

ISSN 1807-1929 Revista Brasileira de Engenharia Agrícola e Ambiental

v.24, n.3, p.200-208, 2020 Campina Grande, PB, UAEA/UFCG – http://www.agriambi.com.br

DOI: http://dx.doi.org/10.1590/1807-1929/agriambi.v24n3p200-208

Convective drying kinetics of osmotically pretreated papaya cubes

João P. de L. Ferreira¹, Deise S. de Castro¹, Inacia dos S. Moreira¹, Wilton P. da Silva¹, Rossana M. F. de Figueirêdo¹ & Alexandre J. de M. Queiroz¹

¹ Universidade Federal de Campina Grande/Centro de Tecnologia e Recursos Naturais/Programa de Pós-Graduação em Engenharia Agrícola. Campina Grande, PB, Brasil. E-mail: joaop_l@hotmail.com (Corresponding author) - ORCID: 0000-0003-1172-7259; deise_castro01@hotmail.com -ORCID: 0000-0001-5040 -3295; inaciamoreira@ymail.com - ORCID: 0000-0002-7855-1895; wiltonps@uol.com.br - ORCID: 0000-0001-5841-6023; rossanamff@gmail.com - ORCID: 0000-0002-6187-5826 ; alexandrejmq@gmail.com - ORCID: 0000-0002-6880-5951

ABSTRACT: This study assessed the fitting of mathematical models to the convective drying kinetics of osmotically pre-dehydrated papaya cubes. Papaya cubes were subjected to osmotic dehydration in sucrose solutions at 40 and 50 °Brix, at temperatures of 50 and 60 °C, followed by complementary convective drying in forced air circulation oven under three temperatures (50, 60 and 70 °C) and constant air velocity of 1.0 m s⁻¹. Ten thin-layer drying mathematical models were fitted to the experimental data. The increase in air temperature and the decrease in osmotic solution concentration resulted in increased water removal rate. Based on the statistical indices, the Two Terms model was the one that best described the drying kinetics of the samples for all evaluated conditions. The effective diffusion coefficients increased with the elevation of air temperature, ranging from 1.766×10^{-10} to $3.910 \times 10^{-6} \text{ m}^2 \text{ s}^{-1}$, whereas the convective mass transfer coefficients ranged from 3.910×10^{-7} to $1.201 \times 10^{-6} \text{ m} \text{ s}^{-1}$ with Biot number from 0.001 to 12.500.

Key words: Carica papaya, osmotic dehydration, effective diffusivity

Cinética de secagem convectiva de cubos de mamão pré-tratados osmoticamente

RESUMO: Este estudo avaliou o ajuste de modelos matemáticos na cinética de secagem convectiva de cubos de mamão pré-desidratados osmoticamente. Os cubos de mamão foram submetidos à desidratação osmótica em soluções de sacarose a 40 e 50 °Brix, em temperaturas de 50 e 60 °C, seguida de secagem convectiva complementar em estufa com circulação forçada de ar sob três temperaturas (50, 60 e 70 °C) e velocidade do ar constante de 1,0 m s⁻¹. Aos dados experimentais foram ajustados dez modelos matemáticos de secagem em camada fina. O aumento da temperatura do ar e a diminuição da concentração da solução osmótica resultou em aumento da taxa de remoção de água. Com base nos índices estatísticos, o modelo de Dois Termos foi o que melhor descreveu a cinética de secagem das amostras para todas as condições avaliadas. Os coeficientes de difusão efetivos aumentaram com a elevação da temperatura do ar, variando de 1,766 x 10⁻¹⁰ a 3,910 x 10⁻⁶ m² s⁻¹, enquanto os coeficientes convectivos de transferência de massa variaram entre 3,910 x 10⁻⁷ a 1,201 x 10⁻⁶ m s⁻¹ com número de Biot de 0,001 a 12,500.

