Aqueous medium fluoride anion sensing by fluorophore encapsulated UiO-66 type zirconium metal–organic framework

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Introduction

Why fluoride anion is important to detect?

- Plays a key role in biological system, health and environment
- Presence of fluoride in drinking water and commercial household product is the emerging concern for public health
- The excess uptake of fluoride causes fluorosis and even chronic renal failure

Zirconium based Metal-Organic Framework (MOF) as sensor

- New class of porous material with huge potential application
- Porous in nature: ideal for guest encapsulation
- Nontoxic: ideal for potential medicinal application
- Stable in broad range of pH: low probability for false response due to pH change
- Presence of fluoride sensitive bond

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Characterization of Zr-based UiO-66 MOF

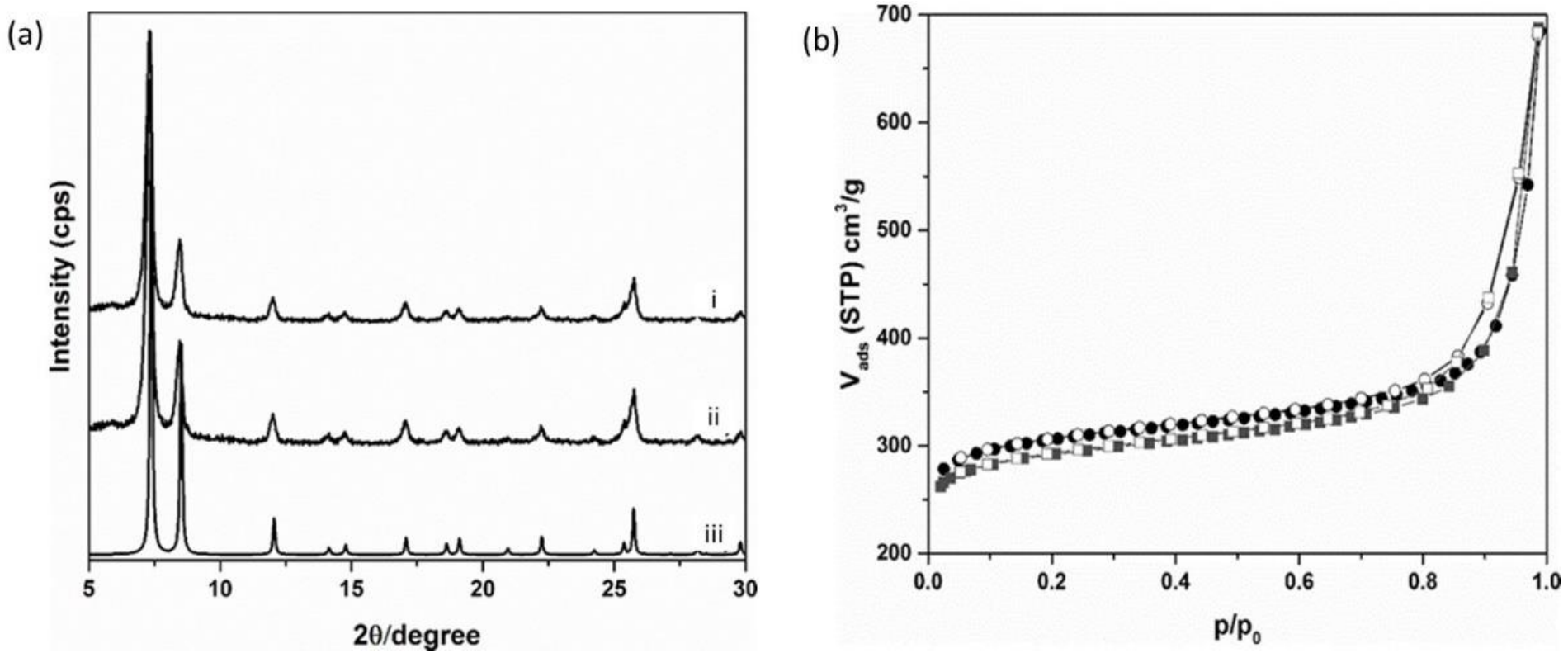

Figure 1. (a) XRPD pattern of (i) pyrene@UiO-66, (ii) only UiO-66 and (iii) simulated pattern of UiO-66 MOF. (b) Nitrogen adsorption (filled symbols) and desorption (empty symbols) isotherms of UiO-66 (circle) and pyrene@UiO-66 (square) collected at –196 °C.

