Supporting information

Quantitative urinalysis using aggregation-induced emission bioprobes for monitoring chronic kidney disease

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Synthesis of IDATPE and general information

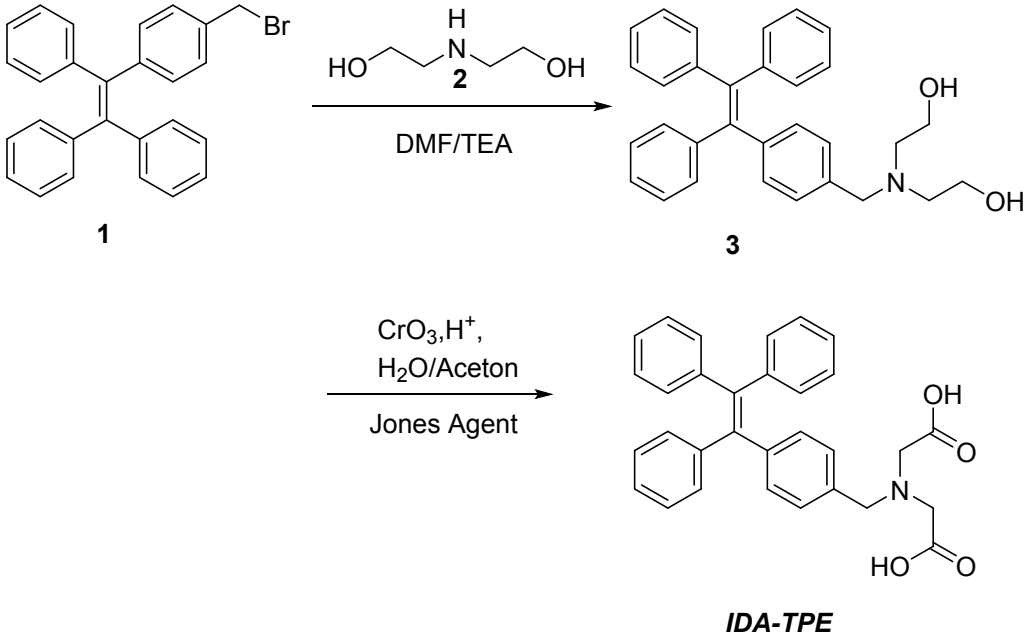
All the reagents used in this study were purchased from Sigma-Aldrich unless otherwise specified.

In a 2 neck-flask under N_2 atmosphere, the compound 1 (200 mg, 0.47 mmol, 1.0 eq) has reacted with compound 2 (0.56 mmol, 1.2 eq) overnight in DMF/TEA as solvent reaction mixture. Then, the DMF/TEA has been removed and the residual product has been washed by DCM in order to remove the starting material (Compound 1). Compound 3 has been obtained as white solid powder in 75% yield. Compound 3 has been further oxidized, performing the Jones oxidation by using CrO_3 in acidic condition and Acetone as reaction solvent, after 4 hrs the starting material was almost consumed. The reaction has been stopped and the final product has been separated from the residual starting material by using water in which the final product is not soluble. The final product has been got in 90% yield due to the stronger oxidation condition. It was further purified by HPLC by using the following condition: column, reverse phase $XDBC_{18}$ ACN: H2O=60: 40.

Characterizations:

^{1}H-NMR main peaks in Acetone d_6 δ (ppm): 7.16, 7.32, 7.46 (m, 9H), 4.8 (s, 1H);

MALDI-TOF found at 447.1362 [M^{2-}].



Scheme 1: Synthesis protocol for IDATPE.

