Russian Chemical Bulletin 2016 vol.65 N6, pages 1505-1513

Specifics of self-organization and properties of highly dilute aqueous solutions of polyoxidonium

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Abstract

© 2016, Springer Science+Business Media New York.Using a combination of physicochemical methods (dynamic and electrophoretic light scattering (DLS and ELS, respectively), nanoparticle tracking analysis, atomic force and transmission electron microscopy (AFM and TEM, respectively), UV spectroscopy, conductometry, pH-metry, dielcometry), it was found that dilute solutions of a multicomponent drug immunomodulator polyoxidonium (PO) are nanoheterogeneous disperse systems, with their disperse phase undergoing considerable restructurings when diluting the solution in the range of calculated concentrations from 1•10–1 to 1•10–16 mg mL–1, which is reflected in the non-monotonous concentration dependencies of specific electroconductivity, dielectric permittivity, and pH of the solutions. Using ELS, AFM, TEM, and UV spectroscopy methods, it was found that the disperse phase with a size of hundreds of nanometers which forms at concentrations of ≤1•10–5 mg mL–1, contains organized water structures substantiating the negative values of ζ-potential, which vary non-monotonously from–5 to–16 mV. Radioprotective properties of dilute solutions of PO (1•10–1 and 1•10–9 mg mL–1) were demonstrated for the first time when exposing the test mutant bacterial strain Salmonella typhimurium TA 100 (Ames test) to X-ray radiation in a dose of 7.50 mGy used for medical diagnostics.

http://dx.doi.org/10.1007/s11172-016-1477-x

Keywords

aqueous nanoassociates, dilute solutions, disperse system, multicomponent drug immunomodulator polyoxidonium, radio-protective properties, self-organization, supramolecular domains