, consisting of two hydrophobic tails connected by a spacer between polar head groups. Their molecular structures confer them particular physicochemical properties as lower critical micelle concentration (CMC) and higher efficiency in decreasing the surface tension of water than the corresponding single chain surfactants. Often, they exhibit unusual morphologies in their aggregates, higher solubilizing capacity and interesting properties that can be explored in potential applications.

Many amphiphilic systems can coordinate metal ions. The interaction of gemini surfactants with metals in many cases can change the aggregate's morphology [1]. Sodium didecamino cystine (SDDC), a gemini surfactant (Figure 1), was synthesized in our laboratory from cystine (dimer of cysteine) and decanoyl chloride, according to literature [2]. Its aggregates were characterized by surface tension measurements, fluorescence quenching and DOSY-NMR. It was found that SDDC forms spherical micellar aggregates of small size (diameter <10 nm), CMC = 3×10^{-4} M and aggregation number of 23.

We studied the interaction of this surfactant with different metallic salts finding the formation of stable aggregates with CuSO₄, AgNO₃ and FeCl₃. Non stable systems were formed with Zn(II), Ni(II) and Co(II). Solutions of CuSO₄ that are unstable at pH higher than 6, in the presence of the gemini surfactant, remains stable for at least 1 month. Similar results were obtained with Ag(I) and Fe(III) but in these cases it was necessary a higher amount of surfactant to maintain the cations in solution. The gemini-metal aggregates were studied using microscopic techniques and SAXS (small-angle X-ray scattering). A transition from micelles to vesicles was observed for the surfactant when it is in the presence of the metallic salts.

The interaction between the surfactant and the cations produces self-assembled systems with different properties than those of the surfactant alone, and in these aggregates the metals are maintained in solution for a long time. All these results will be discussed in detail in this work.

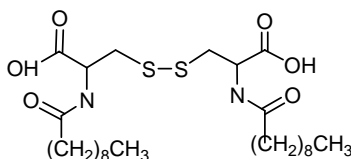


Figure 1 Structure of sodium didecamino cystine (SDDC)

[1] T. Owen, A. Butler, *Coord. Chem. Rev.* 2011, **255**, 678.

[2] H. Fan, F. Han, Z. Liu, L. Qin, Z. Li, D. Liang, F. Ke, J. Huang, H. Fu, *J. Colloid Interface Sci.* 2008, **321**, 227.