Palavras-chave: Carica papaya, desidratação osmótica, difusividade efetiva



INTRODUCTION

Brazil is the second largest producer of papaya in the world, having produced a total of 1.42 million tons in 2016 (FAOSTAT, 2018). Papaya has a fast ripening, which manifests itself immediately as a structural softening that, associated with its high moisture content and water activity, makes the product highly perishable, resulting in post-harvest losses throughout its chain (Kandasamy et al., 2012).

Convective drying, for its simplicity and low cost, compared to other drying methods such as lyophilization, is one of the most used technologies for the conservation of agricultural products. However, this method causes alterations in sensory and nutritional properties and in the bioactive compounds of the dry products (Gava et al., 2008; Orikasa et al., 2014). Such alterations can be minimized using combined drying methods, as proposed in the osmo-convective drying (Prosapio & Norton, 2017; Dermesonlouoglou et al., 2018).

Mathematical modeling of the drying process is fundamental for understanding and providing information about the behavior of certain parameters that describe heat and mass transfer mechanisms (Silva et al., 2014a; Tzempelikos et al., 2015; Pacheco-Angulo et al., 2016), which can provide a solid basis for optimizing the process.

The quality of fit of the models to the experimental data can be assessed with different statistical indices; however, according to Kucuk et al. (2014), the best model to describe the drying curve of the product is the one with highest values of correlation coefficient, coefficient of determination, modeling efficiency and/or adjusted R² and the lowest values of chisquare, mean squared deviation, relative mean percentage error, mean polarization error, standard error of estimation, residual sum of squares, reduced sum of squared errors and/ or residuals.

In this context, the objective was to assess the mathematical modeling of convective drying kinetics, at temperatures of 50, 60 and 70 °C, of papaya cubes osmotically pre-dehydrated in sucrose solutions and to obtain the effective diffusivity coefficients and convective mass transfer coefficients.

MATERIAL AND METHODS

To conduct this study, the raw material used was ripe papaya fruits (*Carica papaya* L.) cv. Formosa, 2017 Season, purchased at the local market of the city of Campina Grande, PB, Brazil. Papaya fruits were washed with neutral detergent and subsequently sanitized with sodium hypochlorite solution (100 ppm) for 15 min. The peel was removed with a stainlesssteel knife, and the seeds were discarded. The pulp was cut into cubes with dimensions of 20 mm, measured with digital caliper (Absolute model, Mitutoyo, Brazil) with resolution of 0.01 mm. The cubes were osmotically pre-dehydrated in sucrose solution (syrup) with 40 and 50 °Brix, in a cubes:syrup proportion of 1:6 (g:g), at temperatures of 50 and 60 °C. The osmotic dehydration (OD) process was carried out in a BOD chamber and lasted 4 h, considering the maximum rate of water removal from the papaya cubes during the OD. The cubes were removed from the sucrose solution with plastic sieves and left on the bench to drain excess solution from the surface.

About 25 g of the osmotically dehydrated cubes were arranged, in a single layer, in stainless-steel rectangular baskets (15 x 12 cm) and dried, in triplicate, in a forced air circulation oven (320/5 model, Foneman, Brazil) at temperatures of 50, 60, 70 °C and air velocity of 1.0 m s⁻¹, determined by means of a digital anemometer (ITTHAL-300 model, Instrutemp, Brazil). Water loss was monitored by weighing on an electronic scale (AS5500C model, Marte, Brazil) with a resolution of \pm 0.01 g, at regular times of 5, 10, 20, 30 and 60 min, until the samples reached constant mass. The data of drying kinetics were used to calculate the drying rates (Eq. 1) (Özdemira et al., 2017) and moisture content ratios (Eq. 2) (Galaz et al., 2017).

$$DR = \frac{M_{t_0} - M_{t_0 + \Delta t}}{\Delta t} \tag{1}$$

where:

DR - drying rate, kg kg⁻¹ h⁻¹;

 M_{t0} - moisture content at previous time, kg kg⁻¹ d.b.;

 $M_{t_0 + \Delta t}$ - moisture content at current time, kg kg^-1 d.b.; and, Δt - difference between the current time (t_i) and previous time (t_o) of drying, min.

$$MR = \frac{M - M_e}{M_i - M_e}$$
(2)

where:

MR - moisture content ratio, dimensionless;

M - moisture content at a specific time, d.b.;

 $M_{e}^{}$ - equilibrium moisture content, d.b.; and,

M_i - initial moisture content, d.b.

