Preparation of pillar[5]arene-quinoline Langmuir-Blodgett thin films for detection of volatile organic compounds with host-guest principle

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† Electronic supplementary information (ESI) available: QCM measurements details, FT-IR spectra, ^{1}H-NMR, ^{13}C-NMR, and EDX mapping image.

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Experimental details

Cleaning Procedure

The UV-ozone cleaning procedure is a highly effective method to remove a variety of contaminants from surfaces. It is a simple to use dry process which is inexpensive to set up and operate. It can produce clean surfaces at room temperature, either in a room atmosphere or in a controlled atmosphere. Glass substrates (Fisher Scientific) and quartz substrates were cleaned carefully by applying the following steps: i) they were rinsed several times with ultrapure water (18.2 MΩ cm) and ethanol; ii) they were then treated in a mixture of NH_3 (25 vol.%), H_2O_2 (30 vol.%), and deionized water with a volume ratio of 1:1:5 at a temperature of 60 °C for 20 min; iii) they were washed with ethanol and dried under a nitrogen stream; and iv) finally, they were exposed in a UV-Ozone chamber (Irvine, CA: Model 42, Jelight Company Inc., USA) for 15 min prior to modification.

QCM measurements

In order to study the sensing properties of **P5-Q** LB film, a thinly cut wafer of raw quartz sandwiched between two electrodes in an overlapping keyhole design was used for the QCM measurement (Figure S1). Standard QCM crystals with a nominal resonance frequency of 3.5 MHz were commercialized from GTE SYLVANIA Company. All experiments were carried out at room temperature (20 °C) using an oscillating circuit designed by us. The quartz crystal was inserted into the electronic control unit, and the frequency of oscillation was monitored as a function of time using dedicated software. The values of frequency changes, which indicate the degree of response, are measured with an accuracy of 1 Hz. After each deposition cycle, the LB film sample was dried for half an hour and the mass change was monitored using this computer controlled QCM measurement system. This system was used for the confirmation of

the reproducibility of LB film multilayers using the relationship between the QCM frequency changes against the deposited mass, which should depend on the number of layers in the LB film.

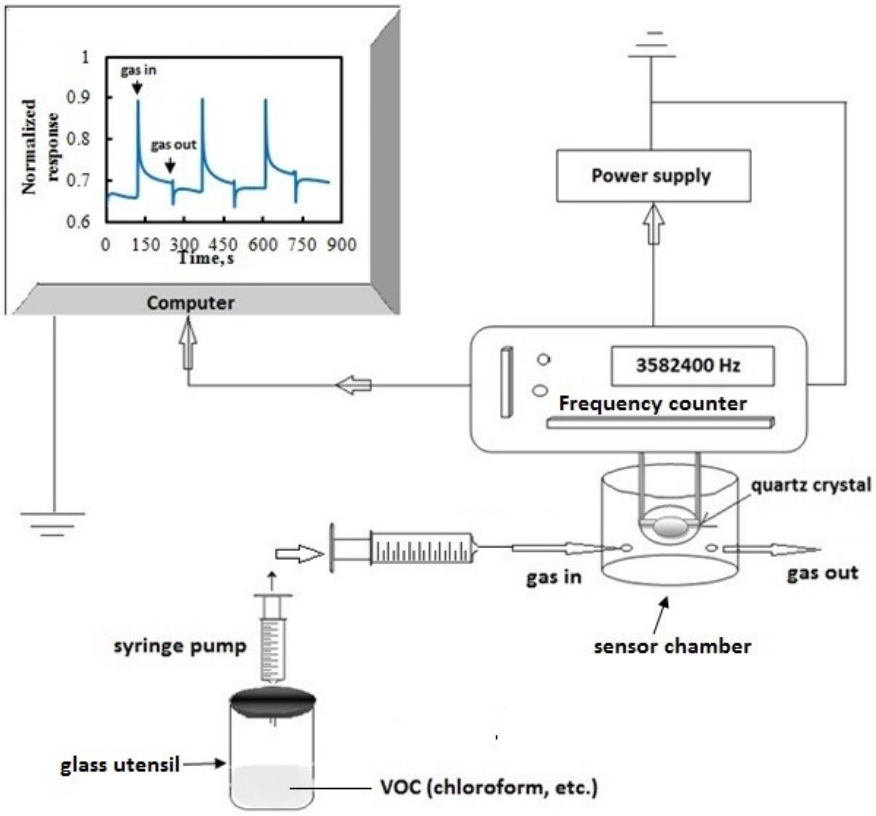


Figure S1. A block diagram of the quartz crystal microbalance measurement system.

