Supporting Information

for

Ionic liquid-immobilized silica gel as a new sorbent for solid-phase extraction of heavy metal ions in water samples

The Thai Nguyen,[a,b] Tu-Hoai Duy Nguyen,[a,b] Minh-Huy Dinh Dang,[b,c] Linh Ho Thuy Nguyen,[b,c] Tan Le Hoang Doan,[b,c] Thinh Phuc Nguyen, [b,d] Mai Anh Nguyen,[b,d*] and Phuong Hoang Tran [a,b*]

[a] *Department of Organic Chemistry, Faculty of Chemistry, University of Science, Ho Chi Minh City, Vietnam. E-mail: thphuong@hcmus.edu.vn*

[b] *Vietnam National University, Ho Chi Minh City, Vietnam*

[c] *Center for Innovative Materials and Architectures (INOMAR), Ho Chi Minh City, Vietnam*

[d] *Department of Analytical Chemistry, Faculty of Chemistry, University of Science, Ho Chi Minh City, Vietnam. E-mail: namai@hcmus.edu.vn*

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Section S1. SPE column with ionic liquid-grafted silica gel

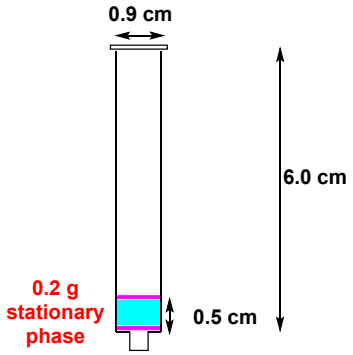
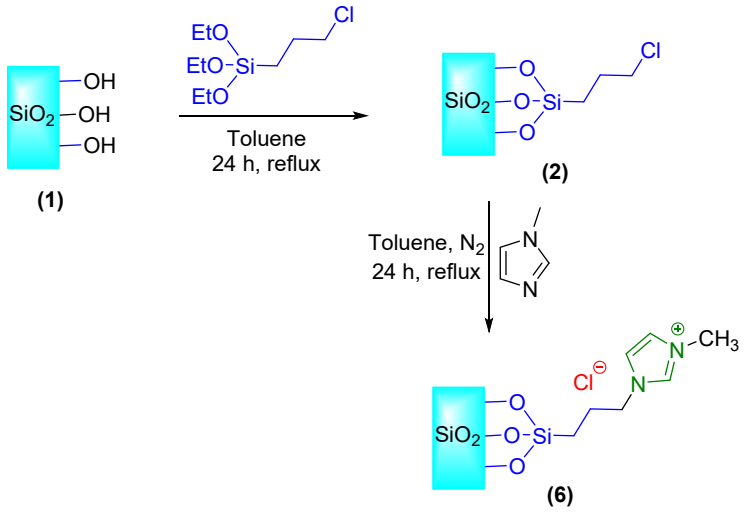


Figure S1. SPE column with ionic liquid-grafted silica gel.

Section S2. Synthetic procedure of ionic liquid-grafted silica gel SiO_2-$(CH_2)_3$-Im-C_1



Scheme S1. Synthetic procedure of SiO_2-$(CH_2)_3$-Im-C_1

The synthetic procedure of ionic liquid-grafted silica gel SiO_2-$(CH_2)_3$-Im-C_1 was shown in Scheme 1. The preparation of activation silica gel (1) and **3-chloropropyl silica (2)** was described in the experimental section of the manuscript. Synthesis of SiO_2-$(CH_2)_3$-Im-C_1 (5') was prepared by the procedure described as follows. 3-Chloropropyl silica (2) (5.0 g) and 1-methylimidazolide (10 mmol, 0.82 g) were added to a 100 ml round-bottomed flask with 30 ml anhydrous toluene. The mixture was refluxed in an oil bath under a nitrogen atmosphere. After refluxing for 24 h, the obtained solid was washed several times by ethanol (5×20 mL) and filtered. The product SiO_2-$(CH_2)_3$-Im-C_1 was dried under vacuum at 100 °C for 12 h. The SiO_2-$(CH_2)_3$-Im-C_1 was confirmed by FTIR, EDX, and TGA.

