

Chitosan biopolymer thin layer properties in aqueous media

Kitozán biopolimer vékonyréteg tulajdonságai vizes közegben

Mátyás Dabóczi, Márta Kabai-Faix, Emőke Albert, Zoltán Hórvölgyi

Centre for Colloid Chemistry, Budapest University of Technology and Economics,

Department of Physical Chemistry and Materials Science

Budapest, Hungary, 1111 Budafoki út 6-8.

daboczimatyas@gmail.com

Summary

Chitosan biopolymer has recently been in the scientific spotlight due to its biocompatibility, biodegradability, pH responsive and antibacterial properties, which pave the way to apply it in controlled drug release technologies, antibacterial and superhydrophobic coatings, waste water cleaning, drug formulation or as packaging material.

During many of its application chitosan is exposed to or continuously in contact with aqueous phase. The purpose of this work was to characterize thin chitosan biopolymer layer's properties in aqueous media by investigating its wetting, swelling and dye permeability. Furthermore the effect of cross-linking the biopolymer layer covalently by glutaraldehyde and ionically by sodium triphosphate was studied.

Thin chitosan coatings were formed by dip-coating technique onto glass substrate and porous silica layer, which functioned as a dye storage layer for permeability investigations. The optical properties of the constituent layers were characterized by UV-Vis spectroscopy. Attenuated total reflection Fourier transform infrared spectroscopy and scanning electron microscopy with energy-dispersive spectroscopy was used to confirm the cross-linking of the polymer thin layers.

The surface of the polymer is the first to be in contact with the aqueous phase and its properties are crucial to investigate. Contact angle measurements were performed to examine the wetting and indirectly the bulk properties of chitosan layers. Time evolution of advancing contact angle of acidic (pH = 3), neutral (pH = 7.3) and basic (pH = 11) aqueous phase droplets were measured and compared for native and cross-linked polymer layers.

In-situ spectroscopic ellipsometric measurements with flow-cell were performed to study the swelling and gain information about the bulk of chitosan layers in contact with neutral aqueous phase (pH = 7.3).

Rhodamine 6G cationic dye was used to investigate the permeability of chitosan thin layers. Adsorption and dye release measurements were performed in acidic (pH = 3), neutral (pH = 7.3) and basic (pH = 11) media. For dye release, Rhodamine 6G was incubated into porous silica thin layer onto which a chitosan second layer was formed and the dye release through the polymer coating was studied.

For providing a better understanding of behaviour of chitosan in contact with aqueous phase, the experimental results are comparatively discussed in our presentation.

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