

Article

FAU-Type Zeolite Synthesis from Clays and Its Use for the Simultaneous Adsorption of Five Divalent Metals from Aqueous Solutions

Ifeoma V. Joseph *, Lubomira Tosheva *, Gary Miller and Aidan M. Doyle

Department of Natural Sciences, Manchester Metropolitan University, Chester Street, Manchester M1 5GD, UK; g.miller@mmu.ac.uk (G.M.); a.m.doyle@mmu.ac.uk (A.M.D.)

* Correspondence: i.joseph@mmu.ac.uk (I.V.J.); l.tosheva@mmu.ac.uk (L.T.)

Citation: Joseph, I.V.; Tosheva, L.; Miller, G.; Doyle, A.M. FAU-Type Zeolite Synthesis from Clays and Its Use for the Simultaneous Adsorption of Five Divalent Metals from Aqueous Solutions. *Materials* **2021**, *14*, 3738. <https://doi.org/10.3390/ma14133738>

Academic Editors: Miguel A. Camblor and Serena Esposito

Received: 29 April 2021

Accepted: 30 June 2021

Published: 3 July 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

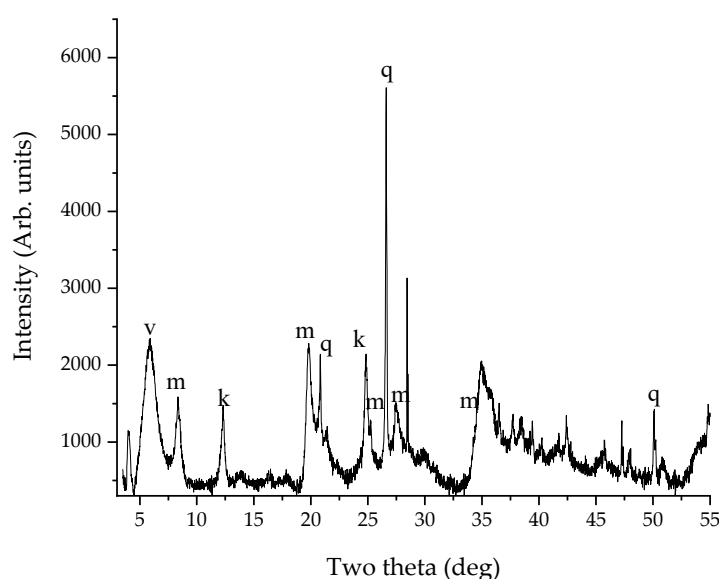


Figure S1. XRD patterns of oriented raw vermiculite - kaolinite clay (VK). k kaolinite, m muscovite, v vermiculite, q quartz.

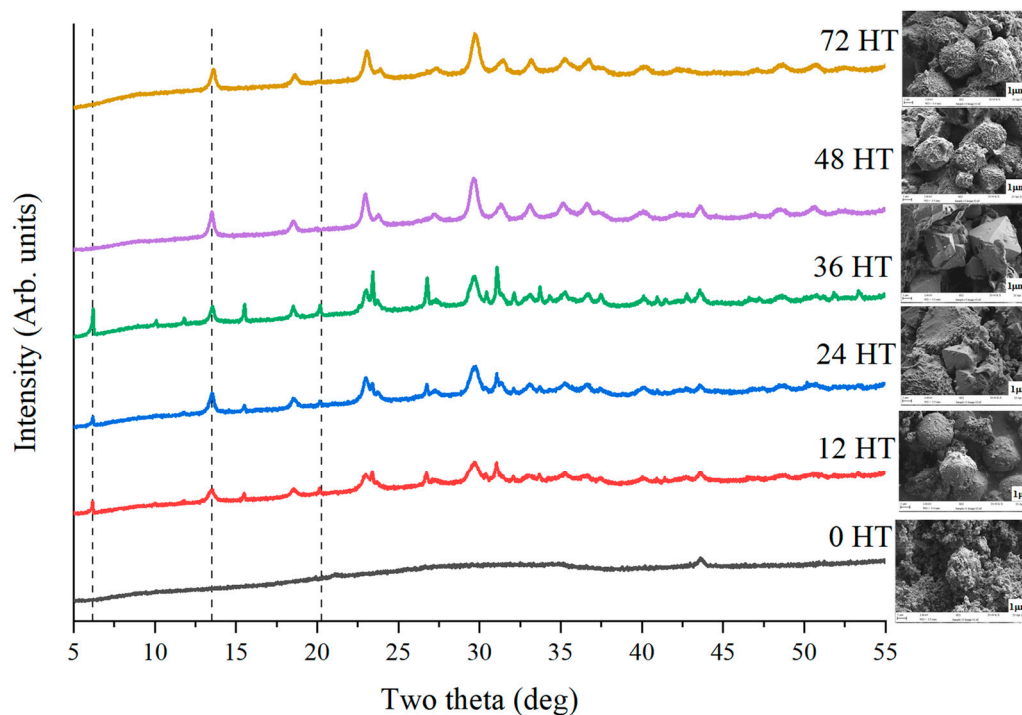


Figure S2. XRD patterns of FAU zeolites from VK for hydrothermal treatment (HT) times from 0 h to 72 h. Dashed lines represent the main FAU zeolite peaks. Inserts contain SEM images of the corresponding samples.

