

第288回化学コロキウムのお知らせ

日時：平成30年9月26日(水) 14:00~15:30

場所：首都大学東京 8号館301室

演者：Michael Gradzielski 教授

(Technische Universität Berlin, Germany)

演題：Investigations of Polyelectrolyte/Surfactant Complexes (PESCs) with Biopolymers like Hyaluronate and Carboxymethylcellulose and Oppositely Charged Surfactant

Abstract: Hyaluronan (HA) is a very important biopolymer that is essential in giving elastic and viscous properties to biological tissue and also relevant in tumor progression. It is a glycosaminoglycan that under neutral conditions is a polyanion and its Mw can range from a few thousand to several million g/mol. In our experiments we investigated mixtures of hyaluronan with cationic surfactant such as simple tetradecyltrimethylammonium bromide (TTAB) but also other cationic surfactants. In our studies we determined first the phase behaviour with a focus on physiological conditions but also compared to the behaviour at other ionic strength and pH, where it can be noticed that for lower ionic strengths the tendency for precipitation is largely enhanced.

In a larger range of the composition space single phases are observed where PESCs are formed, which were characterized in detail by means of static and dynamic light scattering (SLS, DLS), and for further structural details by means of small-angle neutron scattering (SANS). These experiments show a marked aggregation behaviour already for the addition of as little as 0.5 mM TTAB and the formation of relatively large aggregates of ~ 80-120 nm size. However, further TTAB addition does not lead to more of these aggregates or their growth but instead one observes the formation of small, elongated complexes. SANS combined with cryo-TEM (Figs. 1 and 2) give a consistent picture of these large aggregates which are very open and consist to 98-99% of water, as well as of the cylindrical aggregates. Interestingly the surfactant addition has almost no effect on the rheological properties and one has no significant effect even for large surfactant excess.

Our investigation was extended then to HA in the Mw range of 150-2200 kDa, and we observed complex structures that are strongly correlated with the Mw of the HA, forming only rather small elongated structures for short HA and very extended structures for long HA. In contrast the rheological behaviour is largely dominated by the HA itself and the phase behaviour is rather similar for all Mw's. Interesting is the marked salt dependence of the phase behaviour of these systems, which was then further characterized by comprehensive ITC and scattering experiments that show how the HA surfactant interactions change in a systematic fashion here.

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