Results and discussions

Characterization of compounds

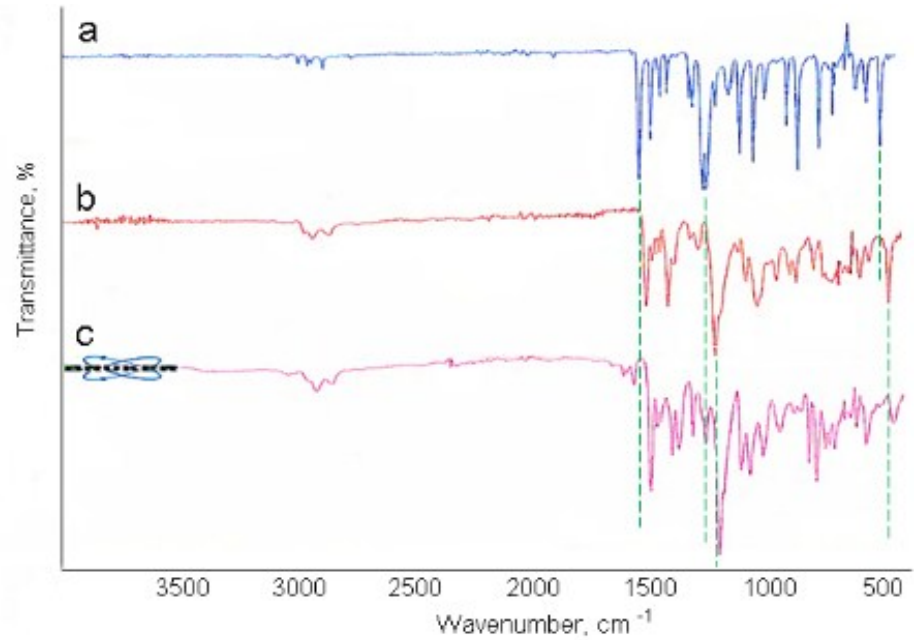
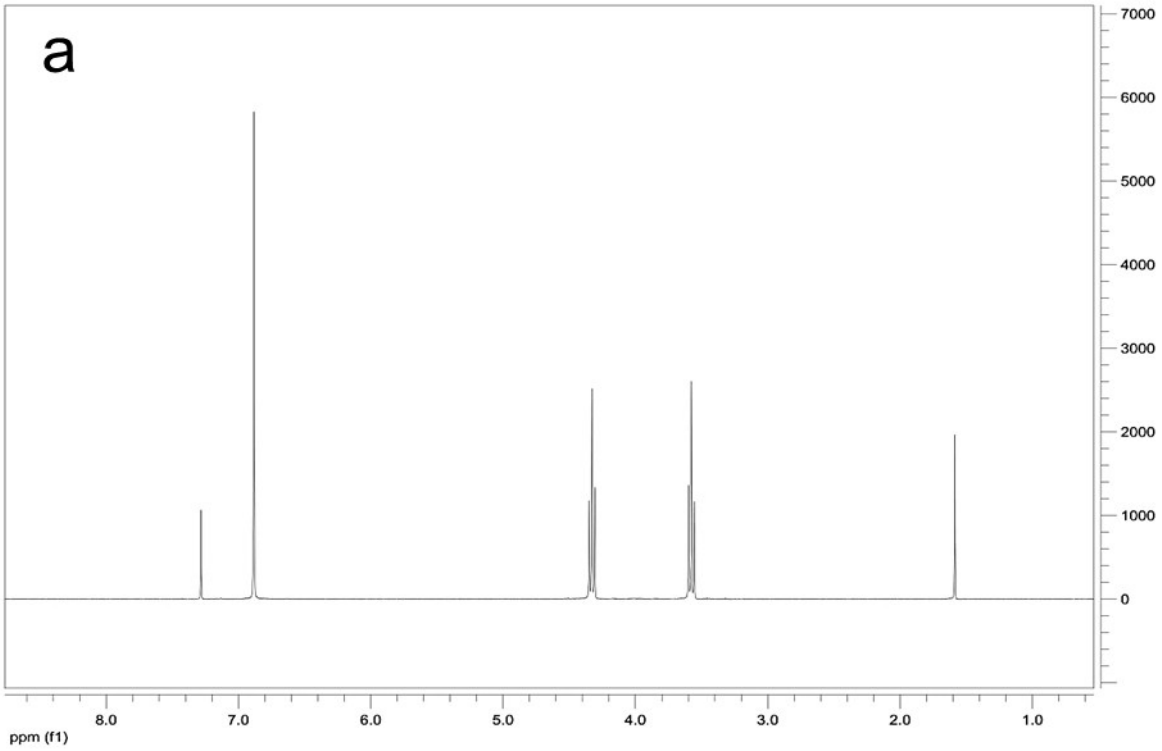


