**Supplementary Information**

**Development of a New Personal Air Filter Test System Using a Low-Cost Particulate Matter (PM) Sensor**

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**Fabrication of Monodisperse Polystyrene Latex (PSL) Particles**

The PSL particles were synthesized by a liquid-phase synthesis method with the detailed experimental setup is shown elsewhere (Sandi et al. 2018). Before the start of the synthesis process, a styrene monomer was purified by 3 M NaOH to remove its inhibitor. The synthesis process began by stirring and heating the distilled water in the reactor system for 15 minutes under a nitrogen atmosphere to ensure oxygen-free conditions. The purified styrene monomer was then added into the reactor and stirred for 10 minutes to disperse the styrene homogenously. To begin the polymerization process, potassium persulphate was added into the reactor system containing the styrene-water solution. The polymerization process lasted for 10 hours at a constant temperature. The final product was then cooled to room temperature.

**Filter Samples Preparation**

The filter samples for PAFT evaluation were made from the electrospun of polyacrylonitrile (PAN) (purchased from Sigma Aldrich, Singapore) with a molecular weight of 150 kDa. The precursor solutions for the electrospinning process were made by dissolving the PAN powder in N,N-dimethylformamide (DMF) solvent (purchased from Sigma Aldrich, Singapore) with a concentration of 10 %w/w. The filters were prepared using the syringe pump flow rate, operating voltage, and needle tip to collector distance of 10 µL/min, 14 kV, and 10 cm, respectively. The PAN nanofibers were collected on a stainless-steel mesh. The variations in the efficiencies of the filters were achieved by changing the duration of the electrospinning time for each filter.

**GP2Y Sensor Sensitivity**

The sensor sensitivity (V/(#/cm3)) defines the magnitude of the sensor output voltage (V) for a given particle number concentration (#/cm3). ~~High sensor sensitivity is necessary to guarantee a high resolution of the measurement.~~ The sensitivity of the PAFT for filter efficiency measurement may be affected by two sources, i.e. the GP2Y sensor sensitivity and the ADC resolution. The ADC used in this experiment has 16-bit resolution with a reference voltage of 3.3 V, which should result in a least significant bit (LSB) voltage of 50.35 µV. We expected that the ADC had sufficient resolution for the filter efficiency measurement and therefore predicted that the major parameter affecting the PAFT sensitivity would be the GP2Y output response sensitivity. As shown in Fig. 7, the GP2Y has an output voltage below 0.80 V for 303 nm PSL particles with a particle number concentration of 3×104 #/cm3. For PM2.5­ source samples, the output voltage was even smaller: below 0.60 V for a particle concentration of 3×104 #/cm3.

**Reference**

Sandi, A., A. Sawitri, A. Rajak, A. Zulfi, D. Edikresnha, M. M. Munir, and K. Khairurrijal. 2018. Fabrication and characterization of monodisperse polystyrene latex (PSL) with various diameters. *IOP Conf. Ser.: Mater. Sci. Eng.* 367: 012015. doi:10.1088/1757-899X/367/1/012015.