

COMBINATION OF NANO/MICRO FIBERS FOR COLLECTION OF PARTICLE MATTER

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Introduction. Air pollution by particle matter (PM) creates a significant hazard to the environment and human health. Most dangerous particles are up to 2.5 μm in diameter [1]. The solution electrospinning method can produce nanofiber membranes capable of efficiently collecting fine particle matter PM_{2.5}. However, the use of these filters is limited because of their fragile structure [2]. These disadvantages can be overcome by combining nanofibers with microfibers. Electrospun nano/microfiber filter possesses low-pressure drop while retaining high 99 % PM_{2.5} filtration efficiency [3]. Due to these advantages, it can be perspective as personal protective equipment.

Methods. A combination of solution and melt electrospinning was used. For the first technique, we prepared a solution of polyamide 6/6 dissolved in formic acid, and for the second, the filament of Vestamid L1723. Both electrospinning techniques were used to achieve the best results: simultaneously, melt-solution-melt, alternating between melt and melt + solution and alternating between melt and solution. Produced mats filtration efficiency and pressure drop were tested with Dekati's Electrical Low-Pressure Impactor (ELPI+) at 5.35 cm/s face velocity using NaCl aerosol particles. To investigate the effects of different electrospinning parameters on nano/microfiber structure SEM analysis was used.

Results and conclusion. The filtration efficiency of NaCl particles of 74-99 % was achieved. Pressure drop varied from 52 to 322 Pa. SEM images showed that fibers diameter varied from 0.02 to 45.6 μm , meaning that different layers of nano- and microfibers were successfully produced. Due to high filter air resistance, further research is needed to be competitive with conventional respirators.

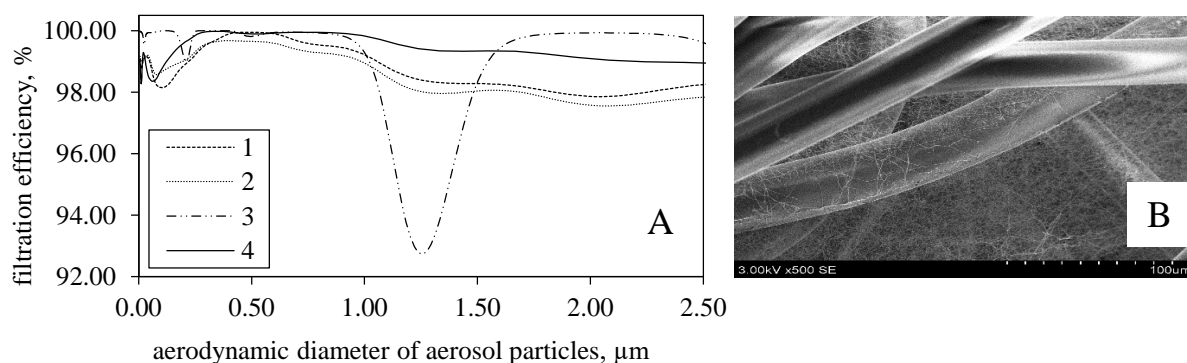


Fig. 1. A – The filtration efficiency of aerosol particles (1 – alternating between melt – melt + solution, 2 – melt – solution – melt, 3 – simultaneously, 4 – alternative respirator). B – SEM image of micro/nanofibers sample 1 at 500x magnification.

References

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