Different mathematical models were fitted to the experimental data of drying kinetics (Eqs. 3 to 12), using the computer program Statistica[®], version 7.0, through non-linear regression, by the Quasi-Newton method (Statsoft, 2007).

- Newton - Lewis (1921):

$$MR = \exp(-kt) \tag{3}$$

- Page - Page (1949):

$$MR = \exp(-kt^n) \tag{4}$$

- Henderson & Pabis - Henderson & Pabis (1961):

$$MR = a \exp(-kt)$$
(5)

- Two-Term Exponential - Sharaf-Eldeen et al. (1980):

$$MR = a \exp(-kt) + (1-a) \exp(-kat)$$
(6)

- Thompson - Thompson et al. (1968):

$$MR = \exp\left[-a\left(a^2 + 4bt\right)^{0.5}\right] / 2b \tag{7}$$

$$MR = a \exp(-kt) + c$$
 (8)

- Approximation of Diffusion - Sharaf-Elden et al. (1980):

$$MR = a \exp(-kt) + (1-a)\exp(-kbt)$$
(9)

- Modified Henderson & Pabis - Karathanos (1999):

$$MR = a \exp(-kt) + b \exp(-kt) + c \exp(-kt)$$
(10)

- Two Terms - Henderson (1974):

$$MR = a \exp(-k_0 t) + b \exp(-k_1 t)$$
(11)

- Midilli - Midilli et al. (2002):

$$MR = a \exp(-kt^{n}) + bt$$
 (12)

where:

MR - moisture content ratio, dimensionless; a, b, c, k, k_0 , k_1 , n - coefficients of the models; and,

t - drying time, min.

The criteria for the fit of the mathematical models to the experimental data were the coefficient of determination (R^2) (Eq. 13), mean squared deviation (MSD) (Eq. 14), mean relative error (P) (Eq. 15), mean estimated error (SE) (Eq. 16) and the chi-square (χ^2) (Eq. 17) (Costa et al., 2016; Haas et al., 2017; Rabha et al., 2017).

$$R^{2} = \frac{\sum_{i=1}^{N} \left[\left(MR_{exp,i} - \overline{MR}_{exp,i} \right) \left(MR_{pred,i} - \overline{MR}_{pred,i} \right) \right]^{2}}{\sum_{i=1}^{N} \left(MR_{exp,i} - \overline{MR}_{exp,i} \right)^{2} \sum_{i=1}^{N} \left(MR_{pred,i} - \overline{MR}_{pred,i} \right)^{2}}$$
(13)

$$MSD = \left[\frac{1}{N}\sum_{i=1}^{N} \left(MR_{\text{pred},i} - MR_{\text{exp},i}\right)^2\right]^{\frac{1}{2}}$$
(14)

$$P = \frac{100}{N} \sum_{i=1}^{N} \frac{\left| MR_{exp,i} - MR_{pred,i} \right|}{MR_{exp,i}}$$
(15)

$$SE = \left[\frac{1}{N-n}\sum_{i=1}^{N} \left(MR_{exp,i} - MR_{pred,i}\right)^{2}\right]^{\frac{1}{2}}$$
(16)

$$\chi^{2} = \frac{1}{N-n} \sum_{i=1}^{N} \left(MR_{exp,i} - MR_{pred,i} \right)^{2}$$
(17)

where:

 $\frac{MR}{MR}$ - experimental moisture content ratio;

 $MR_{exp,i}$ - average experimental moisture content ratio; MR_{pred} - moisture content ratio predicted by the model;

 $\overline{MR}_{pred,i}^{pred}$ - average moisture content ratio predicted by the model;

- N number of observations; and,
- n number of coefficients of the model.

