## Supporting information for:

## Enhanced Capture of Particulate Matter by Molecularly Charged Electrospun Nanofibers

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Figure S1. Illustration of the aerosol filtration efficiency tester set-up.



**Figure S2.** Photograph of soot filtration set-up. (a) The complete set-up with clamps and caps, (b) without the clamps and caps. (c) Side view of one the bottle were the fibers meet the soot particles.



**Figure S3.** (a) Size distribution of dust particles collected on different days. (b) Zeta potential of the dust collected on different days.



**Figure S4.** (a and b) Charge distribution of dust collected from 2 different locations measured using a Faraday cup. (c and d) Scanning electron micrographs of dust collected from 2 different locations. Scale bar corresponds to  $10 \mu m$ .



**Figure S5.** (a, b, c and d) X-ray diffraction patterns of dust collected from 4 different locations matched with the ICSD database.

Table S1.	Chemical	composition	of	dust	collected	from	4	different	locations	and	matched
using ICSE	) database.										

Location	Sample	Inorganic crystal structure	Chemical composition
	name	database (ICSD)	
1	Kyanite	83456	Al <sub>2</sub> O <sub>5</sub> Si
	Quartz low	201353	SiO <sub>2</sub>
	Anorthite	63547	$Al_2Ca_{0.71}Na_{0.25}O_8Si_2$
2	Quartz low	201353	SiO <sub>2</sub>
	Albite low	77423	Al <sub>1</sub> Na <sub>1</sub> O <sub>8</sub> Si <sub>3</sub>
3	Bytownite	30932	Al <sub>1.94</sub> Ca <sub>0.85</sub> Na <sub>0.14</sub> O <sub>8</sub> Si <sub>2.06</sub>
	Quartz low	201353	SiO <sub>2</sub>
	Lauzurite 4A	85087	$Al_6Ca_1Na_7O_{30}S_{2.12}Si_6$
	Andesine	100867	$Al_{1.29}Ca_{0.36}Na_{0.62}O_8Si_{2.7}$
4	Quartz low	201353	SiO <sub>2</sub>
	Albite low	77423	Al <sub>1</sub> Na <sub>1</sub> O <sub>8</sub> Si <sub>3</sub>
	Albite high	9829	$Al_1Na_1O_8Si_3$



**Figure S6.** (a and c) Fiber diameter distribution comparing the bare and chemically treated PAN and PS. (b and d) fibers FTIR spectra comparing bare, chemically treated PAN and bare, chemically treated PS, respectively.



**Figure S7.** Charge distribution of untreated and treated (a) PAN and (b) PS fiber mats.(Inset) (a) Molecular model of ChCl treated PAN where, grey represents carbon, blue represents nitrogen and red represents oxygen. Marked region is enlarged and shown in inset. Marked region of the charge distribution is enlarged and shown in another inset. (b) Molecular model of sulfonated PS where, red represents oxygen and yellow represents sulfur. Time of addition of materials to the Faraday cup is indicated.



**Figure S8.** Water contact angle measurements performed on (a) PAN, (b) PS, (c) ChClPAN and (d) SPS.



**Figure S9.** (a) Pressure drop across various filter mats with different electrospinning time, Here, 4NW30 indicate 4 NW mats with 30 min of electrospinning time. (b) Pressure drop across untreated and treated filter mat before and after exposure to soot for 24 h. Here, untreated, treated represent the untreated and treated filter mat before exposure to soot, respectively. Untreated after and treated after represent untreated and treated filter mat after exposure to soot, respectively. (c) Comparing the mass of fibers collected on the non-woven mat with electrospinning time.



Figure S10. (a) Scanning electron micrograph of chemically treated PS fiber with NaCl crystals on them. (b) Spot energy dispersive spectrum (EDS) for the highlighted region with various components presented in the atomic and weight %. Scale bare corresponds to 10  $\mu$ m. Comparing the filtration efficiencies of the untreated and treated fibers. Expanded view of the filtration efficiency is shown in the inset.



**Figure S11.** (a) Charge distribution of electrospun PAN fibers. Marked region is zone presented in the inset. (b) Scanning electron micrograph of ChCl-PAN fibres. Scale bar corresponds to 5  $\mu$ m. The pores are highlighted by arrows. (c) Filtration efficiency of ChCl-PAN fibres.



**Figure S12.** (a) Charge distribution of PS fibres before and after chemical treatment with sulfuric acid. The time of addition of material is marked. (b) Soot filtration efficiency of SPS fibres.



**Figure S13.** Antibacterial property testing of the filter mats using (a) *E. coli*, (b) *B. subtilis* and (c) *E. faecalis*. Here CPAN represent ChClPAN.