Highly Sensitive Electrospun Sensory Membrane for Multi-Directional Strain Detection

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Abstract: In contemporary times, the heightened concern surrounding air pollution, with its substantial annual death toll, has spurred industries to tackle the issue through the creation of large-scale air filtration systems for public spaces. Detecting air filter clogging is crucial for maintenance, reducing system energy consumption by timely cleaning or replacement [1]. The intriguing field of e-textiles, widely applied in medical, safety, military, and clogging detection scenarios, integrates components seamlessly into soft textile materials based on specific usage requirements [2]. Nanofibers, with their advantageous properties like porosity, light weight, and high surface area, stand out as a prominent textile structure [3]. To achieve conductive nanofibers, the research focuses on employing in situ conductivity using conductive particles and surface conductivity through immersion and printing methods [1]. Utilizing an electrospinning system, thermoplastic polyurethane nanofibers are produced, with carbon ink printed in various patterns to make them suitable for textile sensor applications. The study concludes by testing membranes with different printed patterns in a ventilation tunnel under varying velocities, assessing the impact of patterns on electrical properties and pressure drop. Ultimately, these conductive membranes show promise as effective strain sensors for detecting air filter clogging.

KEYWORDS: air filters, clogging detection, smart textiles, ventilation tunnel

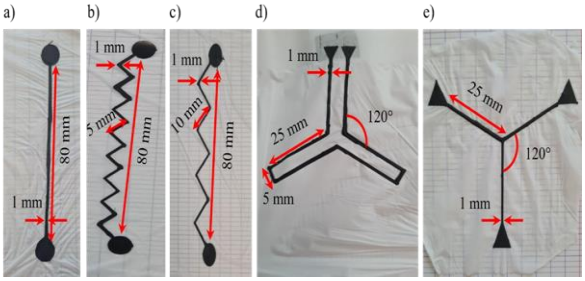

Figure 1. *Different printing patterns on the surface of TPU membranes.*

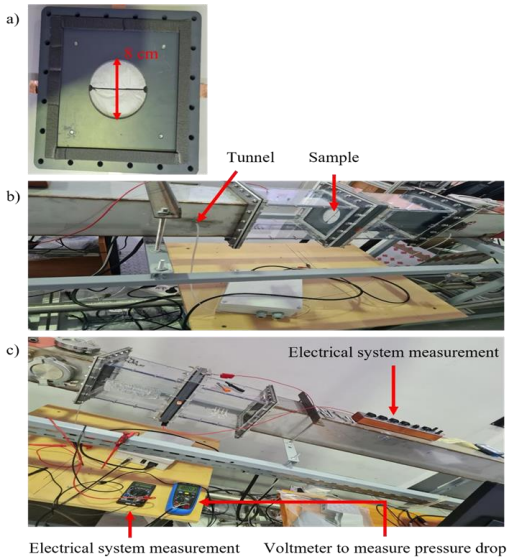

Figure 2. The straight-line printed membrane in the frame, and the sample in the ventilation tunnel.

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