The geometric shape of the samples was assumed to be that of a cube (parallelepiped with equal sides), and the analytical solution of the second Fick's law for this geometry, considering internal diffusive mass flow equal to the external convective flow in the vicinity of the samples (convective boundary condition) (Eq. 18) (Silva et al., 2014b), was fitted to the experimental data of drying kinetics for determining the effective diffusion coefficients (D_{ef}) and convective mass transfer coefficients (h_w), using 16 x 16 x 16 terms of the analytical solution referring to the three summations of Eq. (18), employing the program Convective Adsorption - Desorption, version 3.2 (Silva & Silva, 2018).

$$\overline{M}(t) = M_{eq} + (M_0 - M_{eq}) \sum_{n=1}^{\infty} \sum_{m=1}^{\infty} \sum_{k=1}^{\infty} B_n B_m B_k \cdot \\ \cdot exp \left[- \left(\frac{\mu_{n^2}}{(L_1 / 2)^2} + \frac{\mu_{m^2}}{(L_2 / 2)^2} \frac{\mu_{k^2}}{(L_3 / 2)^2} \right) D_{ef} t \right]$$
(18)

where:

M(t) - average moisture content at time t, d.b.;

M_{eq} - equilibrium moisture content, d.b.;

 M_0^{-} - initial moisture content, d.b.;

 μ_n , μ_m and μ_k - roots of the characteristic equation, obtained through Eq. 19;

 $\rm B_{n},\, \rm B_{m}$ and $\rm B_{k}$ - solution parameters calculated according to Eq. 21;

 D_{ef} - effective diffusion coefficient, m² s⁻¹;

 $\rm L_{_1},\,\rm L_{_2}$ and $\rm L_{_3}$ - length, height and thickness, respectively, m; and,

t - time, s.

$$\cot \mu_{j} = \frac{\mu_{j}}{Bi}$$
(19)

With j equal to the indices n, m and k. The parameter Bi is the mass transfer Biot number and is given by Eq. 20:

$$Bi = \frac{h_w L}{D_{ef}}$$
(20)

where:

h. - convective mass transfer coefficient, m s⁻¹;

L - characteristics length, m; and,

 $D_{_{ef}}~$ - effective diffusion coefficient, $m^2~s^{\text{-1}}.$

$$B_{j} = \frac{2Bi^{2}}{\mu_{j^{2}} \left(Bi^{2} + Bi + \mu_{j^{2}}\right)}$$
(21)

where j is equal to the indices n, m and k.

RESULTS AND DISCUSSION

In the drying curves of the osmotically dehydrated papaya cubes (Figures 1A to D), it can be observed that, as the

concentration and temperature of the solution increase, the drying curves (Figures 1C and D) become less distant from one another, denoting less relative influence of drying temperature on water removal dynamics. Although the increase in concentration and temperature of the solution causes a greater water removal during the OD process (Germer et al., 2011; Souraki et al., 2014), due to the elevation of the concentration gradient of soluble solids between the fruit and the solution, it also results in the incorporation of solute in the sample (Garcia-Noguera et al., 2010; Mendes et al., 2013), which could lead to a higher resistance to heat and mass transfers during convective drying, resulting in lower drying effectiveness. Fernandes et al. (2008) demonstrated, in experiments with pineapple, that OD in solutions with high concentrations (> 35 °Brix) results in high gain of solids by the samples, which may cause a reduction in the water removal rate during convective drying.

The drying rates (Figures 2A to D), for the same concentration of the solution, in general, were higher in samples subjected to solutions at lower temperatures, ranging from 0.85 to 1.64 kg kg⁻¹ h⁻¹ for the samples subjected to OD pre-treatment of 50 °Brix/60 °C and 50 °Brix/50 °C, respectively, dried at 50 °C.

