NANOAEROSOL FILTRATION PROCESS IN POLYMER FIBROUS FILTERS MODIFIED BY ZINC OXIDE

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Aerosol particles present in in-door air may be dangerous, especially for human health, due to presence of abiotic nanoparticles as well as this naturally formed, which are called bioaerosols. The term "bioaerosol" is defined as biological particles dispersed in the gas phase. The particles forming a biological aerosol include: spores, plant pollens, viruses, bacteria, mammalian allergens, fungi or even endotoxins. Microorganisms have good conditions to grow in ventilation and air-conditioning systems, making them a main source of pollutants. Many of those agents, when they are transported by a stream of air, can cause a significant health hazard and could be the reason of adverse reactions from allergies through infections, pulmonary diseases, toxic reactions and other nonspecific symptoms (e.g. sick building syndrome). The application of fibrous filters with high separation efficiency could be a solutions to those problems. Thus, presented work concerns air purification of particles with different morphology by fiber-modified filters.

The main aim of this research is to examine the filtration properties of polypropylene filters made by melt-blown technology, with were chemically modified fibers using zinc oxide nanowires. The surface modification of polymer fibrous filter by chemical bath deposition of ZnO rods (by in situ growth of ZnO nanorods) was applied. Its causes a development of the specific surface area and also significantly increased the roughness of the fiber which is important feature in the filtration process. After the procedure of modification the filters were investigated in tests which consists of two essential parts. The subject of the first part are tests of the initial filtration efficiency for KCl particles and DEHS droplets in a size range from 20 nm to 2 μm. The second part of the research contains experiments of the loading of the filters, by the Arizona test dust, which allows to characterize the changes in lifetime of modified materials.

Investigations of the filtration process for solid KCl and silica particles also for DEHS droplets showed an increase in removal efficiency for all newly developed materials compared to raw filters and for the whole examined range of diameters. The initial filtration efficiency has increased for solid particles as well as liquid droplets the loading tests confirm that ZnO open structures cause the elongation of filters lifetime. Moreover, the initial pressure drop across the filter after modification does not rise to a statistically significant extent.