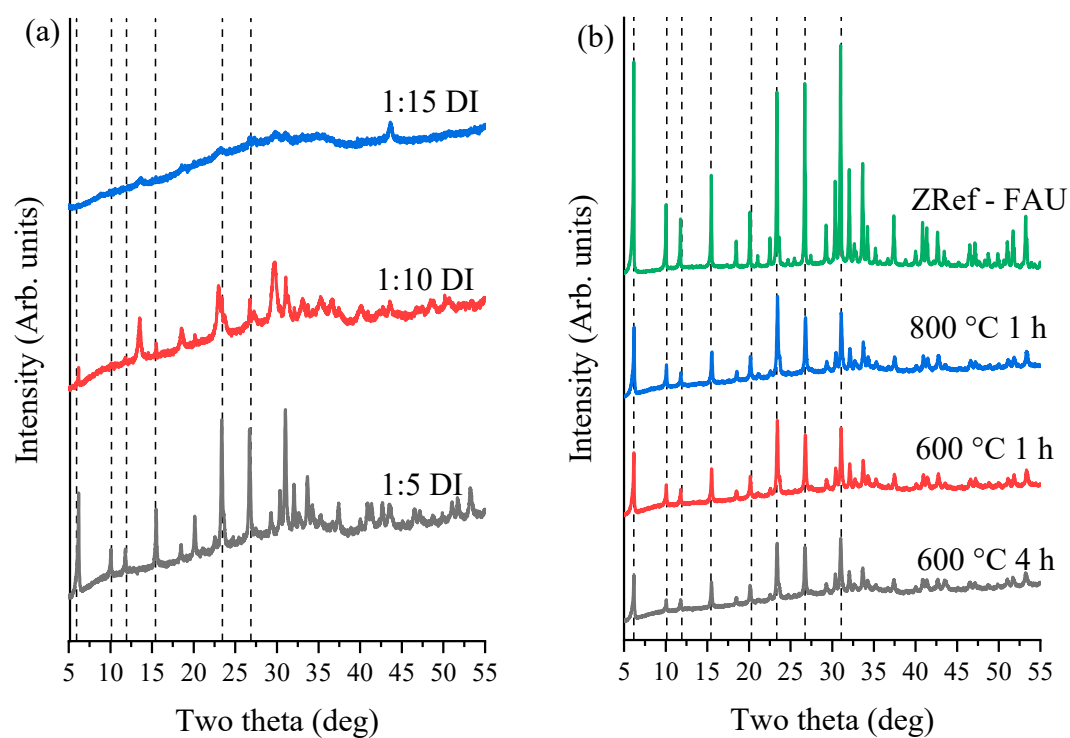
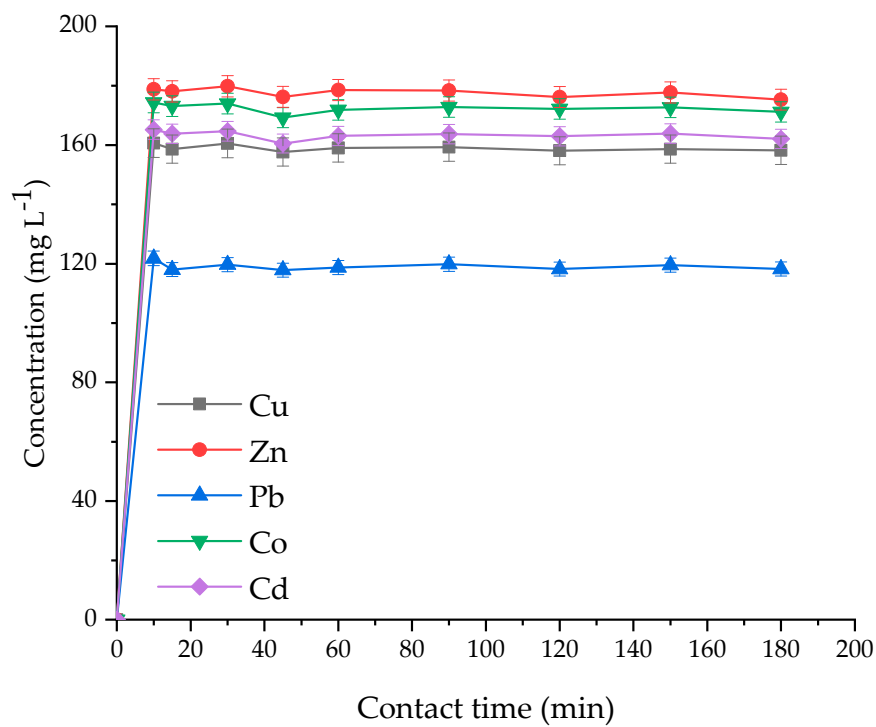


Figure S3. XRD patterns FAU zeolites prepared using (a) fused sample to deionised (DI) water mass ratios of 1:5 to 1:15 and (b) different temperatures and times during the alkaline fusion step. Dashed lines represent main FAU zeolite peaks.

Table S1. XRF chemical compositions (wt%) of reference zeolite (ZRef-FAU) and the optimal zeolite from clay (ZVK-FAU).

Adsorbent	SiO ₂	Al ₂ O ₃	Na ₂ O	MgO	Fe ₂ O ₃	TiO ₂	CaO
ZRef-FAU	32.20	23.50	18.90		0.03	0.00	0.01
ZVK-FAU	42.80	22.50	19.00	2.69	9.31	1.44	1.13

**Figure S4.** Raw VK adsorption studies using 5 g L⁻¹ clay loading for C₀ = 200 mg L⁻¹ and duration of 10 to 180 min.