The values of the drying rates changed over time, gradually increasing to the maximum value and then decreasing rapidly. This occurs because, at the beginning of the drying, liquid diffusion is the main mechanism of water transport and, as the drying progresses, vapor diffusion becomes the dominant mode, so the drying rate increases. However, with the continuity of the process, the samples become unsaturated with moisture, the vapor diffusion decreases and, consequently, the drying rate also decreases (Chen et al., 2017). In addition, drying occurred mainly in the falling rate period, and no constant rate period was observed (Figures 2A to D), indicating that the internal resistance to water movement is greater than the rate of removal from the sample surface (Pilatti et al., 2016). Similar behavior was observed by Kaushal & Sharma (2016) during convective drying at different temperatures (50-70 °C) of osmo-dehydrated jackfruit pulp.

The indices of the models fitted to the experimental data of drying kinetics of the samples (Table 1), at different temperatures, demonstrate that the Two Terms model had the highest values of the coefficients of determination (R^2) (0.997-0.999) and the lowest mean squared deviations (MSD) (0.008-0.014), mean relative error (P) (1.306-6.039%), mean estimated error (SE) (0.009-0.017) and chi-square (χ^2) (1.0 x 10^{-4} -3.0 x 10^{-4}), so it better represents the drying process of the samples under the studied conditions. However, it should be pointed out that the models of Page, Approximation of



Figure 1. Drying curves of papaya cubes subjected to osmotic dehydration at: (A) 40 °Brix/50 °C; (B) 40 °Brix/60 °C; (C) 50 °Brix/50 °C; and (D) 50 °Brix/60 °C followed by convective drying at temperatures of 50, 60 and 70 °C



Figure 2. Drying rates of papaya cubes subjected to osmotic dehydration at: (A) 40 °Brix/50 °C; (B) 40 °Brix/60 °C; (C) 50 °Brix/50 °C; and (D) 50 °Brix/60 °C followed by convective drying at temperatures of 50, 60 and 70 °C

Table 1. Values of the coefficient of determination (R^2), mean squared deviation (MSD), mean relative error (P), mean estimated error (SE) and chi-square (χ^2) of the models fitted to the experimental drying data of papaya cubes subjected to osmotic dehydration (OD)

Madal	OD -	Temperature					
INIUUCI		R ²	MSD	P (%)	SE	χ ² (x10 ⁻⁴)	
				50 °C			
Nouton	40 °Brix/50 °C	0.976	0.047	13.536	0.049	23.0	
	40 °Brix/60 °C	0.978	0.046	19.320	0.048	23.0	
NEWLOIT	50 °Brix/50 °C	0.964	0.058	26.586	0.060	36.0	
	50 °Brix/60 °C	0.985	0.038	19.136	0.040	16.0	
	40 °Brix/50 °C	0.995	0.021	8.199	0.023	5.0	
Daga	40 °Brix/60 °C	0.996	0.018	4.622	0.020	4.0	
Page	50 °Brix/50 °C	0.995	0.021	7.488	0.022	5.0	
	50 °Brix/60 °C	0.997	0.016	6.684	0.017	3.0	
	40 °Brix/50 °C	0.986	0.036	9.661	0.039	15.0	
Handaraan & Dahia	40 °Brix/60 °C	0.984	0.039	15.061	0.041	17.0	
Henderson & Pabis	50 °Brix/50 °C	0.977	0.046	18.852	0.049	24.0	
	50 °Brix/60 °C	0.989	0.033	15.009	0.035	13.0	
	40 °Brix/50 °C	0.995	0.021	7.670	0.023	5.0	
Two-Term	40 °Brix/60 °C	0.995	0.020	8.260	0.022	5.0	
Exponential	50 °Brix/50 °C	0.988	0.033	14.118	0.035	12.0	
	50 °Brix/60 °C	0.998	0.014	6.554	0.015	2.0	
Thompson	40 °Brix/50 °C	0.993	0.025	11.478	0.027	7.0	
	40 °Brix/60 °C	0.997	0.015	4.746	0.016	3.0	
	50 °Brix/50 °C	0.995	0.021	13.451	0.023	5.0	
	50 °Brix/60 °C	0.998	0.013	10.520	0.014	2.0	

