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Doctoral dissertation: **Determination of the effect of structural parameters on the filtration properties of nonwoven composites used to protect against the risk of liquid aerosols.**

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Abstract

In many technological processes, including high temperature, various kinds of oils are used as cooling agents. In mechanical processing, oils can oxidize, pollute the air with metal particles or combustion products, and new harmful substances can be generated. Liquid aerosols can also damage electronic instruments used to operate machinery and equipment. Exposure to liquid aerosols, especially oil mist, can cause the formation of such disease entities as chronic bronchitis, asthma, allergies, and the development of cancer among workers in industry.

Both in the country and in the world, the primary goal for workplace safety in mechanical processing using oil coolers is to provide workplaces users with protection against the risk of exposure to liquid aerosol particles. Nonwoven composites have a significant position among the filter materials used in ventilation systems for machining processes. Layered nonwoven composites not only allow for the proper adjustment of the filter thickness, but also for selecting the right filter cross section structure for the most efficient air cleaning from the polydisperse liquid aerosol.

The purpose of the thesis was to determine the influence of selected structural parameters of the chosen nonwovens on the filtration properties of the nonwoven layer composite materials used to protect against the risk of liquid aerosols. The study included experimental determination of the relationship between such structural parameters of nonwovens as their thickness and composition, and process parameters such as aerosol velocity and its nominal concentration relative to flow resistance and liquid aerosol filtration efficiency. Homogeneous and heterogeneous layered composites consisting of nonwovens arranged in different configurations and produced by "spun-lace" and "melt-blown" methods were tested. Defined dependencies of air flow resistance and aerosol filtration efficiency on structural parameters of nonwovens and process air filtration parameters have been confronted with changes in the performance parameters of clean and liquid aerosol loaded layered nonwoven composites. The quality and usability indexes of the filter defined within the framework of the studies were then used to compare the quality of nonwoven composites of various thicknesses and configurations at the initial stage of the air filtration process and to take into account the actual investment and operating costs incurred by the users.

Determination of the influence of individual structural parameters of nonwoven composites, process treatment and physicochemical liquid aerosols allowed for the determination of variable parameters having a dominant significance in the formation of nonwoven compositions with gradient layering and their application in real conditions at industrial workplaces using mechanical treatment with oil coolers. Analysis of the research results showed the dependence of filtration and utility parameters on the structural parameters of the tested nonwoven composite layers (primarily thickness and porosity), mechanical processing parameters and physicochemical parameters of test aerosols (flow velocities, aerosol inlet concentrations, their dimensions and filter life).

The research results presented in this study show usefulness for the filtration media manufacturers, maintenance workers of ventilation systems for mechanical processing, to support the design of new nonwoven composites and to check the effectiveness of air filters already used in mechanical processing to ensure effective protection of humans from the harmful effects of air pollution consisting liquid