The Structure of Chitosan Based Photocatalytic Systems by AFM Study

V.A. Timofeeva[1], N.A. Aksenova[1], S.Z. Rogovina[1], A.B. Solovieva[1], P.S. Timashev[2], N.N. Glagolev[1]

1. Semenov Institute of Chemical Physics Russian Academy of Sciences, Kosygina st. 4, Moscow, Russia,
2. Institute of Laser and Information Technologies Russian Academy of Sciences, ul. Pionerskaya, 2, Troitsk, Russia

timofeeva@polymer.chph.ras.ru
Keywords: photocatalytic systems, chitosan, pluronic, AFM, dendritic structures

Chitosan (biodegradable and biocompatible nature polysaccharide) is usually used in medicine for wound and burn treatment in connection with its bactericide properties. It is known that high-molecular chitosan (HM) can inhibit virus infections, and low-molecular chitosan (LM) shows regeneration and even immunostimulation properties.

It was shown that photocatalytic systems based on chitosan with different molecular mass with the addition of pluronic F-127 (terpolymers of ethylene and propylene oxides with surfactant properties) and dimegin (disodium salt of 2,4-di(□-methoxyethyl)hematoporphyrin-IX) were very effect in the tryptophan photooxidation. Such systems can have a great potential in the photodynamic therapy of skin diseases. Also the photocatalytic activity of such systems depended on the molecular mass of chitosan. The triple compositions based on the LM display a higher activity than the systems based on HM. This effect can be bound up with the unique surface structure features of chitosan based systems. In this work we have study such systems by atomic force microscopy (AFM).

Thin films of chitosan double and triple systems prepared on mica surface by evaporation of solvent from chitosan, chitosan-pluronic–dimegin and chitosan-pluronic corresponding solutions. We used atomic force microscope (Solver P-47, NT-MDT Russia) in the tapping mode, with NSG 11 cantilevers (with hardness of 40 N/m and a resonance frequency about 160 kHz).

In chitosan-pluronic systems HM crystallized in form of globules and pluronic formed dendritic structures on the chitosan surface. In the LM-pluronic compositions polymers form an interpenetrating dendrites, which can be justify on the basis of better compatibility between LM and F-127. In the presence of dimegin the structure of films showed significant changes only for HM-pluronic compositions. In this case pluronic formed some “islands” structure on the chitosan surface instead of dendritic structures. Obviously, formation of such structure can be bind up with the uncompatibility between HM and F-127. That is why the rate constant of photocatalytic oxidation of the tryptophan for this system is lower. The dimegin addition to the LM-pluronic systems does not lead to any significant changes in film morphology. High photocatalytical activity of LM -pluronic-dimegin compositions in tryptophan oxidation may be related with the higher dimegin solubilization.

We acknowledge the Russian Science Support Foundation, RFBR (project no. 07-03-00100), Russian President Grant no. MK-3125.2008.3

M.A. Pabst, G. Zellnig (Eds.): MC2009, Vol. 2: Life Sciences,
DOI: 10.3217/978-3-85125-062-6-254, © Verlag der TU Graz 2009