chemistry proceedings

MDPI

Abstract

Burned Clay Ceramics Used in Water Treatment †

Andrei Victor Sandu [1,2,3]

[1] Faculty of Materials Science and Engineering, Gheorghe Asachi Technical University of Iași, Blvd. D. Mangeron 71, 700050 Iași, Romania; sav@tuiasi.ro
[2] National Institute for Research and Development in Environmental Protection, 294 Spl. Independenței Blv., 060031 Bucharest, Romania
[3] Romanian Inventors Forum, Str. Sf. P. Movila 3, 700089 Iași, Romania

† Presented at the 17th International Symposium "Priorities of Chemistry for a Sustainable Development" PRIOCHEM, Bucharest, Romania, 27–29 October 2021.

Keywords: ceramics; acid-base character; caustic module; water treatment

This research is the result of a detailed study performed on construction bricks and traditional ceramics of fired clay involved in water treatments as the last stage of filtration after the active charcoal. Using the data obtained through the scanning electron microscope coupled with energy-dispersive X-ray analysis and pH analyses, on the basis of the atomic composition and free concentration of hydronium ions, the normal caustic (Si/Al) and summative [(Si+Ti+FeIII+Cl)/(Al+Ca+Mg+Na+K)] modules were assessed. These data were correlated with the free acidity and, respectively, the capacity of absorption and ionic exchange of the Fe^{3+} and Al^{3+} ions [1,2]. The base-acidic activity of these groups from the structure of the fired-clay ceramics is due to the Si:Al stoichiometric ratio (known in practice as the caustic module, which varies from 1:1 to 4:1), but also the position of the two coordination centers of the basic elementary cell [3,4]. The capacity for ionic exchange is attributed to the acidic structures Si(IV)–O^-H^+, Ti(IV)–O^-H^+, and Fe(III)–O^-H^+. The ceramics with high concentrations of Al(III), Ca(II), and Mg(II) have a character that varies from amphoteric to weakly basic, while those with Si(IV), Ti(IV), and Fe(III) vary from amphoteric to acidic. As a conclusion, based on the caustic module of the ceramics with a high capacity for ionic exchange, the materials presented good performances, even though they have a low cost as waste materials or scraps from the technological flow of construction bricks/tiles or traditional ceramics.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

check for updates

Citation: Sandu, A.V. Burned Clay Ceramics Used in Water Treatment. *Chem. Proc.* **2022**, *7*, 20. https://doi.org/10.3390/chemproc2022007020

Academic Editors: Mihaela Doni, Florin Oancea, Zina Vuluga and Radu Claudiu Fierăscu

Published: 3 March 2022

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

References

1. Sandu, A.V.; Vasilache, V.; Sandu, I.G.; Sieliechi, J.M.; Kouame, I.K.; Matasaru, P.D.; Sandu, I. Characterization of the acid-base character of burned clay ceramics used for water decontamination. *Materials* **2019**, *12*, 3836. [CrossRef] [PubMed]
2. Sandu, I.; Cretu, M.A.; Sandu, I.G.; Vasilache, V.; Sandu, A.V.; Marusic, G. *Implicarea Ceramicilor in Potabilizarea Apelor de Suprafata si Subterane*; Universitații Alexandru Ioan Cuza Iași: Iași, Romania, 2018; p. 250, ISBN 978-606-714-451-2.
3. Luhar, I.; Luhar, S.; Abdullah, M.M.A.; Nabialek, M.; Sandu, A.V.; Szmidla, J.; Jurczynska, A.; Razak, R.A.; Aziz, I.H.A.; Jamil, N.H.; et al. Assessment of the suitability of ceramic waste in geopolymer composites: An appraisal. *Materials* **2021**, *14*, 3279. [CrossRef] [PubMed]
4. Dascalu, M.E.; Nedeff, F.; Sandu, I.; Mosnegutu, E.; Sandu, A.V.; Lopez-Ramirez, J.A. Mathematical model regarding the application of the excitation-emission matrix spectroscopy in nanofiltration process using humic acid with a TiO_2 ceramic membrane. *Mater. Plast.* **2019**, *54*, 995–1002. [CrossRef]