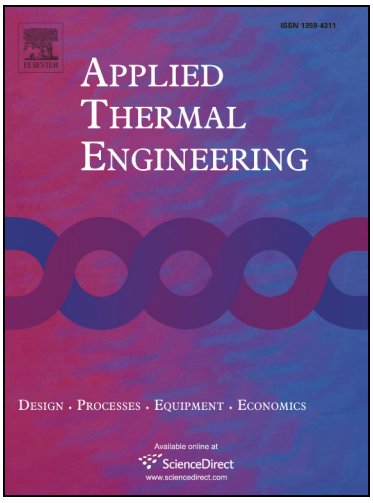

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Experimental study of hygroscopic equilibrium and thermodynamic properties of sewage sludge

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Abstract

A good knowledge of the hygroscopic behavior of sewage sludge is one of the keys to a better perception of the subsequent management of Sewage sludge such as drying, storage or other valorization processes. The present work aims to determine, experimentally, the sorption isotherms of sewage sludge generated at the wastewater treatment plant of Marrakesh city in Morocco by using saturated salt solutions method at different temperatures.

The obtained results show that, at constant water activity, the increase in temperature leads to a decrease of the sorption curves. Seven statistical models have been used for modeling and analyzing the experimental data of sorption. The Peleg model seems to be the most appropriate to describe the desorption and adsorption isotherm curves of sewage sludge with the highest value of correlation coefficient.

Thermodynamic properties of sewage sludge were determined by using the hygroscopic equilibrium data at different temperatures, the net isosteric heat of sorption and entropy of sorption decreased considerably with the increase in equilibrium moisture content. The enthalpy-entropy compensation suggested that the sorption mechanism involved was enthalpy given. Gibbs free energy for adsorption and desorption are respectively 58.87 kJ / mol, and -445.21 kJ/mol, indicating two different processes.

Keywords: *Sewage Sludge, Hygroscopic equilibrium, Sorption isotherms, Modeling, Heat of sorption, Entropy, enthalpy, Compensation.*

Nomenclature

A, B, C, D	model parameters
a_w	water activity
$H_{r,op}$	optimal relative humidity of equilibrium conservation