Figure S2. The FT-IR spectra of 1,4-bis(2-iodoethoxy)benzene **(a)**, iodo-pillar[5]arene **(b)** and **P5-Q (c)** compounds.


a
7000
6000
5000
4000
3000
2000
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0
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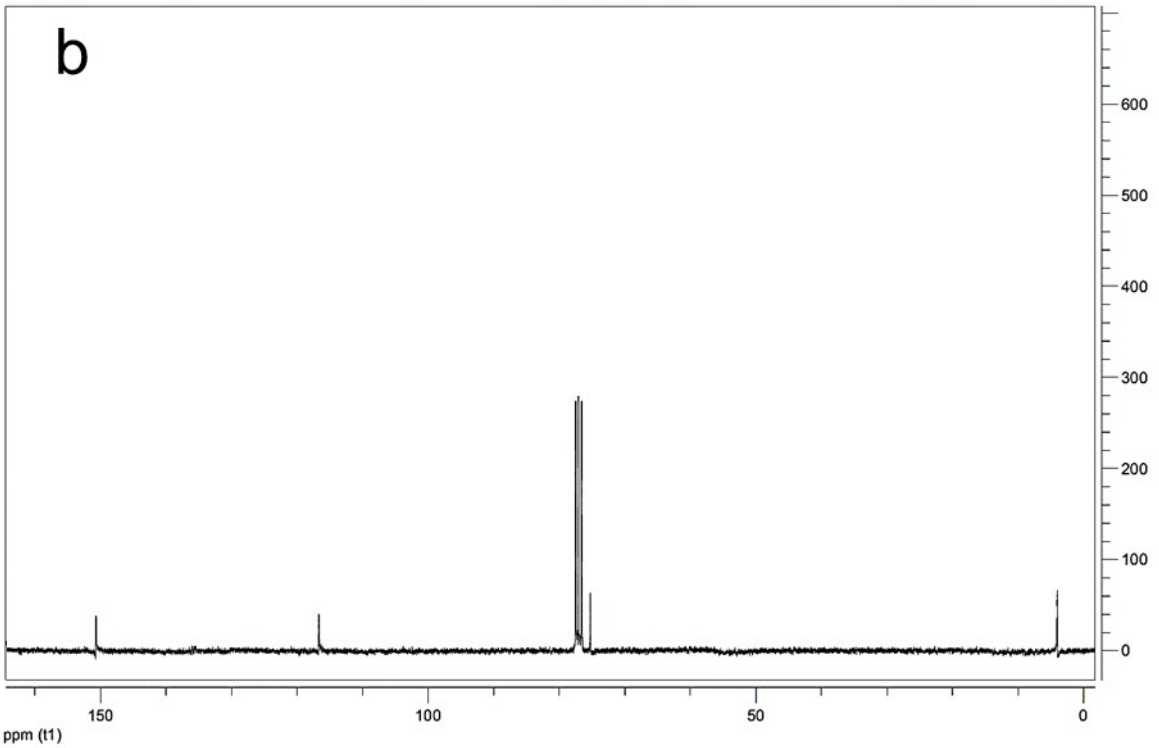
6.0
5.0
4.0
3.0
2.0
1.0
ppm (f1)


