Title Moisture Sorption Behaviour and Thermodynamic Characteristics of Rice stored in a Chamber under Controlled Humidity
Author H. Toğrul and N. Arslan
Citation Biosystems Engineering, Volume 95, Issue 2 , October 2006, Pages 181-195
Keywords rice; moisture sorption

Abstract

The moisture sorption isotherms of rice stored in a chamber, the relative humidity of which is controlled by an atomising humidification system were determined at 25, 35 and 45 °C and within the range of 0·1–0·9 water activity. The sorption isotherm curves of rice showed the characteristics of a type II isotherm. The equilibrium moisture content increased with a decrease in storage temperature at any given water activity. The sorption isotherms exhibited hysteresis over the whole water activity range. The mathematical description of the sorption data was obtained applying some of the most common sorption equations [Guggenheim–Anderson–de Boer (GAB), Brunauer–Emmett–Teller (BET), Henderson, Iglesias and Chirife, Oswin, Peleg, Smith and Caurie equations]. A non-linear regression analysis was used to evaluate the constants of the sorption equations. Among the various models tested to interpret sorption isotherms, the model having best statistical indicators was selected as the most appropriate model. The Peleg model gave the best fit to the experimental sorption data over the range of temperatures and water activity investigated. The agreement between experimental and predicted values of the Peleg model was found to be satisfactory. In the range of water activity 0–0·4, the BET model was shown to give the closest fit to the experimental data. The surface area of monolayer was calculated and the water activities corresponding to the monolayer values were determined. Sorption isotherm data were used to determine the thermodynamic functions such as isosteric heat of sorption, sorption entropy, spreading pressure, net integral enthalpy and entropy. The isosteric heats of sorption were determined from the best-fitting equation using the Clasius-Clapeyron equation. Isosteric heat decreased with increase in moisture content and approached the latent heat of vaporisation of pure water at moisture contents above 0·2 kg [water] kg^{-1} [dry solids]. The spreading pressures increased with increasing water activity. Within the moisture range of 0·013–0·207 kg [water] kg^{-1} [dry solids], the net integral enthalpy decreased with increase in moisture content and net integral entropy increased with increase in moisture content. Net integral entropy was negative in value.