Supporting Information

Hydrothermal Synthesis of Natroalunite Nanostructures and Their F^--ion Adsorption Properties in Water

TongIl Kim[1,2], HakSung Yun[2], JinHyok Ho[1,3], Yung Jon[2], SeGwon O[1,4], ChangSok Kim[1,4], Yang Li[1], Jiao Wang[1], Xianhua Liu[1]*

[1] School of Environmental Science and Engineering, Tianjin University Tianjin, 300072, P. R. China

[2] Institute of Chemistry and Biology, University of Science, Pyongyang, 950003, D. P. R. Korea

[3] Faculty of Electronics and Automation, Kim Il Sung University, Pyongyang, 950001, D. P. R. Korea

[4] Collage of Chemistry, University of Science, Hamhung, 950003, D. P. R. Korea

Table S1. The experiment conditions for the products with different morphologies and crystal phases.

No	$Al_2(SO_4)_3 \cdot 18H_2O$ (mmol)	AcNa (mmol)	IL (mmol)	Tem. °C	morphology of product	Phase of product
S-0	3.0	2.5	0	130	irregular	alunite
S-0'	3.0	2.5	0	150	irregular	alunite
S-1	3.0	2.5	0.7	130	cylindrical	alunite
S-2	3.0	2.5	2.0	130	nanosheet	alunite
S-3	3.0	2.5	3.5	130	nanosheet	alunite
S-4	3.0	2.5	5.0	130	flower like	alunite
S-1'	3.0	2.5	0.7	150	particle	alunite
S-2'	3.0	2.5	2.0	150	particle + plate	alunite
S-3'	3.0	2.5	3.5	150	particle + plate	alunite
S-4'	3.0	2.5	5.0	150	hexagonal plate	alunite
S-5	3.0	5.0	5.0	150	particle	alunite + Ac_2AlOH
S-6	3.0	7.5	5.0	150	particle	Ac_2AlOH

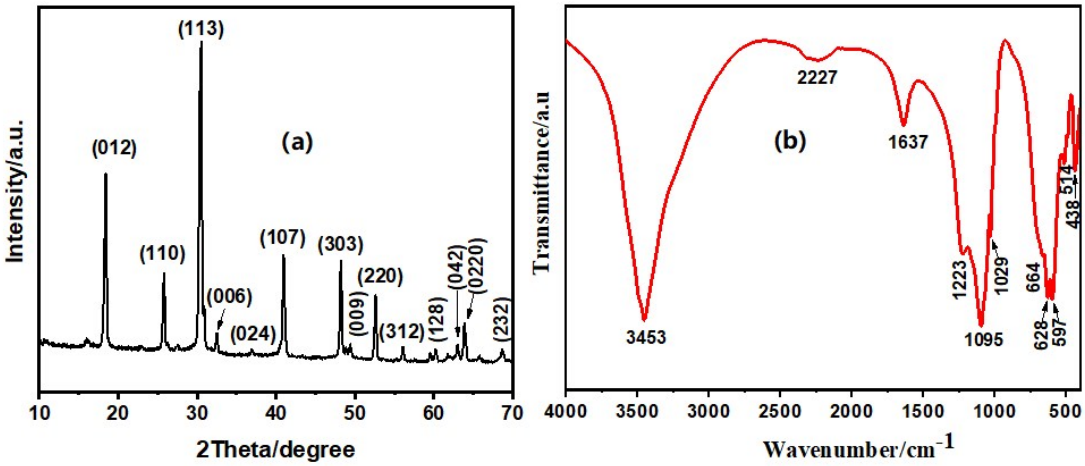


Figure S1. XRD pattern (a) and FTIR spectrum (b) of as-prepared product (S-4': 5 mmol of $[C_{12}mim]Cl$ at 150 ℃ for 10 h).

