Research Note

EQUILIBRIUM MOISTURE CONTENT OF PARCHMENT ARABICA COFFEE[1]

Equilibrium moisture content (EMC) of a material in a given environment is the moisture content which the material would approach if left in that environment. The sorption isotherm is a plot of EMC versus relative humidity (RH) at a given temperature for a material which has been subjected to a wetting environment. The desorption isotherm is a plot for a material which has been subjected to a drying envrionment[2, 3, 4]. The sorption and desorption isotherms for biological materials generally show a sigmoidal curve,[2] and approach a very high moisture content as the relative humidity approaches 100%. Data on hygroscopic equilibria are indispensible in the design and operation of drying, conditioning and storage installations for parched and green coffee beans. For instance, high moisture coupled with warm temperatures in the tropics promotes the growth of molds and insects as well as an increase in respiration rate of the coffee beans. EMC at varying environmental conditions has been evaluated for various biological materials[1-6]. No investigations have been reported on moisture relationships for parched and green coffee beans.

The objective of this study was to evaluate the effects of relative humidity on the equilibrium moisture content of parched Arabica coffee at varying temperatures and develop desorption isotherms using Henderson's and Chung's relationships[1, 5].

A sample of 20 parched coffee beans was suspended in a sealed jar which contained the appropriate saturated salt solution[2] for maintaining a desired relative humidity at a particular temperature. The jar was placed in a constant temperature chamber. The sample was weighed at intervals until there was no further change in its weight. The moisture content of the sample was then determined by the oven-method.[5] The data were obtained at 30, 35, 40 and 45° C replicated three times.

[1] Manuscript submitted to Editorial Board March 14, 1984.

[2] Hall, C. W., 1980. Drying and Storage of Agricultural Crops, AVI Publishing Co., Inc. Westport, CT. Pages 16–38.

[3] Henderson, S. M., 1952. A basic concept of equilibrium moisture content, Agric. Eng., 33 (1):29–31.

[4] Henderson, S. M. and R. L. Perry, 1976. Agricultural Process Engineering. 3rd ed, AVI Publ. Co., Inc. Westport, CT.

[5] Agricultural Engineers Yearbook of Standards (1984). American Society of Agricultural Engineers, St. Joseph-MI. Pages 297–301.

[6] Gustafson, R. J. and G. E. Hall, 1974. Equilibrium moisture content of shelled corn from 50 to 155° F. Trans Am. Soc. Agric. Eng. 17 (1):120–24.

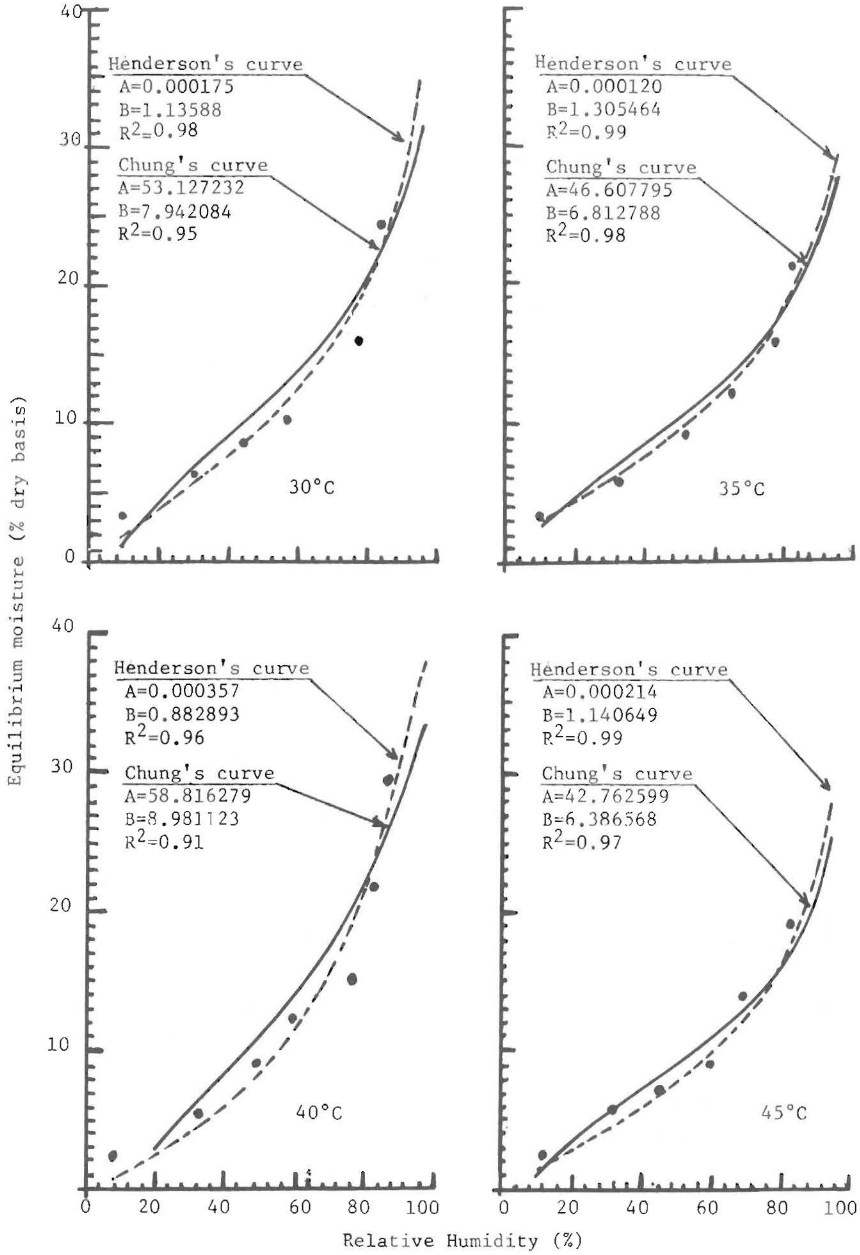

FIG. 1.—Desorption isotherms for parched Arabica coffee.

Henderson's curve:

$$M = \left[\frac{\mathrm{Log}_e(1 - R)}{-A(273 + T)}\right]^{1/B}$$

Chung's curve:

$$M = A - B[\log_e\{-(273 + T)\log_e R\}],$$

where M = equilibrium moisture (% db); R = relative humidity expressed as a fraction; A and B = calculated constants; T = ambient temperature (°C).

Figure 1 shows EMC versus RH relationships at 30, 35, 40 and 45° C. The coefficient of determination (R^2) varied from 0.91 to 0.98 for Chung's curve compared to 0.96 to 0.99 for Henderson's curve. The regression coefficients were significant at the 1% level of significance.

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