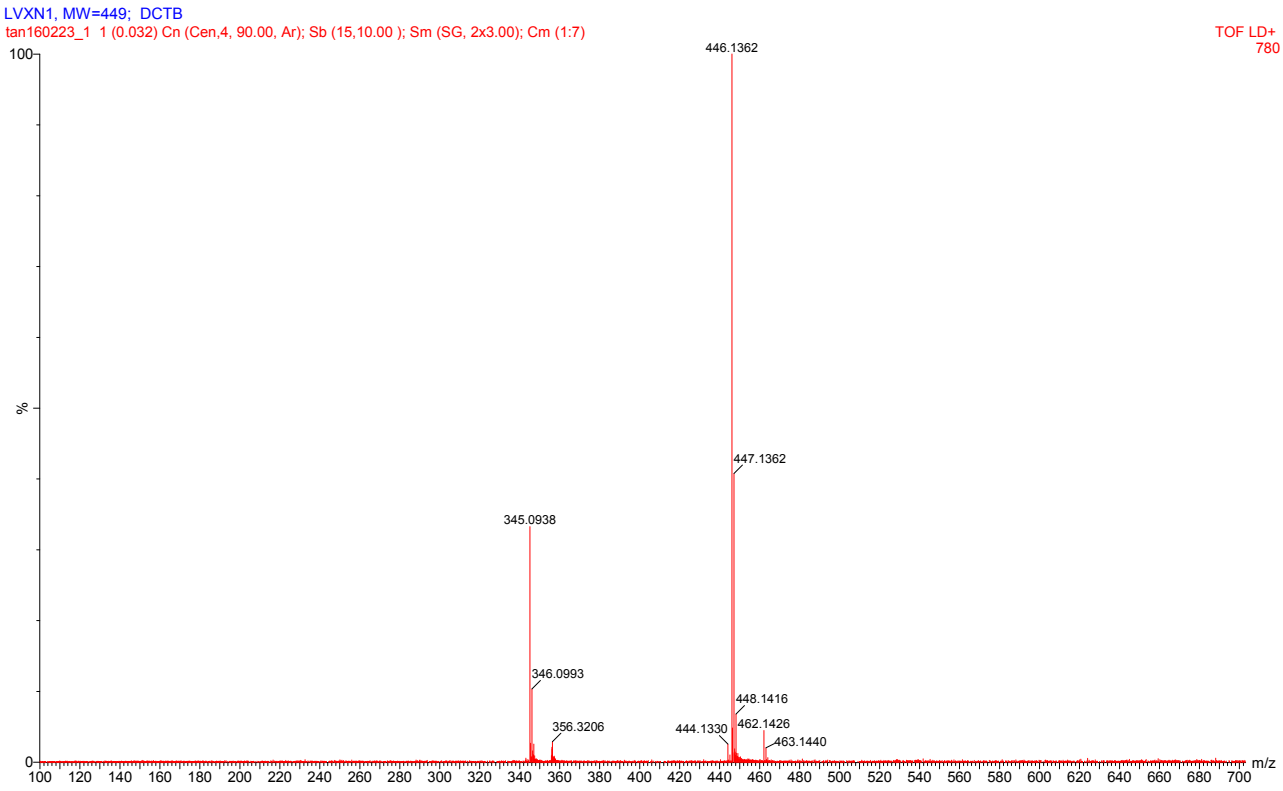


Figure S1. MALDI-TOF of IDATPE.

Effect of water/ACN ratio on IDATPE

The appropriate amount of IDATPE stock solutions were diluted with ACN as well as different portion of water (10%, 20%, 40%, 60%, 80% and 90%) to a final concentration of 40 μM. The solutions were incubated at room temperature for 5 min, followed by photoluminescence (PL) measurement on the fluorimeter with excitation wavelength of 262 nm.

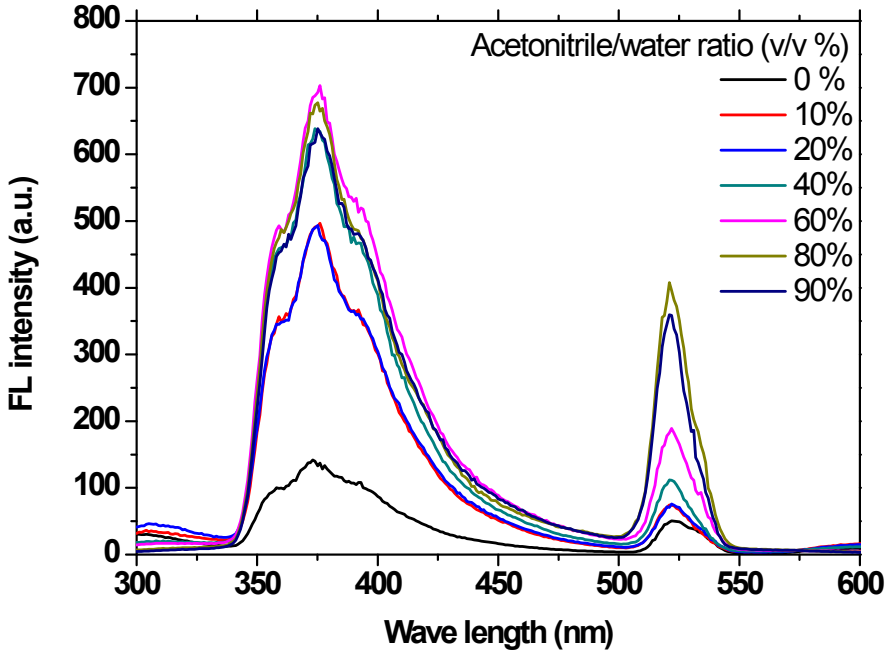


Figure S2. FL spectra of IDATPE in different acetonitrile/water ratios. λ_{ex}=262 nm; [IDATPE]= 40 μm.