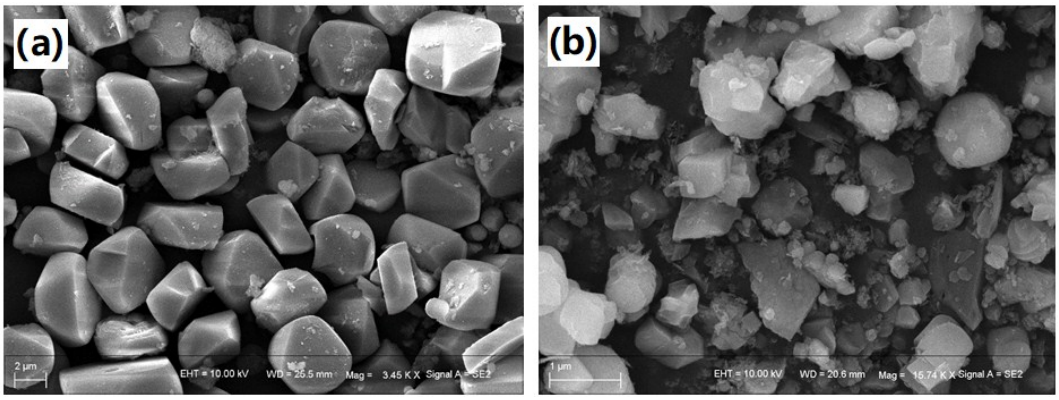


Figure S2. The FE-SEM images of as-prepared products without ionic liquid for 10 h (a: 130 °C, b:150 °C).

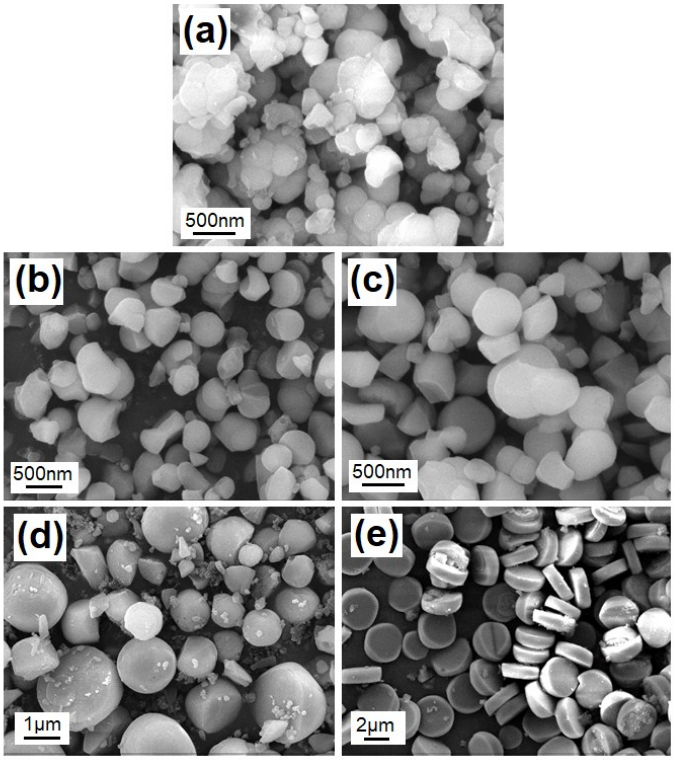


Figure S3. The FE-SEM images of the samples at 130 ℃ for (a) 1, (b) 2, (c) 3, (d) 5 and (e) 7 h, respectively.

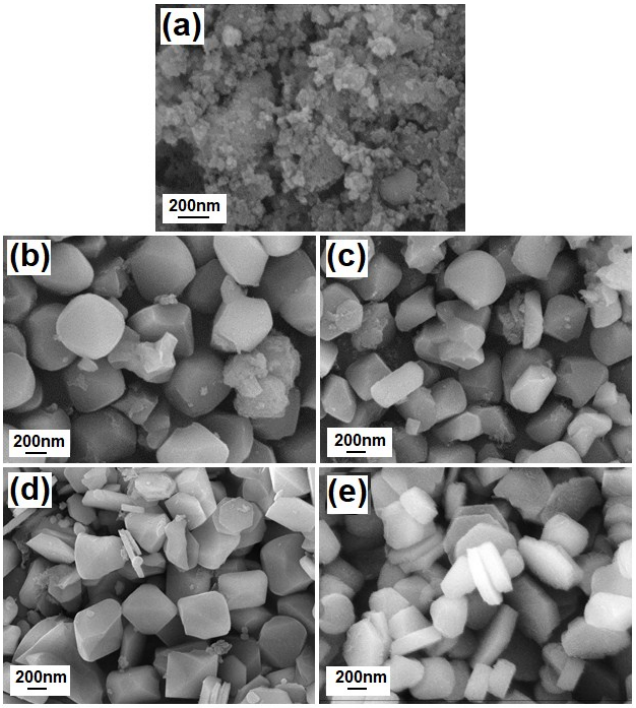


Figure S4. The FE-SEM images of the samples at 150 ℃ for (a) 1, (b) 2, (c) 3, (d) 5 and (e) 7 h, respectively.