b
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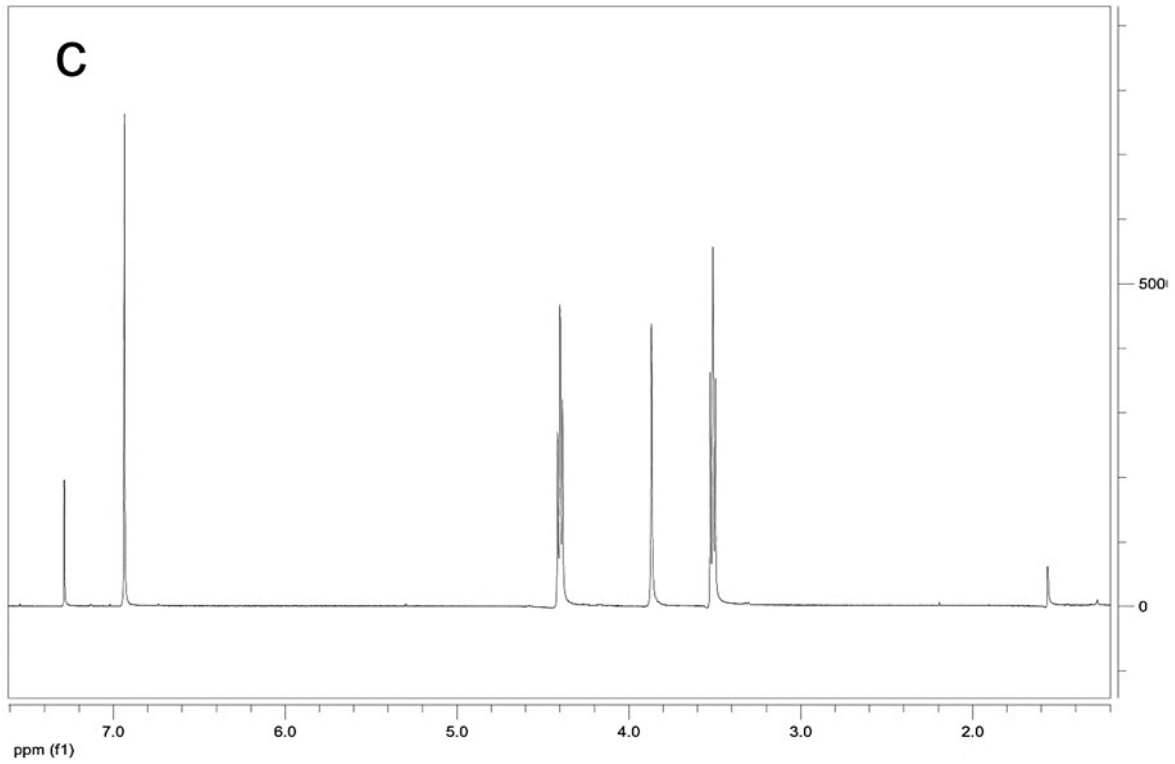
500
400
300
200
100
0
150
100
50
0
ppm (t1)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0
7.0
6.0
5.0