Effect of pH on IDATPE

40 μM IDATPE was diluted from 25 mM stock solution with different pH (pH 6-12) solutions which were adjusted by using different concentration of NaOH and HNO_3 solutions. The solutions were incubated at room temperature for 5 min, followed by PL measurement on the fluorimeter with excitation wavelength of 262 nm.

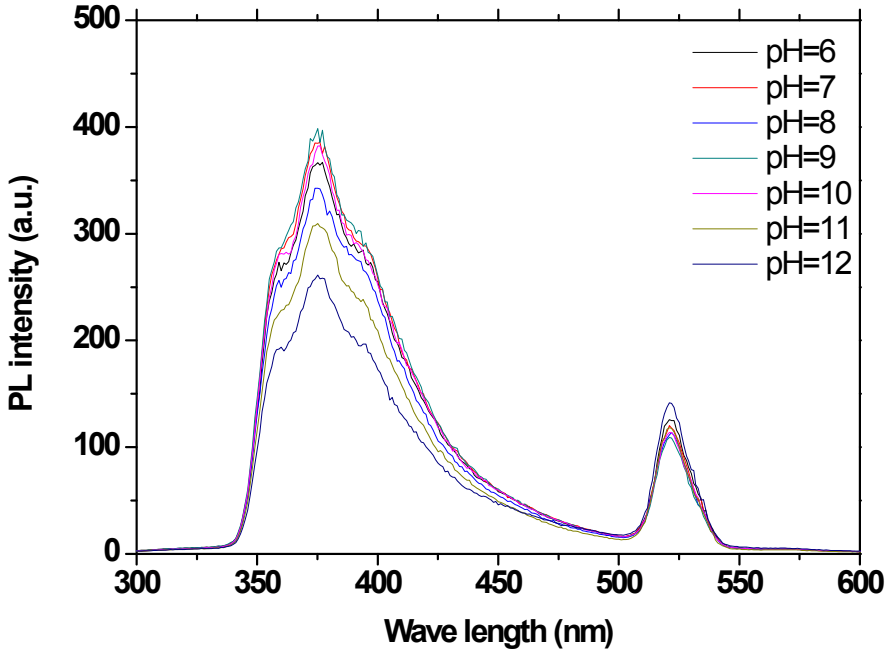


Figure S3. FL spectra with pH values in water. λ_{ex}=262 nm; [IDATPE]= 40 μm; measured at t=5 min.

Effect of creatinine on IDATPE in different concentrations

Different concentration of IDATPE solution was made in artificial urine with or without 70 mM creatinine. After incubated at room temperature for 5 min, the FL intensity was measured at 375 nm with the excitation wavelength at 262 nm.

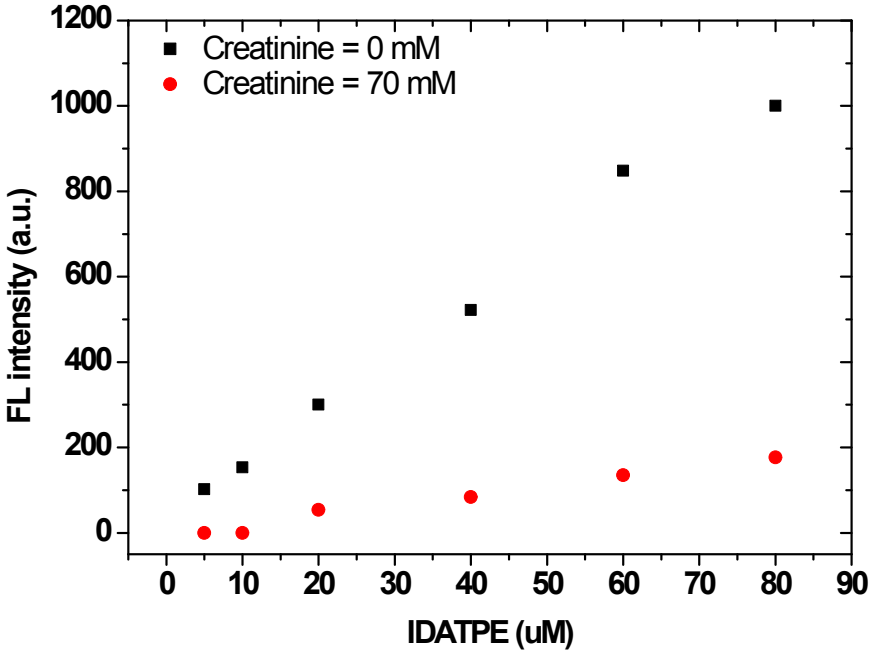


Figure S4. FL intensities at 375 nm with IDATPE concentration without and with 70 mM creatinine in artificial urine. λ_{ex}=262 nm

Time effect on IDATPE mixed with creatinine

Creatinine was mixed with 40 μM IDATPE solution made in artificial urine to a final concentration of 10 mM. FL intensity was measured at the wavelength of 375 nm at different times.

