

Electronic Supplementary Material
Radiation Synthesis of an Imidazole Polymeric Ionic
Liquid Gel with High Adsorption Capacity for
Perrhenate

**Dong Han¹, Xingxiao Li¹, Jing Peng¹, Ling Xu², Jiuqiang Li¹, Huibo Li³, Maolin
Zhai¹**

¹Beijing National Laboratory for Molecular Sciences, Radiochemistry and Radiation
Chemistry Key Laboratory of Fundamental Science, the Key Laboratory of Polymer
Chemistry and Physics of the Ministry of Education, College of Chemistry and
Molecular Engineering, Peking University, Beijing 100871, China

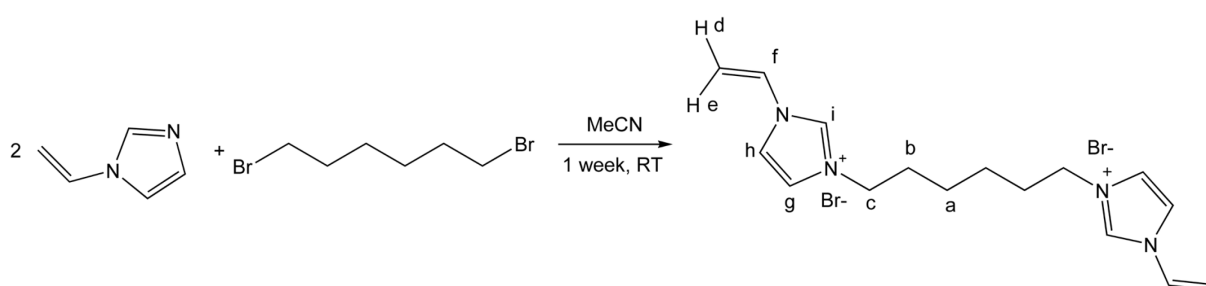
² Department of Energy and Resources Engineering, College of Engineering, Peking
University, Beijing 100871, P. R. China

³China Institute of Atomic Energy, Beijing 102413, China

*Corresponding author: *E-mail address:* mlzhai@pku.edu.cn

1. Synthesis and Characterization of C₆vim₂Br₂

24.4 g (0.100 mol) 1,6-dibromohexane and 21.0 g (0.223 mol) 1-vinylimidazole was mixed into 30mL acetonitrile, and kept in dark for 1 week at room temperature, then white solid product was obtained (Scheme S1). The crude product was filtered and washed by acetone for several times, and then dried in air to get the final product C₆vim₂Br₂.



Scheme S1 Synthesis route of C₆vim₂Br₂

C₆vim₂Br₂ was characterized by ¹H NMR (Bruker AVANCE III, 500 MHz), Elemental analysis (EA, Elementar Vario MICRO CUBE) and ESI-MS (Bruker Apex IV FTMS, positive mode). ¹H NMR(d₆-DMSO): δ=1.32(4H_a), 1.86(4H_b), 4.24(4H_c), 5.44(2H_d), 6.01(2H_e), 7.34(2H_f), 8.01(2H_g), 8.26(2H_h), 9.71(2H_i). EA: 13.0% N, 44.4% C, 5.6% H, which were agreed with the calculated data. ESI-MS: the main peaks occurred at m/z=351.1 and 353.1, which were the isotope peaks of C₆vim₂Br⁺.

2. Adsorption capacities of reported ReO₄⁻ adsorbents

Adsorption capacities of recently reported ReO₄⁻ adsorbents were listed in Table S2. PC₂vimBr gel had the highest capacity of Re at 8.6×10² mg·g⁻¹.

Table S1 Adsorption capacities of reported ReO₄⁻ adsorbents

Adsorbent	Adsorption capacity (mg·g ⁻¹) ^a	Remarks	Ref.
PS-g-4VP-IE	252	theoretical maximum capacity	[1]

bio-char from <i>Acidosasa edulis</i>	14.6	under the optimum conditions.	[2]
surface ion-imprinted microsphere	62.8	pH = 6, Langmuir model	[3]
2-VP grafted PP	ca. 113	pH = 2.2, estimated from figures	[4]
amino-functionalized nano-SiO ₂	3.68	pH = 2.0, Langmuir model	[5]
gel-like polymers containing polyamine	803	Langmuir model	[6]
PC ₂ vimBr gel	8.6×10 ²	Langmuir model	This work

^a Unit of adsorption capacity was converted to mg·g⁻¹(Re) to make it easy to be compared

References

1. J. H. Zu, M. S. Ye, P. Y. Wang, F. D. Tang and L. F. He, *RSC Adv.*, 2016, **6**, 18868-18873.
2. H. Hu, B. Jiang, J. Zhang and X. Chen, *RSC Adv.*, 2015, **5**, 104769-104778.
3. X. Shu, L. Shen, Y. Wei and D. Hua, *Journal of Molecular Liquids*, 2015, **211**, 621-627.
4. J.-H. Zu, Y.-Z. Wei, M.-S. Ye, F.-D. Tang, L.-F. He and R.-Q. Liu, *Nuclear Science and Techniques*, 2015, **26**, 510302 (510307 pp.)-510302 (510307 pp.).
5. Y. Li, Q. Wang, Q. Li, Z. Zhang, L. Zhang and X. Liu, *Journal of the Taiwan Institute of Chemical Engineers*, 2015, **55**, 126-132.
6. B. Gierczyk, M. Ceglowski and M. Zalas, *Plos One*, 2015, **10**.