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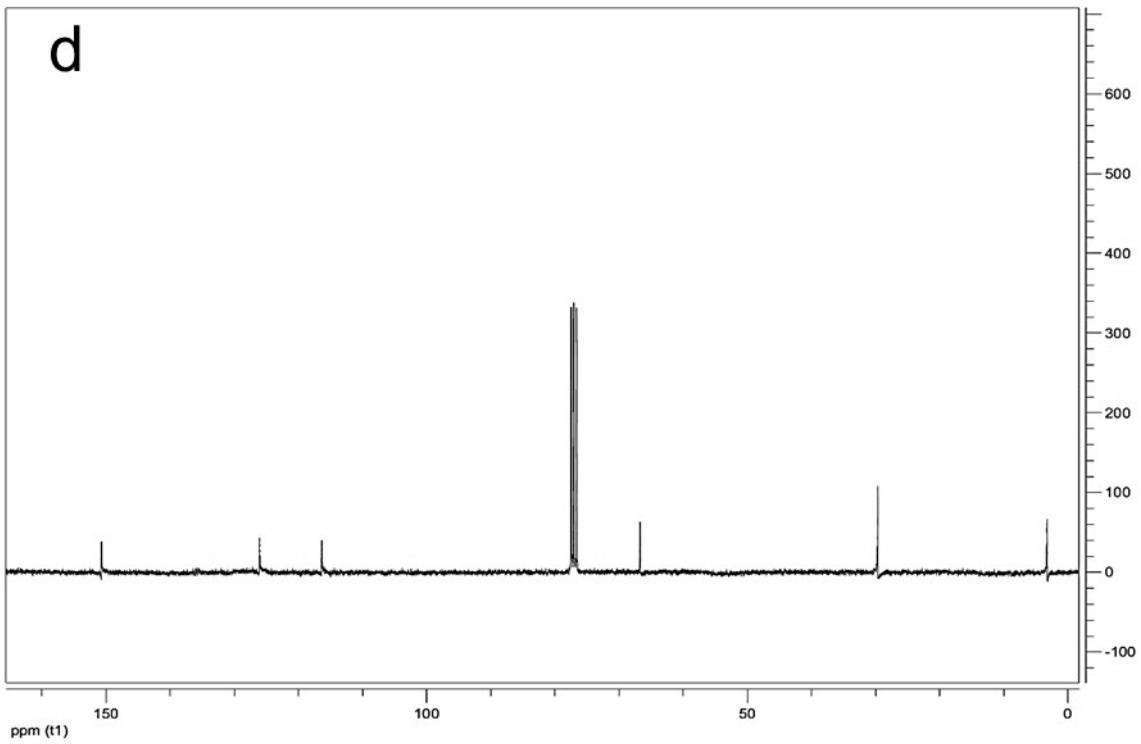
3.0
2.0
ppm (f1)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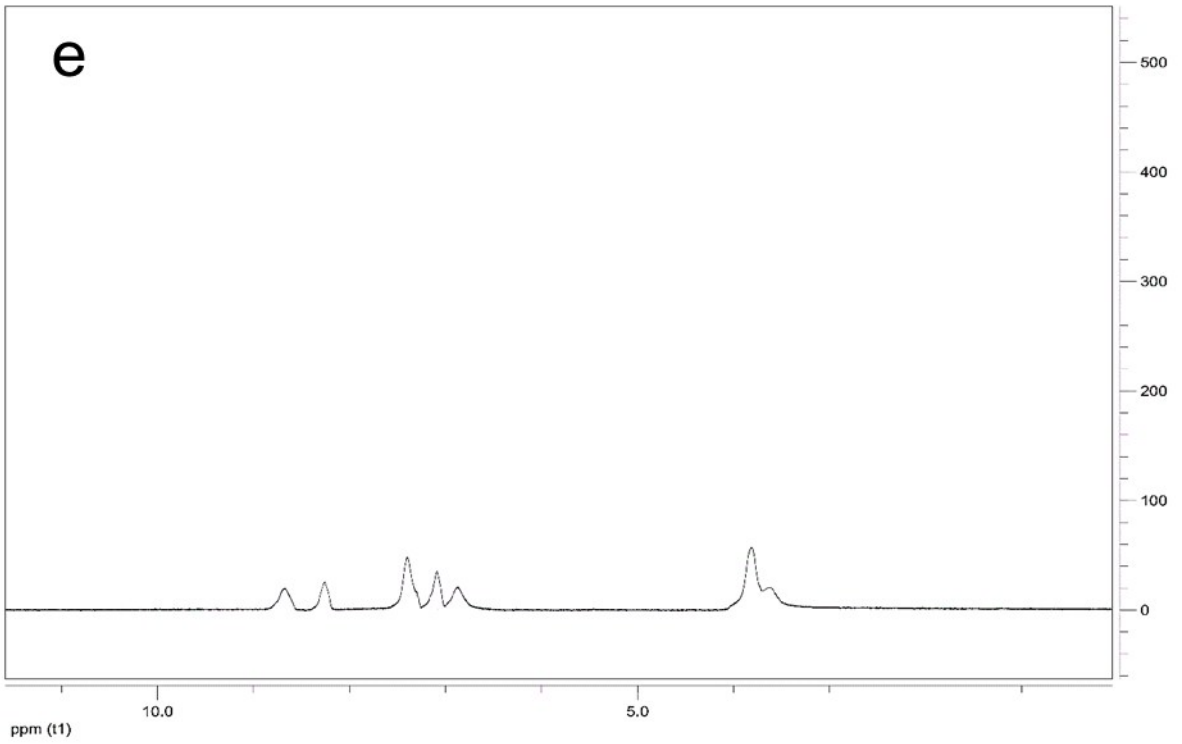