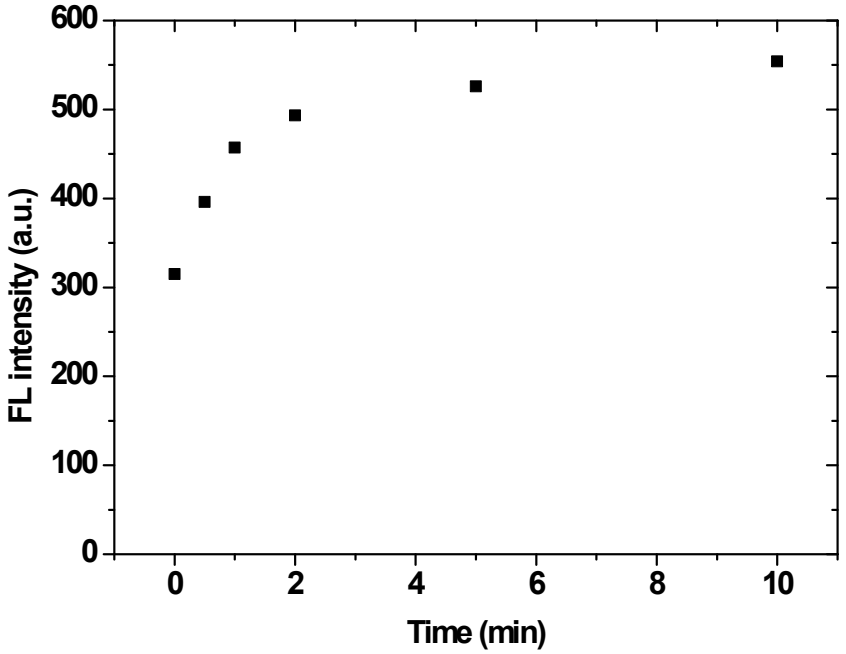


Figure S5. FL intensities evolution at 375 nm with creatinine concentration of 10 mM in artificial urine. λ_{ex}=262 nm; [IDATPE]= 40 μm.

Effect of creatinine on IDATPE in different time course

IDATPE was mixed with different concentration of creatinine solution made in artificial urine to a final concentration of 40 μM. The FL intensity was measured at 375 nm with the excitation wavelength at 262 nm after incubated at room temperature for 0 min, 5 min and 1 hr respectively.

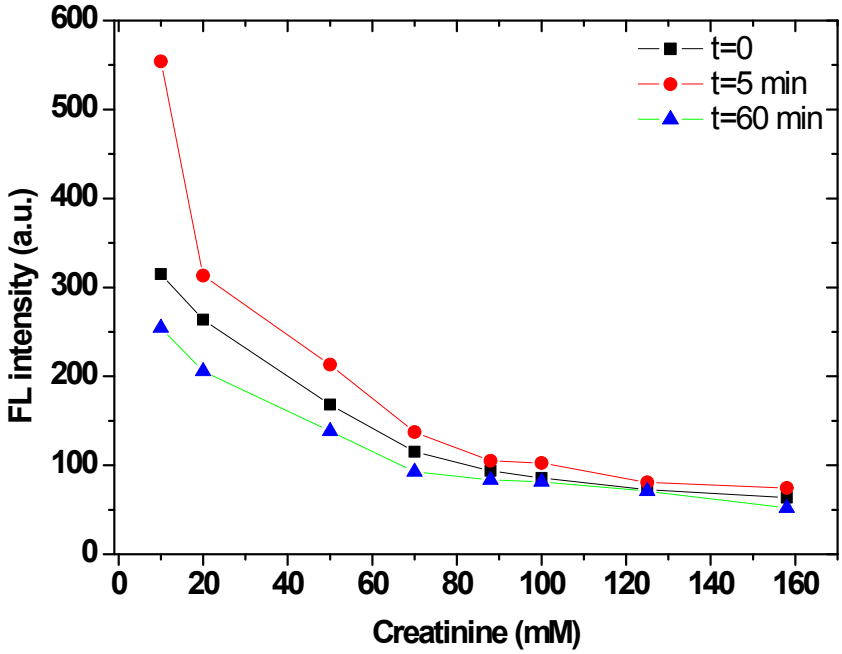


Figure S6. FL intensities at 375 nm with creatinine concentration in artificial urine. λ_{ex}=262 nm; [IDATPE]= 40 μm; measured at different times t=0, 5 and 60 min.