Continues on the next page

Continuation of Table 1

Model UD RI MSD P (%) SE X² (rd 9) Loganthmic 40 98% (5) ° 0.987 0.035 11.583 0.038 15.0 Loganthmic 50 98% (5) ° 0.982 0.027 15.988 0.030 9.0 Approximation of 40 98% (5) ° 0.987 0.018 2.78 0.044 2.00 Approximation of 40 98% (5) ° 0.999 0.019 2.488 0.010 3.0 Modified 40 98% (5) ° 0.999 0.001 2.583 0.010 1.0 Modified 40 98% (5) ° 0.999 0.033 15.059 0.044 19.0 Modified 40 98% (5) ° 0.999 0.033 15.09 0.037 14.0 Modified 40 98% (5) ° 0.999 0.013 4.28 0.017 3.0 Modified 40 98% (5) ° 0.999 0.010 1.308 0.011 1.0 Modified 40 98% (5) ° 0.999 0.019 5.481 0.016 3.0	Medel		Temperature				
Logarifmic 40 SinkS 0: 0 990 0.0131 9 0.06 0.0134 2.2 0.044 2.0 0.035 1.5.5.3 0.038 1.5.0 0.034 0.7.2 0.007 0.0392 0.027 1.5.9.8 0.035 0.034 2.0 0.014 0.027 0.0390 0.012 0.0 0.012 0.0 0.012 0.0 0.012 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Model	00 -	R ²	MSD	P (%)	SE	χ² (x10 ⁻⁴)
A0 Bit NetSo C 0.997 0.035 11.583 0.038 15.0 Logarithmic A0 Bit NetSo C 0.992 0.017 15.883 0.039 9.0 Approximation of Diffusion Bit NetSo C 0.992 0.014 4.2.76 0.044 1.2 Approximation of Diffusion Bit NetSo C 0.999 0.015 6.169 0.017 3.0 Modified 40 Bit NetSo C 0.999 0.010 5.633 0.010 1.0 Modified 40 Bit NetSo C 0.999 0.033 15.059 0.044 19.0 Modified 40 Bit NetSo C 0.999 0.033 15.069 0.017 3.0 Modified 40 Bit NetSo C 0.998 0.013 4.2.82 0.017 3.0 Midifi 50 Bit NetSo C 0.998 0.014 5.088 0.017 3.0 Modified 50 Bit NetSo C 0.999 0.016 5.382 0.017 3.0 <					50 °C		
Loganithmic B0 flirk/00 °C 0.990 0.031 9.606 0.034 1.2 Approximation of Diffusion 30 flirk/00 °C 0.992 0.042 15.948 0.030 9.0 Approximation of Diffusion 30 flirk/00 °C 0.992 0.011 5.448 0.011 1.0 Approximation of Diffusion 30 flirk/00 °C 0.998 0.010 4.643 0.010 3.0 Modified 40 flirk/00 °C 0.996 0.039 1.5.069 0.044 19.0 Henderson & Pable 50 flirk/00 °C 0.997 0.014 6.039 0.017 3.0 Mon Terms 50 flirk/00 °C 0.997 0.014 6.039 0.011 1.0 Mol 50 flirk/00 °C 0.997 0.016 3.489 0.011 3.0 Mol 50 flirk/00 °C 0.997 0.016 3.489 0.011 3.0 Mol 50 flirk/00 °C 0.997 0.016 3.489 0.013 3.0 Mol 0.997 0.016 3.489	Logarithmic	40 °Brix/50 °C	0.987	0.035	11.583	0.038	15.0