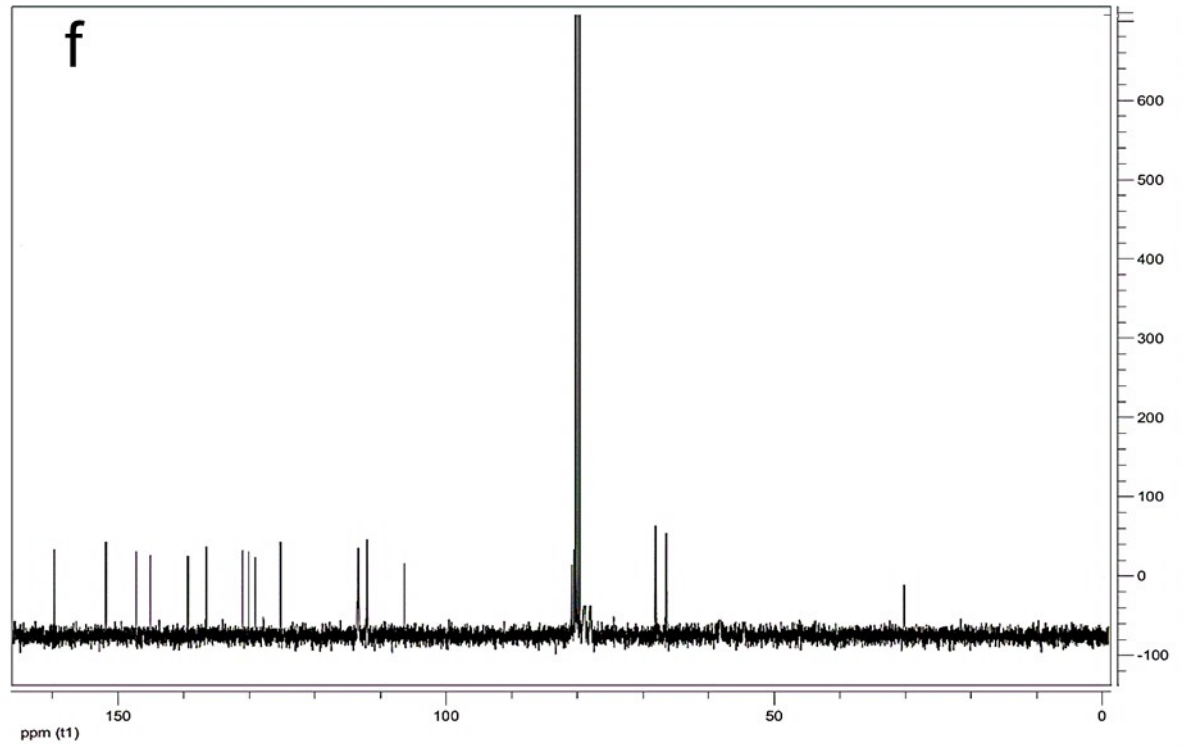

Figure S3. ^{1}H and ^{13}C NMR of 1,4-bis(2-iodoethoxy)benzene (**a** and **b**), iodo-pillar[5]arene (**c** and **d**) and **P5-Q** (**e** and **f**).

