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POSTER ABSTRACT PRESENTATIONS

SESSION TITLE: COMPLEX AND EMERGING TECHNIQUES IN STRUCTURAL BIOLOGY

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Abstract P-48: Injectable Self-Assembled Surfactant-Clay Hydrogel

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Background: Soft nanocomposite hydrogels can be based either on polymer network or on self-assembled network of wormlike surfactant micelles (WLMs). To provide additional functionality to the matrix the hydrogels can contain delivery vehicle components, for instance, nanoclay tactoids, which make them very promising for drug delivery and tissue engineering applications.

Injectable systems represent an ever-growing class of nanomaterials possessing a unique combination of physical and chemical properties. For the injection applications, the hydrogels should demonstrate a shear-thinning behavior and a fast recovery of the initial state, when the deformation is no longer applied. Such hydrogels can be used as control delivery systems, since they can be delivered in a minimally *invasive* manner, because their final form and shape are defined by the space, into which they are injected.

Methods: Cryo-electron microscopy experiments were performed to study network structure. To measure the gap between the clay platelets, X-ray diffraction analysis was carried out. The influence of organoclay on the mechanical properties of mixed WLMs of surfactants was studied by rheometry. The oscillation recovery tests were carried out both at small and high stress amplitudes to study breaking and recovery of the nanocomposite WLM network.

Results: The present study is devoted to soft nanocomposite based on network of WLMs composed of biocompatible zwitterionic and anionic surfactants with embedded plate-like bentonite nanoclay particles. It is shown that nanoparticles enhance significantly the rheological properties of WLM hydrogel acting as physical cross-links between micellar chains. It was explained by the formation of micelle-nanoparticle junctions as a result of binding of the WLMs end-caps to the layer of surfactant adsorbed on the particle surface.

The studied network possesses gel-like properties. In particular, its rheological properties demonstrated plateau modulus, low values of loss factor. At the same time, under high deformation, the micellar chains was disrupted, which induced a much more pronounced drop of viscosity than the

disruption of physical cross-links in polymer gels. The disrupted micellar chains were completely recovered due to restoration of non-covalent bonds between surfactant molecules within the micelle.

Conclusion: It was demonstrated that the prepared nanocomposite hydrogels possess promising properties for injection applications.

Key Words: injectable hydrogel • nanoclay • wormlike micelles

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