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XANTHAN NETWORKS WITH IMPROVED MECHANICAL PROPERTIES

4. Polymers and soft materials for Life Sciences

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Abstract

The paper is devoted to the study of the networks based on stiff-chain polysaccharide xanthan. Such networks are used as carriers for drugs and proteins and as scaffolds for cells. For these applications, it is important to modulate the mechanical properties of the networks, which can be done by varying the cross-linking density or by adding another component like surfactant micelles. In this work, we study the structure and the rheological properties of networks based on xanthan macromolecules cross-linked by multivalent metal ions. At first, the structure and rheological properties of the networks in the absence of surfactant were investigated [1]. As shown by freeze-fracture transmission electron microscopy, the networks have a microphase separated structure with polymer-rich areas (network skeleton) containing aggregated xanthan double helices. The increase of the cross-linking density leads to the thickening of the polymer skeleton and simultaneous decrease of the network mesh size leading to the enhancement of the mechanical properties, e.g. the increase of the elastic modulus. It is also observed that xanthan macromolecules within the network have sharp kinks due to the presence of short flexible segments probably being "melted" xanthan helices, which join rigid double helix segments together [2]. It was demonstrated that the mechanical properties of the networks can be significantly modified by surfactant addition. Responsive structure of surfactant aggregates allows easy altering of the mechanical properties of the polymer-surfactant networks thus providing a tool to get polymer matrix with desirable characteristics for a given application.

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References

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