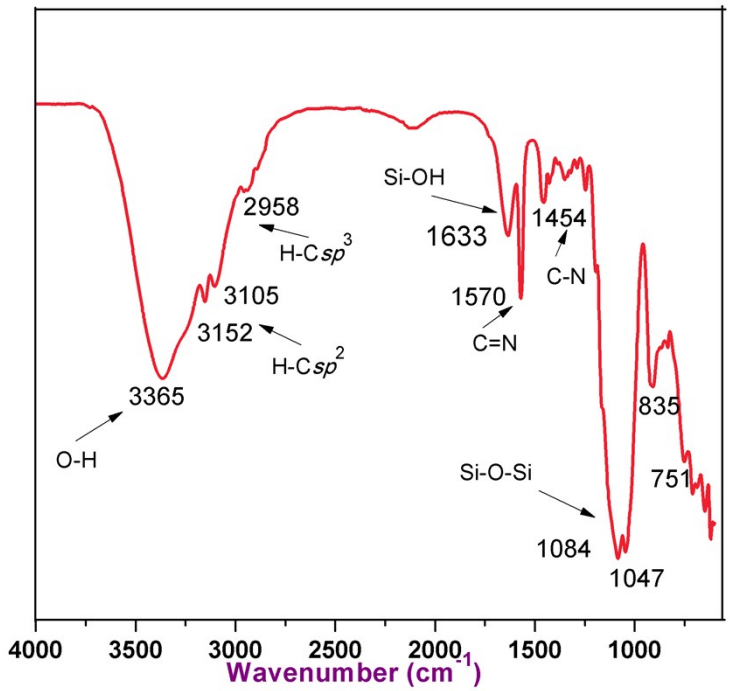


Figure S2. FTIR spectrum of SiO_2-$(CH_2)_3$-Im-C_1.

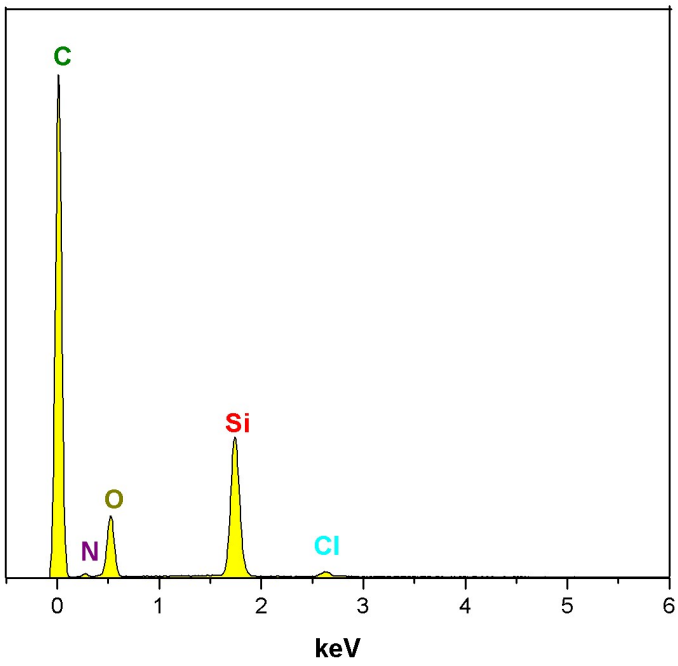


Figure S3. EDX spectrum of SiO_2-$(CH_2)_3$-Im-C_1.

