Study of silver nanoparticles release from antibacterial gel formulations

Elżbieta Sikora[1]*, Magdalena Oćwieja[2], Ewa Koziel[1]

[1] – *Institute of Organic Chemistry and Technology, Cracow University of Technology, Krakow, Poland*
[2] –*Jerzy Haber Institut of Catalysis and Surface Chemistry, Polish Academy of Sciences, Krakow, Poland*

* *esikora@pk.edu.pl*

Silver nanoparticles (nAg) thanks to their unusual bactericidal, fungicidal and virucidal properties are widely synthesized and applied in various branches of science, industry as well as in many consumer products of daily use, including cosmetics [1]. From toxicological point of view, it is important to determine the mechanisms of the nanoparticles penetration thorough the skin as well as their interactions with human cells [2]. Although the importance, the controlled release of nAg from different forms still has not been well developed.

For this reason, the aim of our work was to determine and compare the release kinetics of four types of silver nanoparticles of similar average size (c.a. 10-17 nm) and different surface properties from the gel formulations. The influence of the products viscosity and kind of used stabilizer systems on nAg release was determined. Charge-stabilized silver nanoparticles were prepared by the chemical reduction of silver nitrate using: tannin acid, sodium hexametaphosphate, borohydride and glucose. The surface properties of nanoparticles were determined by measurements of electrophoretic mobility. Additionally, the range of the nanoparticles stability at various pH and ionic strength conditions was determined using dynamic light scattering (DLS) technique and UV-vis measurements [3]. The aqua gel formulations were obtained by use of various thickening agents (sodium hyaluronate, xantan gum and polyacrylic acid). The physicochemical properties (stability, viscosity, pH) of the nAg-loaded gel formulations were investigated. Microbiological stability of the formulations was checked using Mikrocount® Combi kit. The release study was carried out at the temperature T=32^{o}C, in thermostatic diffusion cells system, using the Spectra/Por Standard Regenerated Cellulose (RC) membrane. The concentration of nAg in the receptor solution (i.e. deionized water, 1μS) was analyzed by UV-VIS spectroscopy.

The physicochemical and biological stable gel formulations were prepared based on sodium hyaluronate. The obtained results showed that the gels viscosity and the type of silver nanoparticles significant influence on the nAg release.

References:

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