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Adsorption isotherms, kinetics and thermodynamics of NH_4^+–N from aqueous solutions using modified ceramsite and its regeneration performance

Tianpeng Li[a,b], Tingting Sun[c], Tallal Bin Aftab[a], Dengxin Li[a,*]

[a]*College of Environment Science and Engineering, Donghua University, Shanghai 201620, China, Tel. +86 2167792541; Fax: +86 2167792522; emails: lidengxin@dhu.edu.cn (D. Li), tianpeng985@126.com (T. Li), Tel. +86 13122174017; email: tallal@live.com (T.B. Aftab)*
[b]*College of City and Architecture Engineering, Zaozhuang University, Zaozhuang, Shandong 277160, China*
[c]*School of Basic Medical Science, Wenzhou Medical University, Wenzhou, Zhejiang 325035, China, Tel. +86 57188208160; email: ttsun@zju.edu.cn*

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ABSTRACT

Ceramsite was prepared from solid wastes by high-temperature sintering process and modified using NaCl solution. The adsorption of ammonium nitrogen (NH_4^+–N) from aqueous solution by modified ceramsite (MC) and its chlorination regeneration were investigated. The results showed that the q_e of MC was 2.49 mg/g after being stirred for 180 min when initial concentration of NH_4^+–N was 100 mg/L at 328 K, which was 1.79 times higher than that of ceramsite. The adsorption process of NH_4^+–N on MC can be well described by the Langmuir isotherm model in the whole experiments, with $R^2 > 0.95$ and root mean squared error (RMSE) < 0.02. On the contrary, the adsorption process of NH_4^+–N on ceramsite followed the Freundlich isotherm model, with $R^2 > 0.95$. Compared with the pseudo-second-order reaction kinetics, the adsorption of NH_4^+–N onto MC fitted better in the pseudo-first-order reaction kinetics when initial concentration of NH_4^+–N was 35 mg/L at 298 K, with $R^2 > 0.95$, standard deviation error <0.13 and RMSE <0.13. The thermodynamics results indicated that the adsorption process of NH_4^+–N onto MC was a spontaneous, endothermic and physisorption process. Moreover, the regeneration results demonstrated that NaClO solution was an effective regenerant for the recovery of exhausted MC, the q_e of MC was about 1.50 mg/g even after 15 cycles and no significant change compared with initial.

Keywords: Ceramsite; Modification; Adsorption capacity; Physisorption process; Chlorination

* Corresponding author.