Ionic Liquid-Based Fluorescent Sensing Paper: Rapid, Ultrasensitive, and In-site Detection of Methamphetamine in Human Urine

Electronic Supplementary Information

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ESI1: Experimental

1.1 Reagent and chemicals

MA-HCl was obtained from Institution of Forensic Science, the Criminal Department of Ordos Public Security Bureau. Ionic liquids were synthesized in our lab. HPLC-grade methanol and acetonitrile were obtained from Tianjin YongDa Chemical Reagent Development Center (Tianjin, China). 1M Sodium hydroxide was used to adjust the pH values of aqueous solutions. Ultrapure water was used for the preparation of mobile phase and sample solution.

The stock solution (0.1 mg mL^{-1}) of MA-HCl was prepared in ultrapure water and stored at 4 °C before use. Then the aqueous samples solutions were prepared daily by diluting the stock solution with ultrapure water.

1.2 Instrument

An Agilent 1100 liquid chromatograph equipped with a UV was used. An Agilent ZORBAX SB-C18 column (4.6×250 mm, 5 mm particle size) was employed for the separation at 30 °C. The mobile phase was obtained with acetonitrile/30 mmol L^{-1} ammonium acetate (15:85, v/v) at 1 mL min^{-1}, the injection volume was 20 μL and detection wavelength was 217 nm.

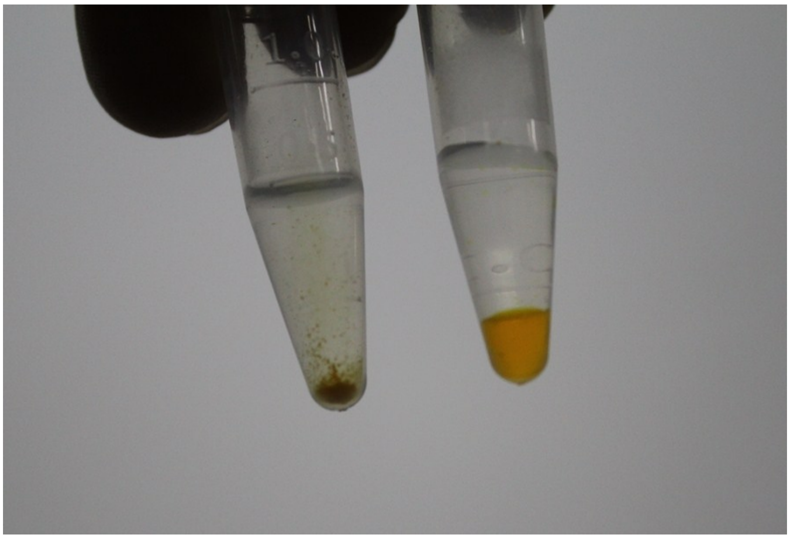
1.3 Sample

Drug-free human urine samples were collected from a healthy volunteer and stored below 0 °C. The real human urine sample of MA abuser was provided by Ordos Public Security Bureau for application of the testing paper. Working solutions at 5000 ng mL^{-1} were freshly prepared by appropriate dilution of the stock solution with ultrapure water.

