

Influence of nanosilica on the water phase transitions in hygroscopic systems

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Keywords: hydrophobic and hydrophilic nanosilica, biopreparation Enoxil, low-temperature

¹H NMR spectroscopy, thermogravimetry.

Abstract

By low-temperature ¹H NMR spectroscopy and thermogravimetry methods, the effect of hydrophobic (AM1) and hydrophilic (A-300) nanosilica on the process of evaporation and freezing water, linked to hygroscopic grape seed extract, bio-preparation Enoxil (Ex), has been studied. It is shown that nanosilica modifies the character of binding water in composite systems. The total amount of water retained in the composite becomes substantially smaller than in pure bio-preparation. It varies in the series Ex > Ex/A-300 > Ex/(A-300 + AM1) > Ex/AM1, which is reflected in values of the water absorbed mass, as well as in the values of interfacial energy, concentration of strongly bonded water and the cluster size of the adsorbed water. It is suggested that the observed effect is due to formation of the nanoparticles of bio-preparation, in which the water solubility is substantially less than in the bulk of Ex. This effect can be used to stabilize lyophilized biological tissues and cell cultures.