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Effective biologically active additives for animals based on compositions of α-tocopheryl acetate with micellar nanocarriers

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Encapsulation of biologically active substances, such as vitamins and antioxidants, into hydrophilic, biocompatible, and biodegradable nanocarriers is one of the possibilities for creating effective food additives for humans and animals. At the same time, the encapsulation processes make it possible to protect active agents from oxidation and rapid elimination from the body, thereby increasing their effectiveness. Current work is devoted to the development and research of non-toxic micellar nanocarriers based on diblock and triblock copolymers (DBCs and TBCs) with biocompatible and biodegradable polyethylene oxide and poly(acrylic acid) blocks for encapsulation and delivery of poorly soluble vitamin E and its analogs, in particular, α-tocopheryl acetate (α-TOCA), in animal organisms. DBCs and TBCs are intramolecular polycomplexes that form special micellar structures of the "cut" and "hairy" types with a complex "core" in aqueous solutions at pH <5. The special structure of DBC and TBC micelles, in particular, the ability of the complex “core” stabilized by a system of hydrogen bonds to self-adjust during drug encapsulation, pH-sensitivity of micelles turned out to be very effective for encapsulation of poorly soluble vitamin E and its analogs (Figure 1). The obtained compositions of -tocopheryl acetate with both types of micellar carriers showed high stability over time in a wide range of pH=3.5-9.0 and in physiological solution. However, in the case of “hairy” micelles, the developed “corona” of longer unbound segments of the polyacrylic acid block provided more reliable protection of the encapsulated drug molecules from the “salting out” effect. The composition of -tocopheryl acetate with given nanocarrier was tested in vivo on a group of sows as a dietary supplement. The positive effect of the micellar form of the drug on metabolic processes in sows, as well as on increasing the productivity of sows, stress resistance and safety of born piglets has been established.

Biography

Nataliya Permyakova graduated from the Faculty of Chemistry of Taras Shevchenko National University of Kyiv in the specialty of physical chemistry of polymers and colloids. From 1980 to 2018 she worked as the scientific researcher at the Department of Macromolecular Chemistry of Faculty of Chemistry, Kyiv National University. She defended of the PhD thesis on "Intermolecular polycomplexes formed by hydrogen bonds as new functional materials." Since 2019 and to the present, she works as the scientific researcher at the Department of Polymer Physics of the Institute of Macromolecular Chemistry of the NAS of Ukraine. Research direction and interests: design and research of physicochemical and functional properties of heteropolymers, polymer/inorganic hybrids and multicomponent systems, based on them, for nanotechnology, biomedicine, environment and agriculture, in particular, creation of micellar nanocarriers for drug delivery.

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