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Summary of the doctoral dissertation

„Study on the preparation and properties of cellulosic materials modified with carbon nanoadditives"

Cellulose is a biopolymer commonly found in nature, which is cheap and easily accessible. Cellulose is a polymer that can be modified, both physically and chemically. The many possibilities offered by this biopolymer encourage the creation of new materials that meet our expectations.

The development of new materials was possible by nanotechnology, which is largely based on carbon nanomaterials. Carbon nanostructures include, among others, nanotubes, fullerenes, graphene or graphene oxide. The last one is an oxidized derivative of graphite and is characterized by the content of various types of oxygen groups. The chemical structure of graphene oxide is promotes to the creation of cellulose-based composites, resulting in new, biodegradable materials with previously undescribed and interesting properties.

In this dissertation, the task of developing, manufacturing and detailing cellulose materials modified with graphene oxide was undertaken. These materials were obtained in two ways. The first consisted in dissolving wood cellulose in 1-ethyl-3-methylimidazole acetate, followed by the introduction of the additive GO (dispersed in dimethylformamide), followed by the formation of fibers by the wet method. In this way, composite fibers based on regenerated cellulose were obtained. The second method consisted in the biochemical synthesis of bacterial cellulose, during which aqueous dispersion of GO was introduced in situ. As a result of this experiment, composite nanotextiles with a layered structure were obtained. The effect of graphene oxide addition on the properties of the obtained cellulose matrix composites was investigated. It has been shown that the nanoadditive introduced into the cellulose matrix affects physicochemical, structural, mechanical and microbiological properties. Under the influence of GO, the degree of crystallinity increases for regenerated cellulose, while it decreases for bacterial cellulose. GO modified fibers as well as modified composite nonwovens are characterized by a higher temperature of thermal decomposition. Thus, the addition of GO increases the thermal stability of composite fibers. Scanning microscopy confirmed that GO is embedded inside the structure of composite fibers and non-woven fabrics, which ensures the

safety of using the manufactured composite materials. At the same time, the obtained composite materials have biocidal properties. As a result of the conducted research, new, previously undescribed composite materials with unique properties were obtained.