Supramolecular Structures with Peroxides as possible Active Long-Lived Drug Substances.

E.G. Ippolitov, T.A. Tripolskaya, I.V. Pokhabova, V.S.Pervov

Kurnakov Institute of General and Inorganic Chemistry, Russia,Moscow.

A key reaction in the biological and material world is the controlled linking of molecular building blocks.Using these reactions, it is possible to create supramolecular structures, which , for example, contain cavities and display specifically desired properties [1]. The best example in this context is the chemistry of host-guest interactions. It is known, that the layered double hydroxides LDH are the host-guest compounds (intercalates) with composition: $M^{2+}_{1-\delta}M^{3+}_{\delta}[(OH)_2(An^{n-})_{x/n}\cdot mH_2O]$ or $M^{1+}_{1-\delta}M^{3+}_{\delta}(OH)_2[(An^{n-})_{(2\delta-1)/n}\cdot mH_2O]$. These compounds have found many practical applications including medicine. For example, Al-Mg-LDH are used in drugs with acid-neutralizing action like Almagel (Pharmachim Holding) and Maalox (Rhone-Poulenc Rorer). We developed methods for the synthesis of peroxide-containing supramolecular host-guest systems. These methods are based on heterohpase ion- exchange reaction between solid LDH and hydrogen peroxide in aqueous solution and in the gaseous phase. Lithium-aluminium, magnesium-aluminium and zinc-aluminium LDH form supramolecular structures of formulas: $Li_{0,33}Al_{0,67}(OH)_2[(OOH)_{0,33}\ nH_2O\ mH_2O_2$, $Mg_{0,6}Al_{0,4}(OH)_2[(OH)_{0,4}\ nH_2O\ mH_2O_2$ and $Zn_{0,78}Al_{0,22}(OH)_2[(OH)_{0,22}\ nH_2\hat{I}\ mH_2O_2$ with variable active oxygen contents (5.5 - 9.3%, 4,7 - 7%, 12,6 - 15,4), respectively. The degree of intercalation depends on the initial hydrogen peroxide concentration in the solution and on the reaction time. A mechanism of the intercalation of Li-Al LDH by hydrogen peroxide was proposed. According to this mechanism, during the reaction of LDH with hydrogen peroxide, peroxide groups substitute for two mobile hydroxo groups, located in the interlayer space. Bound molecular water is also partially replaced by hydrogen peroxide molecules. In the Mg-Al and Zn-Al compounds hydrogen peroxide molecules are intercalated in the interlayer space of host structures. We studied the influence of different anions on the intercalation process using the anion-containing LDH, as the host-structure. These matrices contained no hydroxide groups and water molecules. It was found that hydrogen peroxide was intercalated into LDH-SO_4^{2-} and into LDH-NO_3^{1-} only in reaction with hydrogen peroxide vapor. Peroxide supramolecules contained solvated hydrogen peroxide in this case. With the use of a complex of physicochemical methods, we established a correlation between the active oxygen content and the rate of exchange reactions. Comprehensive studies have been performed to evaluate the capacity of a wide variety of layered compounds of nontransition metals for forming supramolecular essembles with hydrogen peroxide.

[1] A.Muller, H.Reuter, S.Dillinger, Angew.Chem.Int.Ed.Engl.1995,34,2328-2361