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Anion sensing experiment

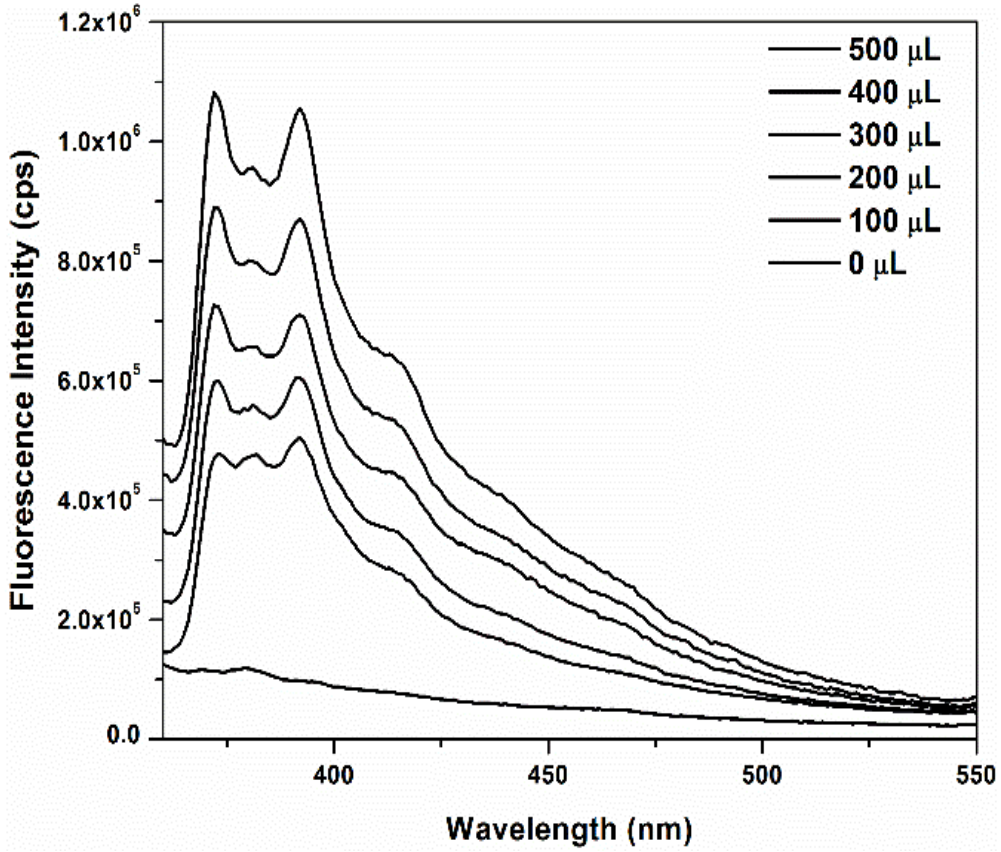

Figure 2: Change in fluorescence intensity with gradual addition of F^- solution to a suspension of pyrene@UiO-66 in aqueous medium.