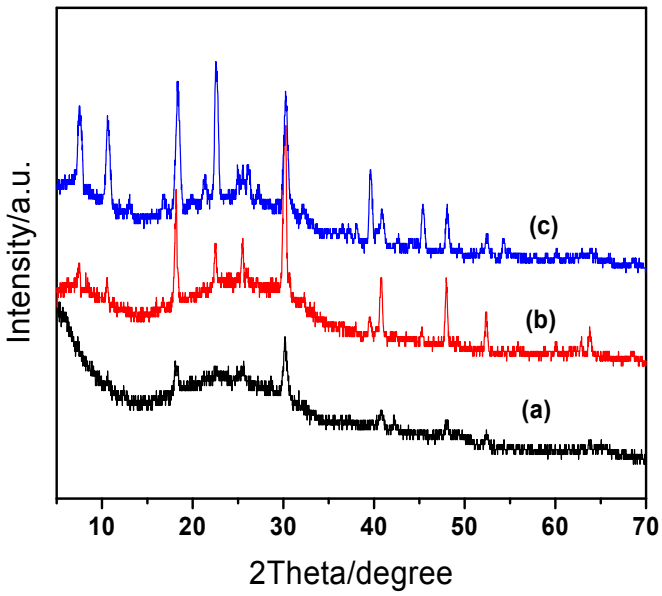


Figure S5. XRD spectra of the products obtained with different amount of AcNa at 130 ℃ for 2 h (a: 2.5, b: 5, c: 7.5 mmol).

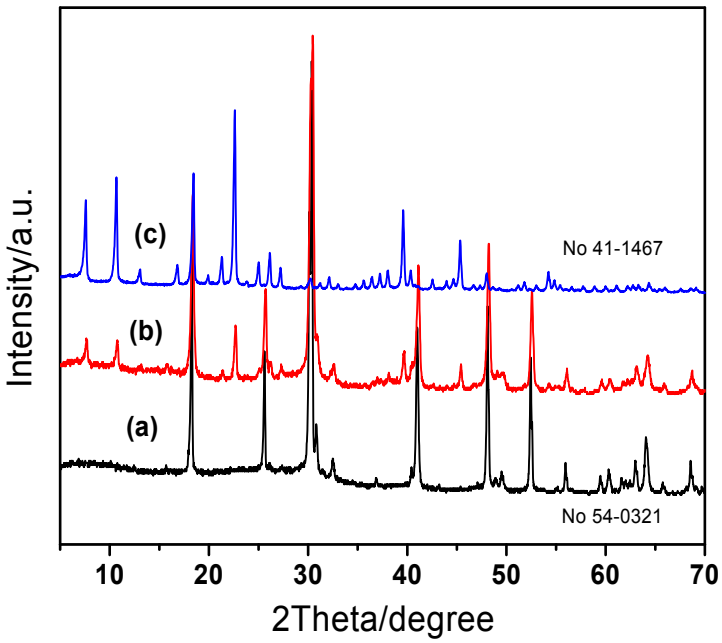


Figure S6. XRD spectra of the products obtained with different amount of AcNa at 130 ℃ for 10 h (a: 2.5, b: 5, c: 7.5 mmol).

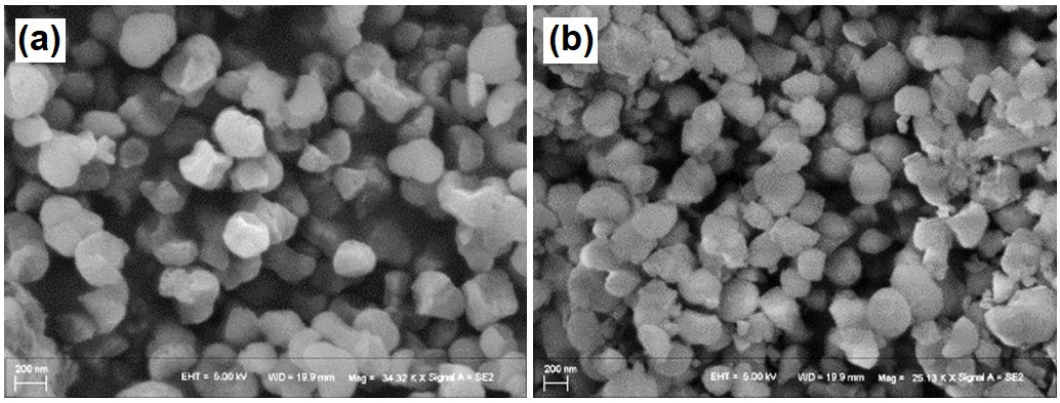


Figure S7. SEM images of the products obtained with different amount of AcNa at 130 ℃ for 10 h (a: 5, b: 7.5mmol).