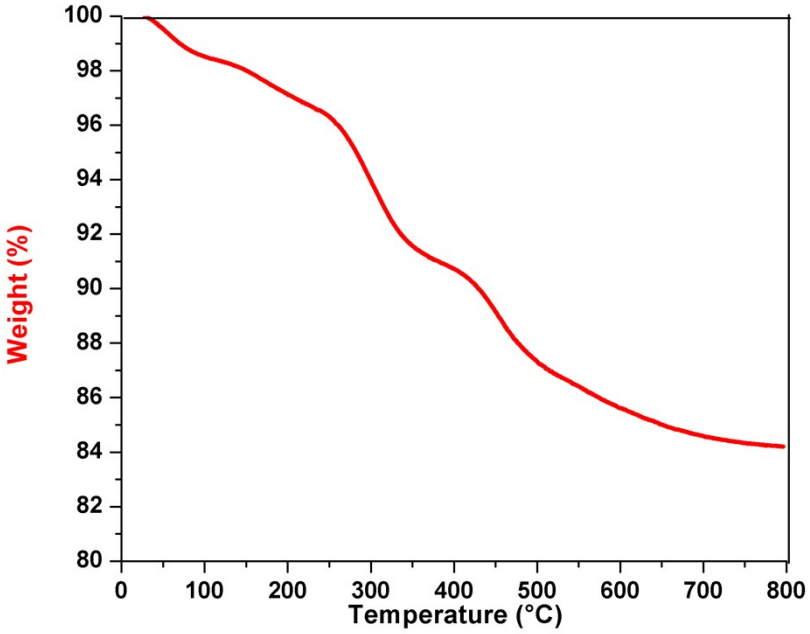
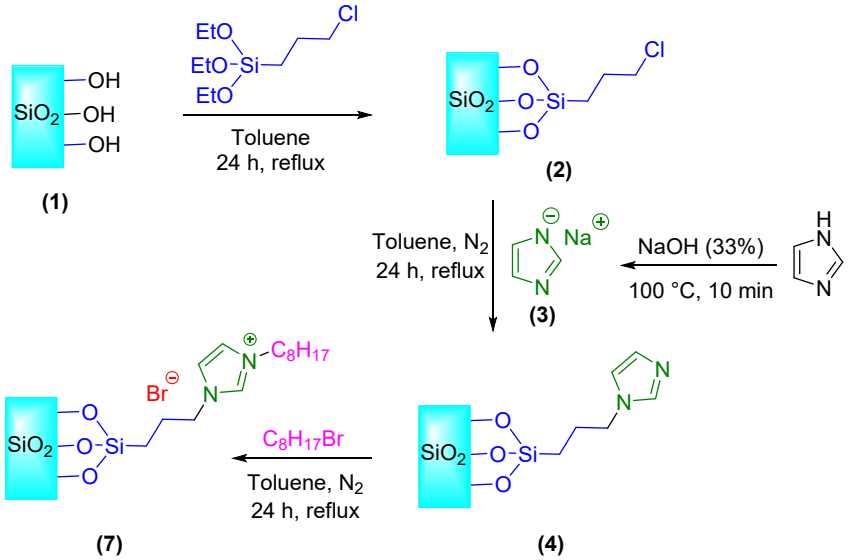


Figure S4. TG analysis of SiO_2-$(CH_2)_3$-Im-C_1.

Section S3. Synthetic procedures of ionic liquid-grafted silica gel SiO_2-$(CH_2)_3$-Im-C_8



Scheme S2. Synthetic procedure of SiO_2-$(CH_2)_3$-Im-C_8

The synthetic procedures of activation silica gel (1), **3-chloropropyl silica (2),** sodium imidazolide (3) and 3-(1-imidazole)propyl silica (4) were described in the experimental section of the manuscript. Next, 3-(1-imidazole)propyl silica gel (3.0 g) was added into 70 ml of a

toluene solution containing 10 mmol of 1-bromooctane (1.92 g) and stirred vigorously. The reaction mixture was heated at 120 °C for 24 h. After the completion of the reaction, the resulting product was rinsed several times with ethanol and water and collected from mixture by filtering. Lastly, the purified product was dried under vacuum at 100 °C for 12 h to afford SiO_2-$(CH_2)_3$-Im-C_8 (7). The SiO_2-$(CH_2)_3$-Im-C_8 was confirmed by FTIR, EDX, and TGA.

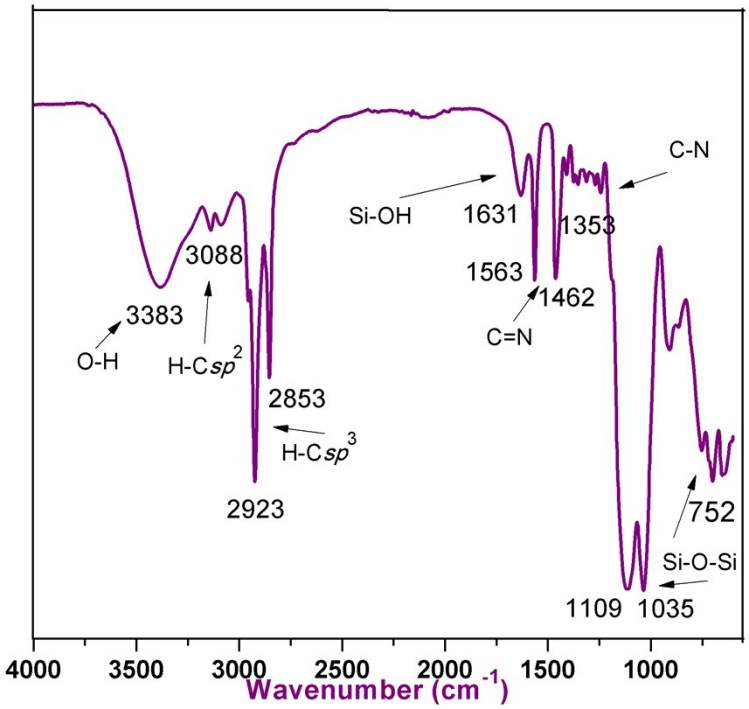


Figure S5. FTIR spectrum of SiO_2-$(CH_2)_3$-Im-C_8.

