

GLYCINE ADSORPTION ON TiO₂ AND ZrO₂ NANOPARTICLES SURFACE

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In recent times inorganic nanoparticles (NPs) have attracted much attention because of their unique physico-chemical properties and potential applications in biomedical field such as various imaging and therapy applications, targeted drug delivery [1]. Proper surface modification is important to retain the colloidal stability in complex biological environments. Zwitterionic NP surface coating by small surface ligands can be a promising approach. The detailed structural analyses techniques have confirmed the successful passivation/functionalization of Fe₃O₄ nanoparticles with glycine molecules. These nanoparticles also have showed good colloidal stability, optimal magnetization, biocompatibility with human cancer cell lines and protein resistance behavior with good specific absorption rate [2].

Therefore, developing a method of selecting the optimal passivation/functionalization - process conditions can be useful for future studies connected with different small surface ligands passivated NPs.

The essence of the method is to maintain the particles in the surfactant solution, then separate the liquid phase and analyze it by infrared spectroscopy to determine quantitative indicators of glycine adsorption on the surface of the nanopowder. To construct the calibration curve we prepared 6 aqueous solutions of glycine at a concentration of 0.33 ... 2 M. Construction of the spectrum lines shows intensive absorption bands at 1411.638 cm⁻¹ and 1330.64 cm⁻¹, while in the sample of distilled water there aren't any bands.

As objects of the study plasmachemical titanium oxide (TiO₂, 22,4 m² / g) and zirconia (ZrO₂, 8,1 m² / g) nanopowders have been selected. Suspensions were prepared in a following way: 0.5 g of the nanopowder was added to 20 ml of a freshly prepared 2 M glycine solution. Selected 3 ml of the each supernatant were explored by FT-IR spectroscopy in comparison with a pure solution of 2M glycine. Construction of the spectra lines has showed a narrowing of peaks in areas 1411.638 cm⁻¹ and 1330.64 cm⁻¹. From the values of transmittance for the selected peaks, we can identify the change in concentration of surfactant in the aqueous solution separated from the nanopowder.

It is experimentally shown that the spectral absorption peak in area 1330.64 cm⁻¹ can help to identify amino groups in aqueous solution [3]. Dependence of glycine concentration on peak height has been determined and depicted graphically. Suppose that for making the suspension a known concentration glycine solution is taken. Then, using measured peak height (1330.64 cm⁻¹) and calibration curve, the change of acid concentration and, consequently, its adsorption on the surface of the nanopowder, can be determined.

Thus, on the example of nano TiO₂ and ZrO₂ suspensions we demonstrate suggested method of quantitative and qualitative assessment of glycine adsorption on the nanopowder surface. It is shown that the aminoacetic acid is adsorbed on the surface of chosen nanopowders imperceptibly, and on a TiO₂ NP's surface phenomenon is more pronounced.

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KINETICS AND MECHANISM OF ORGANIC COMPOUNDS OXIDATION BY PULSED CORONA DISCHARGE

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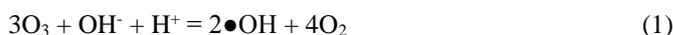
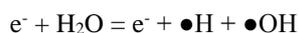
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Nowadays there are huge variety of wastewater treatment methods and oxidation is one of the mostly used. It is not a secret that an advanced oxidation processes showed their efficiency and methods based on using chemicals to oxidize pollutants becomes a secondary. Ozone is an efficient oxidant of organic matter but its production is expensive. The process of hydroxyl radical generation from ozone/hydrogen peroxide modelled in the 1980s, which made it possible to optimize the use of ozone in the elimination of hazardous pollutants, such as pesticides, PAHs, etc. Now the system ozone/hydrogen peroxide is a new choice for water reclamation and potable reuse. The use of the ozone/hydrogen peroxide system as a tertiary treatment of domestic and urban wastewater could provide reclaimed water to use in agriculture or industrial processes [1]. In the present work, the kinetic and mechanism of organic compounds oxidation have studied. As an oxidation method, we used representative of advanced oxidation processes – pulsed corona discharge oxidation. The effectiveness of electrical discharges generated by high voltage has been proven to degrade pollutants in wastewater [2] also widely used for disinfection of microbial contaminated liquids [3]. In water, high voltage discharge includes a non-thermal plasma method for producing ozone and hydroxyl radicals from water and oxygen [4]. Mechanism for highly reactive oxidants producing based on ozone decomposition follows to these reactions (1-3):



Hydroxyl radicals resulting from the reaction between ozone and hydroxide ions can be generated by either direct attack of the molecular ozone or indirect attack of the hydroxyl radicals. Mostly researches on the ozone decomposition in water based on descriptions of overall kinetics founded for “pure water”. Even so, systems of primary decomposition of ozone are kinetically complex because of free radicals producing, which may react with further ozone to produce more free radicals. The kinetics of this reaction depend on many parameters and the rate reported in the literature is rather difficult and the results from different authors seem contradictory [5].

As objects of research, oxalic acid and phenol have chosen. Pulsed corona discharge reactor was a generator of active oxidants and pulse frequency was changing from 300 to 833 pps. To define temperature dependence there were two different temperature rates: from 10⁰C to 45⁰C in the different pulse frequency conditions, in spite of that fact, the same energy has delivered. According the data about concentration after oxidation, it makes sense say that mechanism of degradation goes by directly ozone influence. The reaction rate constants determined assuming that the combined