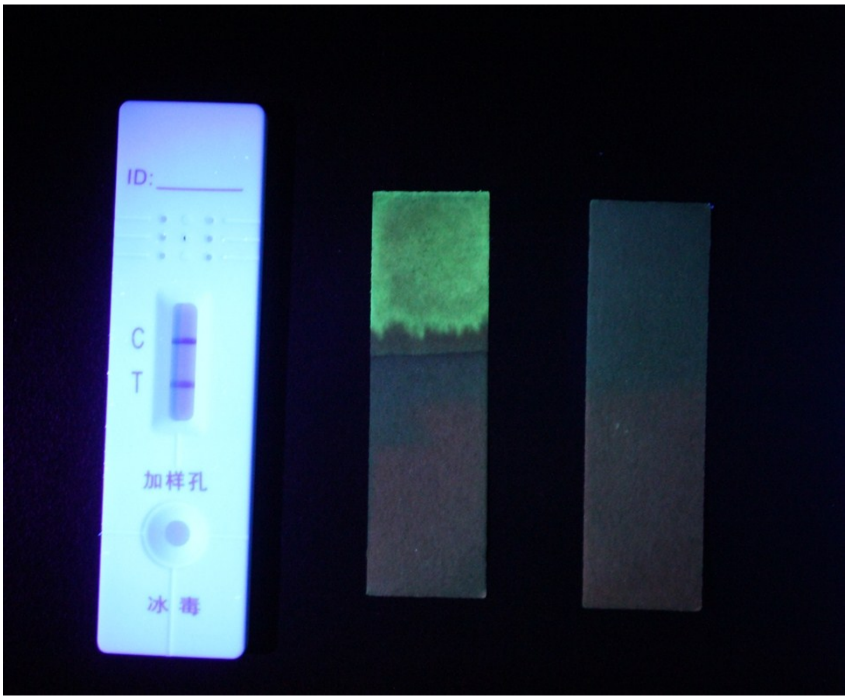
1.4 extraction procedure

The liquid-liquid extraction was performed according to the following procedures: (1) 10.0 mL ultrapure water spiked with methamphetamine was put into a 15 mL centrifugal tube, and subsequently 0.5 mL ionic liquids was introduced to the sample solution and shaking 15 s; (2) the solution was centrifuged for 10 min at 7000 rpm; (3) 20 μL of the water phase was injected into HPLC for analysis.

ESI2: The solubility of DNC in water(left) and $BPyNTf_2$(right)

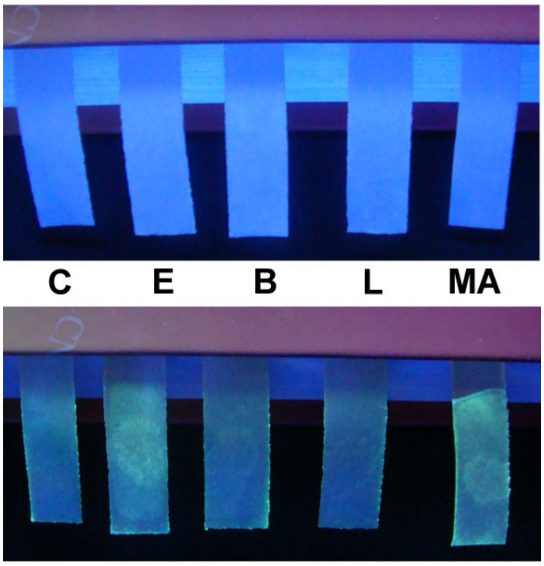


ESI3: The comparative test between ILBF-sp and IMCG-tp (from market) under a portable UV lamp



Urine (60 μL, from an “ice” addict) was dropped on IMCG-tp and ILBF-sp was dipped in the urine sample, respectively. ILBF-sp (middle) showed positive with a strong fluorescent signal, the IMCG-tp (left) showed negative. A blank ILBF-sp (right) was severed as the reference.

ESI4: The controlled experiment to test the detection selectivity of ILBF-sp under a portable UV lamp



C, E, P, and L standed for chlorpheniramine, ephedrine, phenobarbital, and lorazepam, respectively. MA standed for methamphetamine severed as the reference.

Upper photo: blank filter papers were dipped in the ultrapure water solutions of these medicines at 100 ng mL^{-1}. The results showed that these medicines could not generate fluorescence signal by themselves under UV light.

Bottom photo: ILBF-sp were dipped in the ultrapure water solutions of these medicines at 100 ng mL^{-1}. The results showed that no obvious fluorescence could be seen for chlorpheniramine, phenobarbital, and lorazepam except ephedrine, referencing to methamphetamine.