Effect of HSA on IDATPE in detecting creatinine

IDATPE was mixed with different concentration of creatinine solution made in artificial urine with 3.6 μM HSA, to a final concentration of 40 μM. After incubated at room temperature for 5 min, the PL was recorded with the excitation wavelength at 262 nm.

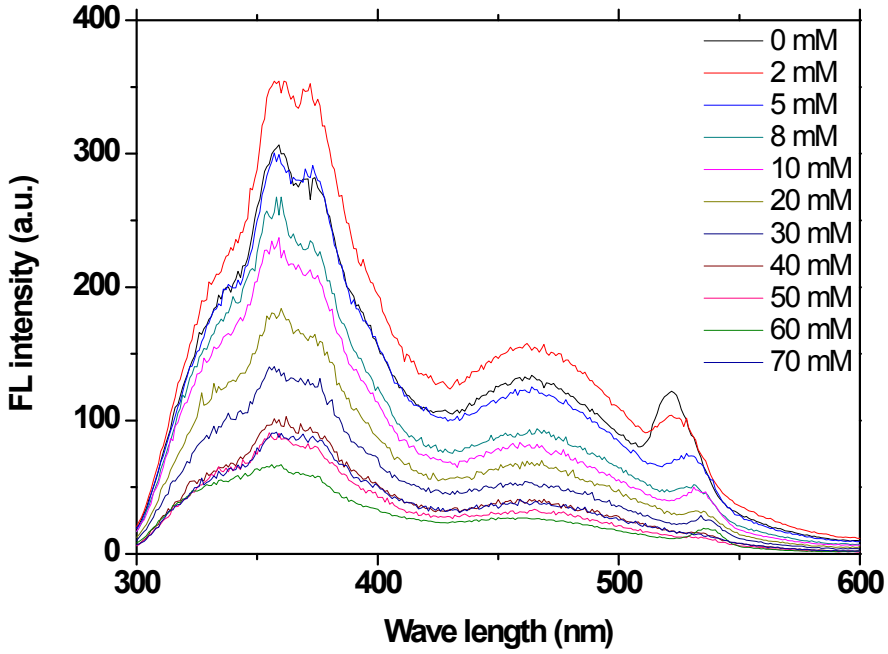


Figure S7. FL spectra of IDATPE with different concentration of creatinine containing 3.6 uM human serum albumin (HSA) in artificial urine. λ_{ex}=262 nm; [IDATPE]= 40 μm; measured at t=5 min.

Preparation of artificial urine

The artificial urine solution was prepared according to the procedure previously published [28].

Table S1. Component of artificial urine used in this study [28].

	Molecular formula	Concentration (mM)	Molar mass
Ammonium chloride	NH_4Cl	15	53.49
Calcium chloride	$CaCl_2$	3	110.98
Creatinine	$C_4H_7N_3O$	varies	113.12
Magnesium sulfate	$MgSO_4$ $7H_2O$	2	246

Monosodium phosphate	NaH_2PO_4	3.6	119.98
Potassium chloride	KCl	30	74.5513
Sodium bicarbonate	$NaHCO_3$	2	84.007
Sodium chloride	NaCl	54	58.44
Sodium citrate	$Na_3C_6H_5O_7$ $2H_2O$	5	294.10
Sodium oxalate	$Na_2C_2O_4$	0.1	133.999
Sodium phosphate dibasic	Na_2HPO_4	0.4	141.96
Sodium sulfate	Na_2SO_4	9	142.04
Urea	CH_4N_2O	200	60.06
Uric acid	$C_5H_4N_4O_3$	1	168.11
pH	6.2		
Specific gravity (g/ml)	1.01		
Osmolality (mOsm/kg)	446		

The molecular weight ratio of HSA/creatinine calculation

M_w of HSA and creatinine is 66437 and 113 g/mol, respectively, use UACR = 30 mg/g as the threshold ratio for the molecular weight ratio of HSA/creatinine calculation.

$$\frac{HSA}{Creatinine} molecular\ ratio = \frac{30\times10^{-3} g / 66437 g / mol}{1g / 113 g / mol} = \frac{30\times113\times10^{-3}\ mol}{66437\ mol} = 0.5\times10^{-4}$$