OIL NANODROPLETS FILTRATION PROCESS IN FIBROUS FILTERS MODIFIED WITH AEROGELS IN THE PRESENCE OF ORGANIC SOLVENTS

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Among various ways to remove droplet from the airstream, filtration with the use of fibrous filters is the most promising, simple to implement and relatively inexpensive method. Moreover, separation in nonwovens is the most efficient means for collecting nano-, and submicron particles and droplets. Due to the increasing need for environment and human health protection from exposure to fine particles, filtration is becoming more and more important.

The aim of this study was to check the initial separation efficiency of DEHS (diethylhexyl sebacate) oil nanodroplets on flat fibrous materials, which were made of polypropylene via the melt-blown technology. The surface of filters was modified by a sol-gel reaction, which led to the formation of aerogel spherical structure on the fibers. The volume ratio of precursor - MTMS (Methyltrimethoxysilane) to solvent - MeOH (methanol) was 1:15. Further, the series of aerogel synthesis were carried out in organic solvent mixture such as: MeOH-toluene, MeOH-acetone and MeOH- isopropanol in volume ratio 9:1, 7:3 and 1:1 for each mixture. The use of a second solvent was supposed to influence the reactions occurring during the aerogel synthesis and as a consequence the properties of the modified filter materials.

During the research, series of images of the nonwoven fabrics were made using the scanning electron microscope SEM. Furthermore, the mass changes of the tested filter samples before and after modification was measured. The average weight gain of the aerogel in the nonwoven was determined. The tests of filtration process allowed to determine the changes in the filtration efficiency for nanodroplets in size range from 20 to 220 nm. Moreover, the overall efficiency for each tested material was determined. The influence of solvent mixtures used in modifications on the pressure drop across the filters were checked.

In the case of modified samples, it has been observed that, the developed surface cause an increase in separation efficiency. Unfortunately, filling the volume of nonwovens by aerogels results also in significant increase in the airflow resistance on the nonwoven fabric, what will be the subject of further investigation.

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