Adsorption isotherms, kinetics and thermodynamics of NH$_4$+-N from aqueous solutions using modified ceramsite and its regeneration performance

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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

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