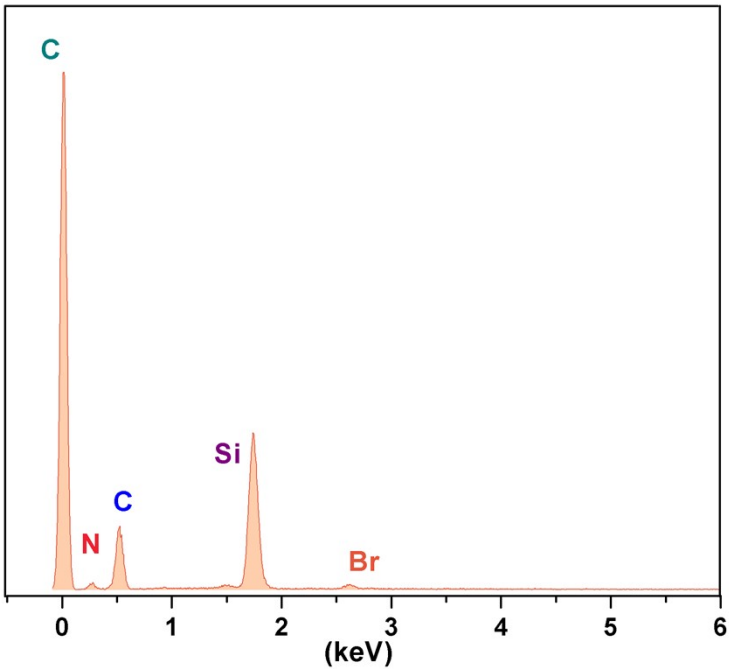


Figure S6. EDX spectrum of SiO_2-$(CH_2)_3$-Im-C_8.

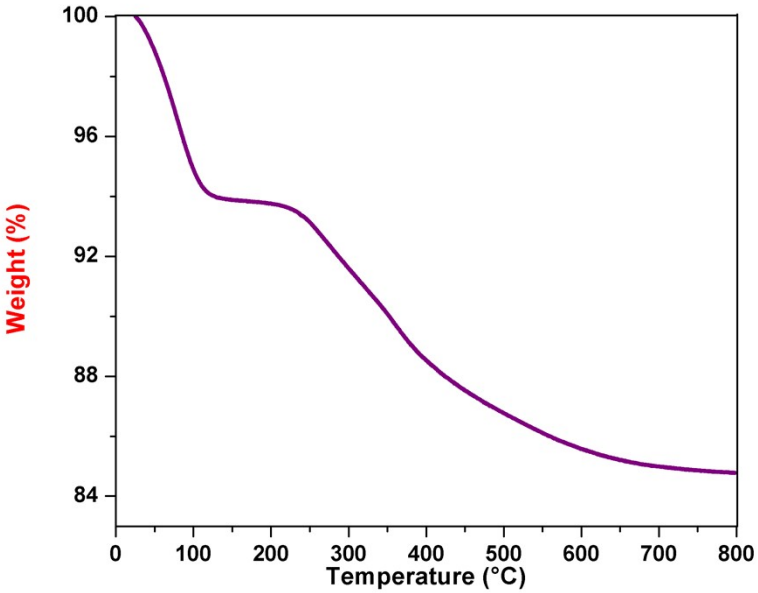


Figure S7. TG analysis of SiO_2-$(CH_2)_3$-Im-C_8.

Section S4. The linear range of the calibration curve

The calibration curves for Cr^{3+}, Ni^{2+}, Cu^{2+}, Cd^{2+}, and Pb^{2+} were linear in the concentration range from 0.1 ppb to 50 ppb with high correlation coefficients from 0.9998 to 1

Metal ion	Linear regression equation	R^2
Cr	y = 39823x + 12248	1
Ni	y = 15982x + 5824.6	1
Cu	y = 39855x + 7669.2	0.9999
Cd	y = 9177.6x - 2531.1	0.9998
Pb	y = 59585x + 19769	0.9999