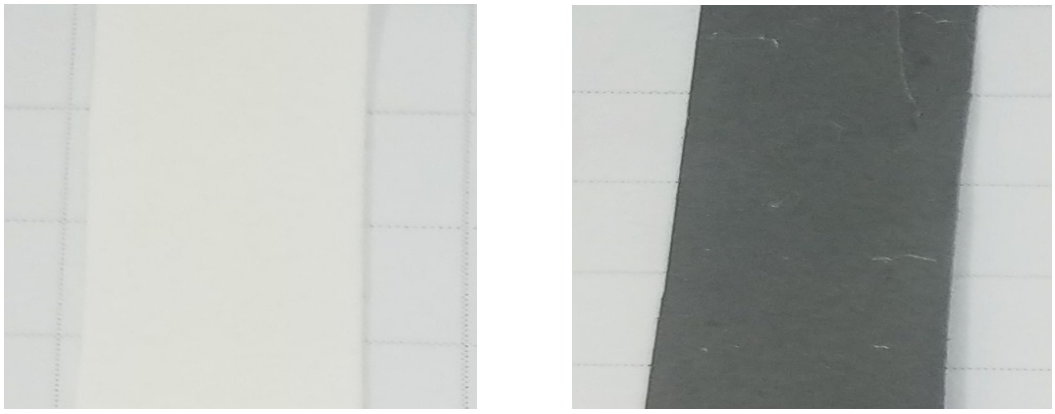
Electronic Supplementary Material (ESI) for Analytical Methods.

Supplemntary materials

1. Paper substrate and conductivity

Paper is nonconductive, but after painting of a conductive substance onto the porous nonconductive paper can produce large active electrode areas. In this work, conductive carbon ink was selected as the conductive material for fabrication of a potentiometric paper sensor. Carbon ink can be easily adsorbed onto the fibres of the paper exhibiting of excellent conductivity. As shown in Fig. S1, after successive paininting of carbon ink on the paper surface, a conversion of a conventional paper is produced. Before coating with the carbon ink, the resistance of the paper was extremely high, but after painting of the carbon ink the values were close to < 500 Ω/cm^2. The photographic macro-images of the paper before (a) and afer (b) the painting of carbon ink are shown in Fig. S_1a and S_1b.

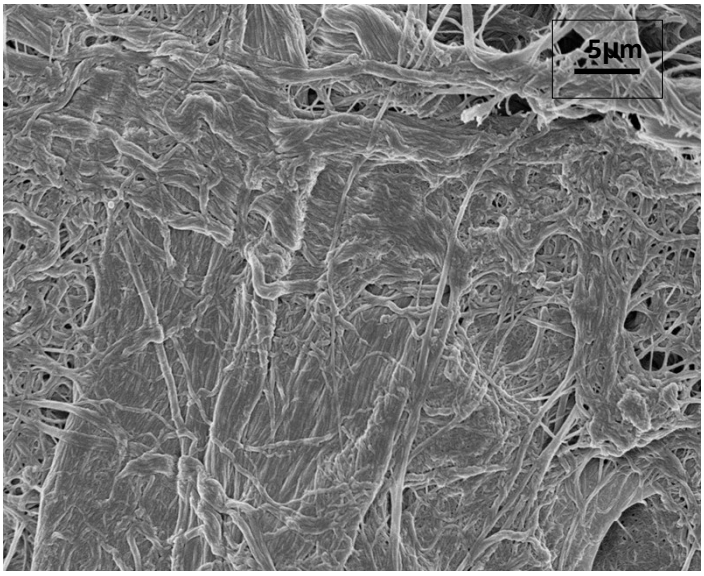
Fig. S_1 Conversion of paper into a conductive paper: (a) Photographic images for the filter paper before (a) and after (b) the application of carbon ink.



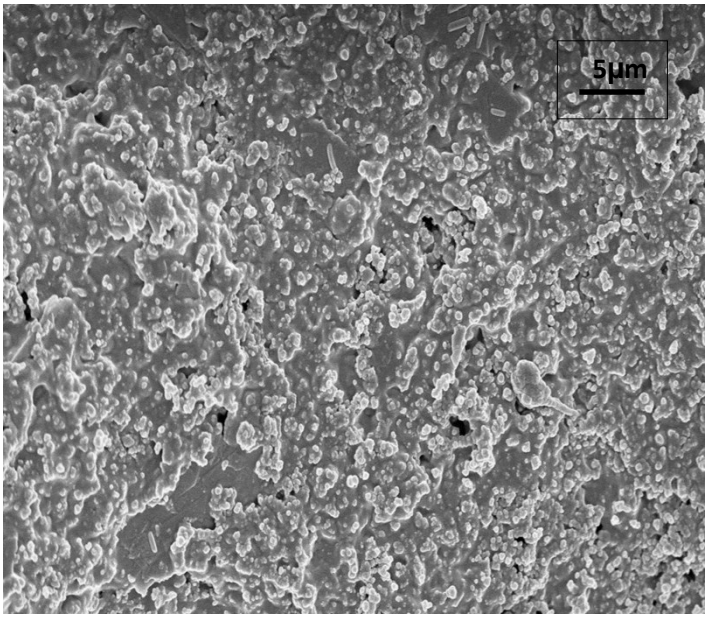
(a) (b)

After the painting process is done, a dark and porous paper surface is obtained. Scanning electon microscope (SEM) images were further employed to characterize the micro-structure of the paper before (Fig. S_2a) and after (Fig. S_2b) the painting. As shown in Fig. S2, afer painting the cellulose fibres of the nonconductive paper are

completely covered by a widespread interconnected network of carbon ink. The excellent stabilization of carbon ink on the cellulose fibres can hinder the drop from the fibre surface upon rinsing the paper with water.



(a)



(b)

Fig. S_2 SEM images of the surfaces of the papers before (a) and after (b) the painting of carbon ink.

2. Optimization of the FIA set-up

Preliminary studies were carried out to establish the best flow injection parameters.

2.1. Effect of sample loop volume

The effect of varying sample loop volume from 50-500 µL for piperidine solution ranging from 10^{-5} to 10^{-2} M on the potentiometric response (slope in mV/decade at pH 7.0 was initially evaluated. The potentiometric response increased with the increase of sample volumes from 50 to 100 µL and was maintained constant in sample volume starts from 100 µL. Therefore, a sample volume of 100 µL was selected for further experiments.

2.2. Effect of flow rate

The effect of flow rate of the buffer carrier was examined over a range of flow rates starts from 1.5 to 7.0 mL/min for Pip^+ solutions ranging from 10^{-5} to 10^{-2} M using the small planar detector mentioned in this work. The potentiometric slope response expressed in mV/decade was recorded and plotted against the flow rate. The optimal flow rate was chosen to be 4.5 mL/ min. In flow rates lower than 4.5 mL/min, the sensor platform showed a slight memory effect accompanied with a long washing times and low sample frequency. At flow rates higher than 5.5 mL/min, the sensor response begin to decrease with a narrow peak width. This is because of the decrease in residence time of the sample. The formation of the potentiometric signal is based, in general, on dynamic equilibrium reactions, thus the magnitude of the signal is independent of the rate of the transport process. Accordingly, the flow rate affects only the transient signal produced at rapid concentration changes.[1,2]. A similar behavior for the effect of flow rate on the detector response was also reported previously. [3,4]

References

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