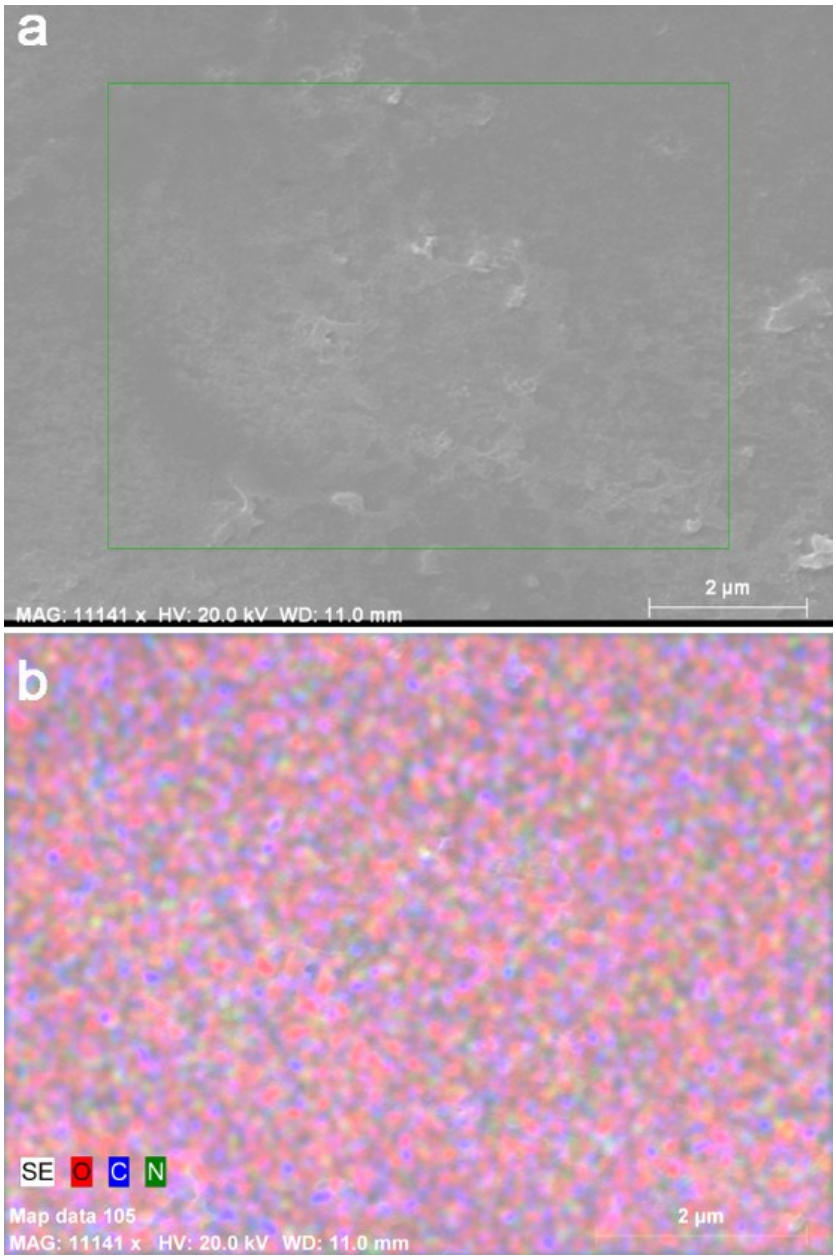

Figure S4. SEM image **(a)** and EDX mapping **(b)** of **P5-Q** LB film.