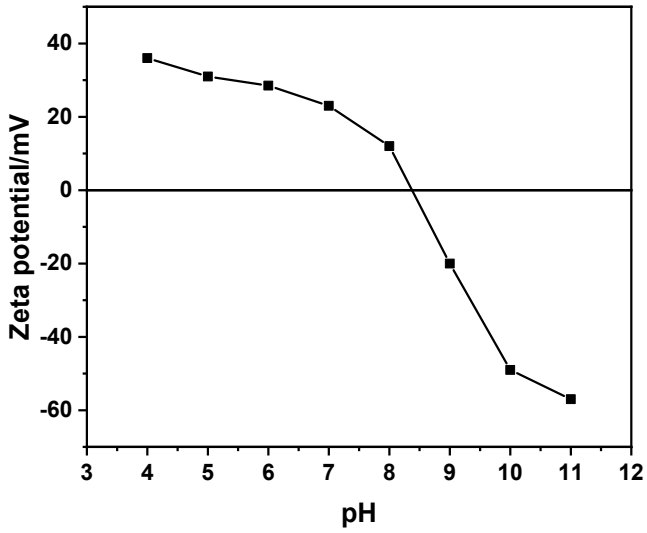


Figure S8. Zeta potential of natroalunite hexagonal nanoplate (S4') as a function of pH.

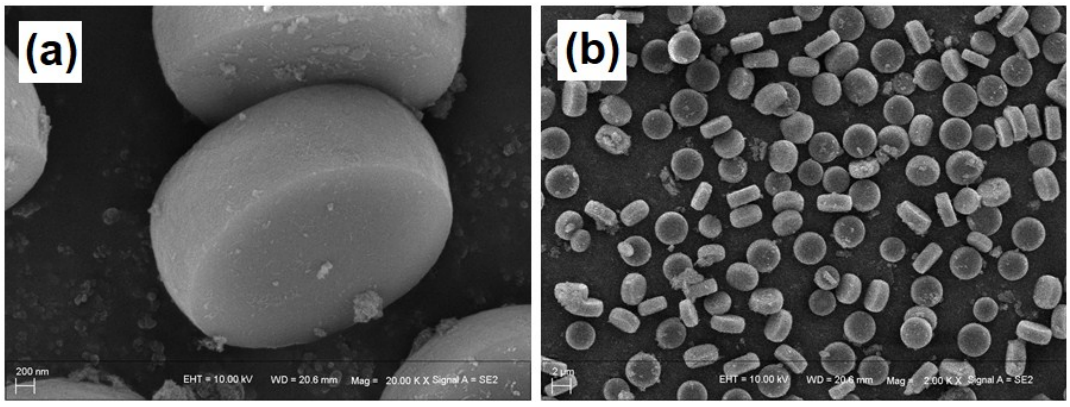
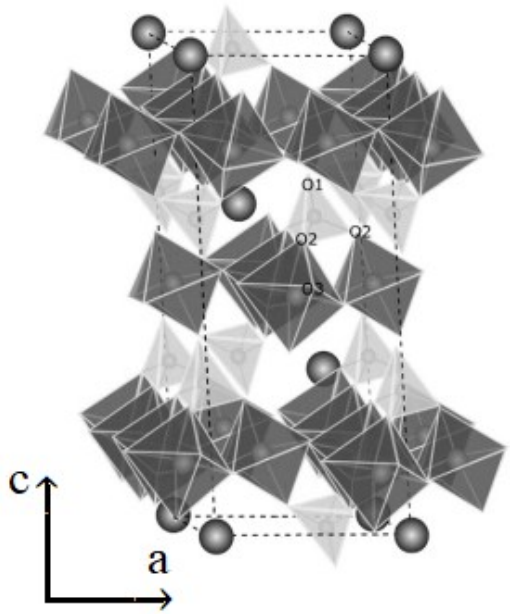


Figure S9. The FE-SEM images of as-prepared product with ionic liquid [Bmim] at

130 °C for 10 h.



Scheme S1. Schema of the natroalunite structure.† The dashed lines show the unit cell. SO_4 groups are the light colored tetrahedra, $Al–O_2(OH)_4$ octahedra are dark grey and the large spheres represent Na. The SO_4 group is triply coordinated with $Al–O_2(OH)_4$ octahedra through the O_2 atom, whereas the O_1 (apical) atom is not coordinated. The O_3 atom is linked as OH group (H atoms are not shown).

† Sunyer, A.; Viñals, J. Arsenate substitution in natroalunite: A potential medium for arsenic immobilization. Part 1: Synthesis and compositions *Hydrometallurgy* **2011**, *109*, 54-64.