

DETERGENT-DISINFECTANT AGENT BASED ON COLLOIDAL SILVER STABILIZED BY QUATERNARY AMMONIUM COMPOUNDS FOR THE DAIRY INDUSTRY

Andrey Vladimirovich Blinov^{1*}, Andrew Georgievich Khramtsov², Anastasia Alexandrovna Blinova¹, Alexander Vladimirovich Serov¹, Konstantin Vasilevich Kostenko¹, Alexander Alexandrovich Kravtsov^{3,4}, Julia Jurevna Snezhkova¹

¹Institute of Engineering, North Caucasus Federal University, Kulakova str. 2, 355029 Stavropol, Russia

²Institute of Living systems, North Caucasus Federal University, Kulakova str. 2, 355029 Stavropol, Russia

³Scientific-research laboratory of ceramics and technochemistry, scientific-laboratory complex of clean rooms, Institute of Engineering, North-Caucasus Federal University, Kulakova str. 2, 355029 Stavropol, Russia

*e-mail: blinov.a@mail.ru

Abstract

Within the framework of the present work, in order to obtain the basis for a detergent, a method for the synthesis of colloidal silver stabilized by a quaternary ammonium compound was developed and optimized.

The preparation of colloidal silver was obtained by the method of chemical reduction in aqueous medium using didecyldimethylammonium bromide as a stabilizer, silver nitrate as a precursor, and sodium borohydride as a reducing agent. The structure, morphology, properties and size of silver particles in the preparation were studied using photon correlation spectroscopy, atomic force and scanning electron microscopy, acoustic and electroacoustic spectroscopy. By means of neural network modelling, the process of washing away protein-fat contamination from the working surface with the developed detergent has been optimized in a model experiment. A model experiment was carried out under conditions of circulation washing at the temperatures of 50 - 55 °C. The working surfaces in the model experiment were glass, steel and aluminium plates. The effectiveness of the detergent based on colloidal silver preparation has been studied. For this purpose, during the experiment, the time of complete removal of contamination from the surface of the plates, as well as the change in the pH and conductivity of the detergents solutions with the change of the contamination concentration were registered. The corrosion rate was determined by the gravimetric method, based on the difference in the mass of the sample before and after washing, respected to the unit of surface and to the unit of time

It has been established that colloidal silver particles are spherical with an average hydrodynamic diameter of about 50 nm. The colloidal preparation shows high aggregative stability. A study of the quality of sanitization of working surfaces with the developed detergent made it possible to establish the fact of the complete absence of bacteria of the group of *Escherichia coli*, pathogenic microorganisms, including *Salmonella* spp., on the working surfaces treated with detergent.

It has been determined that the developed detergent does not possess corrosive properties, and completely washed off from the working surfaces upon completion of the washing process and therefore can compete with modern detergents used at dairy enterprises.

Key words: Colloidal silver, Detergent-disinfectant, Sanitizing, dairy industry, Washing.