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Anion sensing experiment

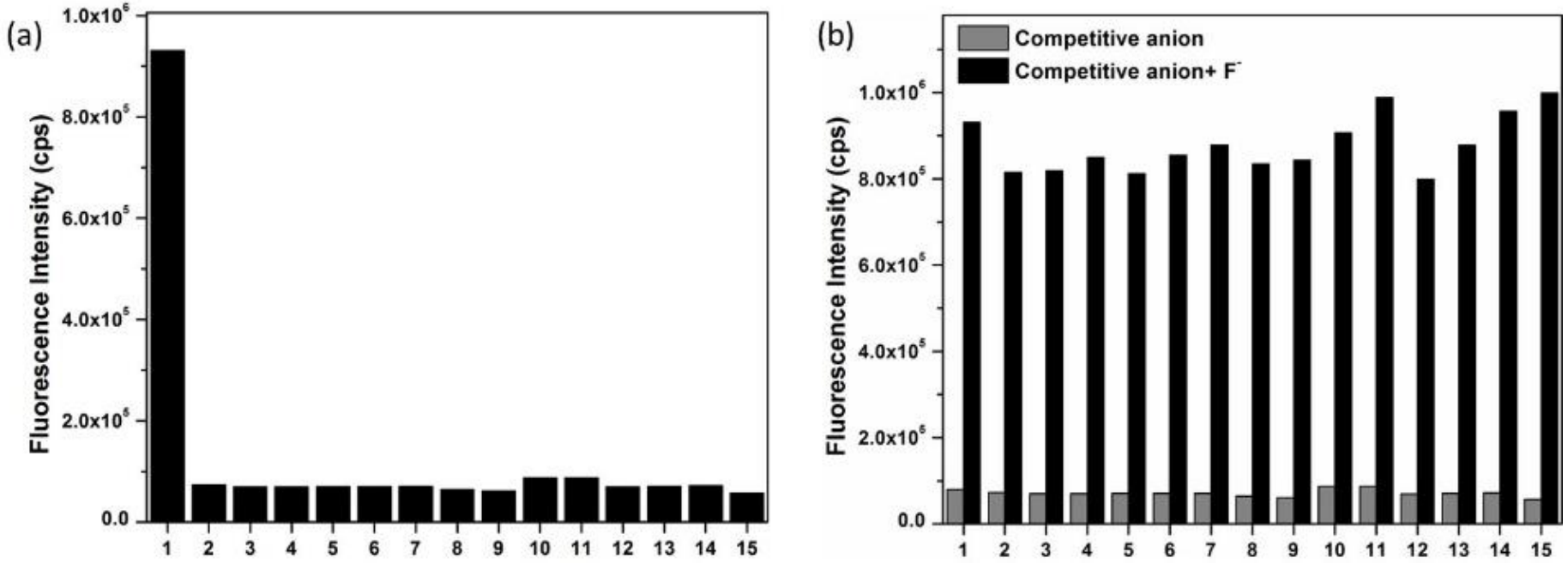

Figure 3: (a) Change in the fluorescence intensity of pyrene@UiO-66 upon incremental addition of different anions. (b) Change in the fluorescence intensity of pyrene@UiO-66 upon addition of F^- solution in the absence and presence of different anions. (F^- (1), Cl^- (2), Br^- (3), I^- (4), NO_2^- (5), No_3^- (6), AcO^- (7), $S_2O_3^{2-}$ (8), HSO_3^- (9), SO_4^{2-} (10), HSO_4^- (11), SO_3^{2-} (12), ClO_4^- (13), SCN^- (14) and HCO_3^- (15))

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Plausible mechanism for sensing

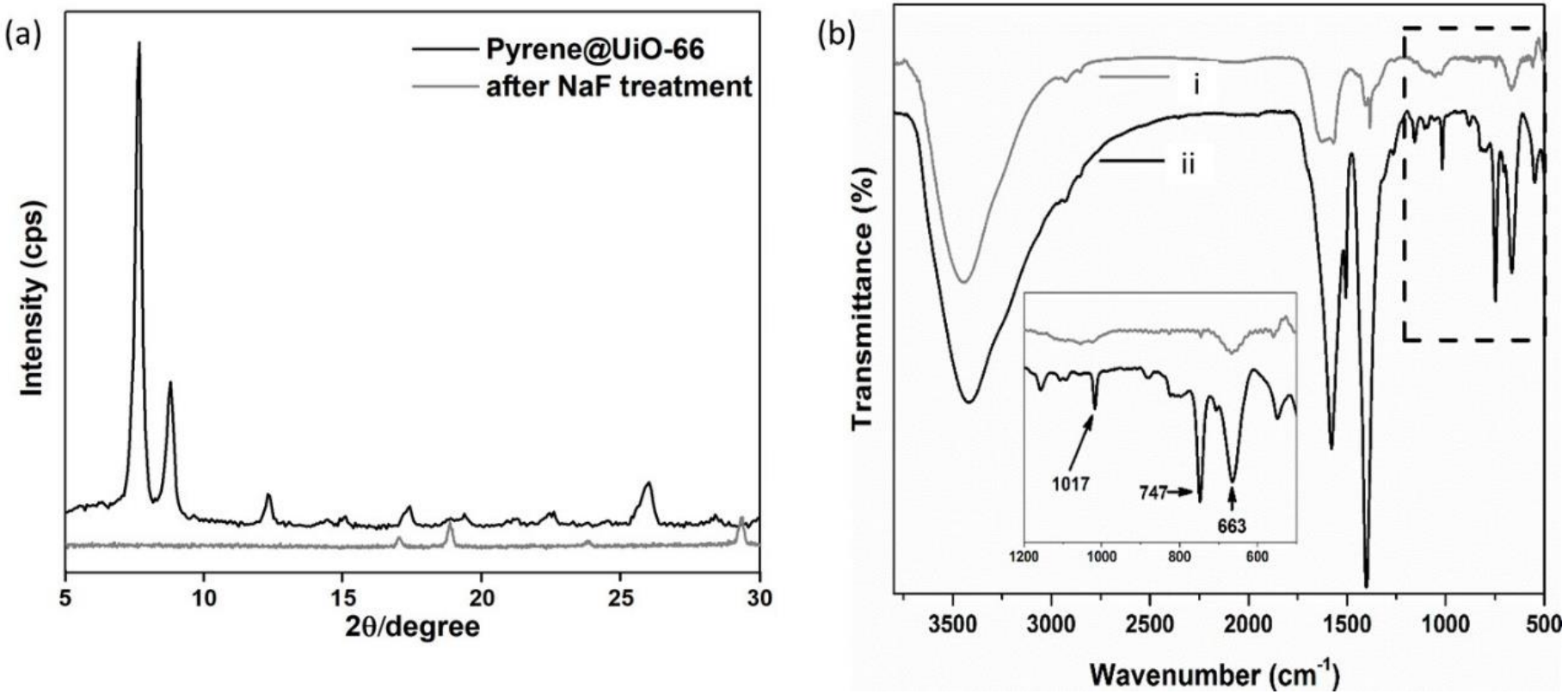

Figure 4: (a) The XRPD pattern and (b) FT-IR spectra of pyrene@UiO-66 before and after fluoride treatment.

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Thank you

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