Streszczenie (w języku angielskim)

The subject of the doctoral thesis was the creation and development of scientific foundations: methods of synthesis, design and control of the properties of nanostructured materials that can be used in medicine, hygiene and perfumery. Design of modern materials with controlled nanoparticle morphology, surface topology and structure, textural characteristics and sorption properties, hydrophilic-hydrophobic properties of surfaces, etc. Extensive experimental research and theoretical modeling of phenomena at the interfaces of various phases in composites and determination of their mechanisms for the creation of more effective nanostructured composites. When creating effective composite materials, the synergy of components determines better performance and final properties of systems than individual components.

A number of clays were tested: black, gray; green, blue; kaolin; White; yellow and blue and white. All clays contain not only crystalline components, but also various amorphous components. On their basis, a number of composite materials were obtained by mechanochemical activation. The ball-knife dispersion of composite materials based on kaolin and highly dispersed pyrogenic silica allows for an almost 2-fold reduction in the average particle diameter compared to the original kaolin, while the sample of kaolin/highly dispersed silica (knife mill) is characterized by high particle size uniformity. Morphological and structural characteristics in the compositions are slightly changed due to the fact that the treatment was carried out with relatively low mechanical loads.

The composites obtained in this way were characterized by a number of methods: transmission (TEM) and scanning (SEM) electron microscopy, ASAP, X-ray powder analysis, 1H MAS and ^{29}Si CP/MAS NMR spectroscopy, FTIR spectroscopy and electrochemical double layer (pwe) spectroscopy, and quantum chemical calculations were performed.

The release of chlorophyll, carotenoids and anthocyanins is more pronounced in the case of composite materials than in the case of vegetable raw materials. Depending on the structure of the composition, the structure of the release products of SBC (biologically active substances) after machano-activation can be influenced. The influence of NaCl on this process is quite specific, which is related to the ion-exchange properties of inorganic structural composites.

Clays and composite materials have an antibacterial effect. By examining the effect of clays and composites based on them on the development of opportunistic microorganisms, it was shown that clays have a bactericidal effect on gram-negative microflora. Thus, the growth of *P. aeruginosa* was completely suppressed by blue and white clay. In addition, black clay, kaolin and blue-white clay, and the white clay/A300/neem and white-blue/neem/A300 composite materials halved the number of cells. The growth of E. coli was inhibited to the greatest extent by black clay and kaolin/neem/A300 composite - growth inhibition was almost 2-fold, and K, pneumoniae by white clay, blue and white clay, gray clay, black clay and kaolin/neem/A300, black clay/neem/A300 composites. In the case of S. aureus, no growth inhibition was found in the tested samples of clays and composites. Thus, kaolin, blue white kaolin clay and blue white clay/neem/A300 composite may be the most promising for medical and cosmetic applications.

The method of sample preparation affects the particle size, surface charge density, zeta potential and pH value of aqueous suspensions. As the rose clay preheating temperature increases, the size of the particles (aggregates) may decrease, the surface charge density changes, and the zeta potential also changes. This affects the release of bioactive compounds from acai composites.

Nanostructured composite mixtures based on rose clay with the main crystalline phases of α-quartz and kaolinite with the addition of hydroxyapatite, nanosilica and alkyd powder (30% by weight) remain porous, similar (or stronger) to the original rose clay after mechanical treatment.

The mixtures retain mainly morphological features and textural components by mechanical treatment at room temperature for dry powders.

The amount of water (adsorbed from the air) contained in the hydrophilic components may favor the effect of reorganization of nanostructured aggregates and agglomerates of aggregates. With most mixes, the textural properties are better than with rose pink clay alone. Studies confirm the positive effects of small additions of nanosilica and nanostructured hydroxyapatite (5-10 wt%) in several aspects, including in the bioactivity of composites. For the proposed composite materials clay/nanosilica/plant raw materials/hydroxyapatite, the safety indicators of components and composite materials were tested. The possibility of their use in cosmetics is justified. The hypoallergenicity of all tested systems has been confirmed. Kinetic studies of the release of biologically active substances (with acai in composites) can be used as a factor regulating the direction of preventive action of cosmetics. The release of cyanidin-3,5-diglycoside (anthocyanins), as a bioactive compound, is greater in the case of composites than in the case of acai with rose clay alone. Composites with clay / nanosilica / plant raw materials / hydroxyapatite can be considered better systems for cosmetics and medicinal preparations than rose clay alone, because the control of morphological, electrochemical and textural features of the composites allows to ensure the appropriate activity of the systems.

The "Rana" program was developed and used to assess the toxicity of the obtained products. Products are evaluated according to three indicators: carcinogenicity, developmental and reproductive toxicity, allergy and immunotoxicity. Green - from 1 to 33, yellow - from 34 to 77, black - from 78 to 100. The obtained materials can find practical application in medicine and cosmetics. Formulas for creams and toothpastes have been developed. Organoleptic properties were tested and utilitarian creams and toothpastes. The shelf life of the paste has been extended from 12 to 36 months thanks to the optimized composition and the introduction of composite materials with antibacterial properties.

New porous nanocomposites based on various types of synthetic and natural materials were synthesized, the composition of materials and conditions of synthesis were optimized.
in composites, which leads to an increase in their effectiveness and regulation of release. Different types of interactions in complex systems enabled the regulation of the nature of interactions not only nanoparticle-organic substance, but also composite-adsorbate in order to control the release of biologically active substances (e.g. in the case of shampoos and toothpaste). The software for analyzing the security level of the received materials was developed and improved. Know-how, trade secrets, publications, monographs and numerous oral and poster presentations at national and international conferences have been formalized on the basis of received materials.