Superstring So PriceSor C 0.982 0.0440 18.276 0.0444 20.0 Approximation of Diffusion 40 PriceSor C 0.997 0.015 6.189 0.0172 1.0 Approximation of Diffusion 80 PriceSor C 0.998 0.010 2.440 0.012 1.0 Modified 40 PriceSor C 0.998 0.010 8.5589 0.044 1.0 Herderson A Pable 50 PriceSor C 0.999 0.014 6.039 0.0177 3.0 Modified 40 PriceSor C 0.999 0.013 1.509 0.037 14.0 Modified 40 PriceSor C 0.999 0.014 6.039 0.017 3.0 Modified 40 PriceSor C 0.999 0.016 4.889 0.018 3.0 Midellini 40 PriceSor C 0.999 0.016 3.899 0.018 3.0 Midellini 40 PriceSor C 0.997 0.016 3.899 0.018 3.0 Midellini 40 PriceSor C 0.997		40 °Brix/60 °C	0.990	0.031	9.606	0.034	1.2
So Bitwen C 0.992 0.027 15.999 0.030 9.0 Approximation at Unission 40 Bitwon C 0.992 0.015 6.199 0.0177 3.0 Approximation at Unission 50 Bitwon C 0.988 0.010 2.540 0.017 3.0 Montined 40 Bitwon C 0.988 0.038 5.981 0.018 3.0 Montined 40 Bitwon C 0.988 0.038 5.959 0.044 19.0 Henderson & Pabs 50 Bitwon C 0.999 0.046 18.852 0.0037 14.0 Monter 40 Bitwon C 0.999 0.001 4.389 0.011 1.0 Monter 40 Bitwon C 0.999 0.001 4.389 0.011 1.0 Monter 40 Bitwon C 0.999 0.016 4.889 0.018 3.0 Meditii 40 Bitwon C 0.988 0.011 4.089 0.011 1.0 Meditii 40 Bitwon C 0.988 0.011 3.0 0.011		50 °Brix/50 °C	0.982	0.040	18.276	0.044	20.0
Approximation of Diffusion 40 'Birky0 C 0.997 0.015 6.169 0.017 3.0 Modified 40 'Birky0 C 0.997 0.014 4.743 0.016 3.0 Modified 40 'Birky0 C 0.997 0.014 4.743 0.016 3.0 Modified 40 'Birky0 C 0.999 0.035 9.053 0.017 3.0 Modified 50 'Birky0 C 0.999 0.014 6.039 0.017 3.0 Modified 40 'Birky0 C 0.999 0.014 6.039 0.017 3.0 Modified 40 'Birky0 C 0.999 0.016 4.899 0.018 3.0 Modified 40 'Birky0 C 0.997 0.016 3.899 0.018 3.0 Modified 40 'Birky0 C 0.997 0.016 3.899 0.018 3.0 Modified 40 'Birky0 C 0.997 0.016 3.890 0.017 3.0 Modified 40 'Birky0 C 0.998 0.014 2.6473 <td< td=""><td>50 °Brix/60 °C</td><td>0.992</td><td>0.027</td><td>15.998</td><td>0.030</td><td>9.0</td></td<>		50 °Brix/60 °C	0.992	0.027	15.998	0.030	9.0
Approximation of Diffusion 40 Bit/x0 °C 0.998 0.010 2.440 0.012 1.0 Diffusion 50 Bit/x0 °C 0.999 0.014 4.743 0.016 3.0 Modified 40 Bit/x0 °C 0.999 0.019 5.833 0.010 1.0 Modified 40 Bit/x0 °C 0.984 0.033 1.559 0.044 1.0 Hendesson & Pabs 50 Bit/x0 °C 0.997 0.014 1.6093 0.0052 2.70 Two Terms 50 Bit/x0 °C 0.997 0.016 4.889 0.011 1.0 Sy Bit/x0 °C 0.997 0.016 4.889 0.018 3.0 Midili 50 Bit/x0 °C 0.997 0.016 4.889 0.018 3.0 Midili 50 Bit/x0 °C 0.997 0.016 4.889 0.016 3.0 Metion 40 Bit/x0 °C 0.997 0.016 4.889 0.016 3.0 Pape 40 Bit/x0 °C 0.997 0.016 4.89 0.017 3		40 °Brix/50 °C	0.997	0.015	6.169	0.017	3.0
Diffusion Binx30 C 0.997 0.014 4.743 0.018 3.0 Modified 40 Finx00 C 0.996 0.038 9.661 0.044 19.0 Modified 40 Finx00 C 0.986 0.038 9.661 0.042 17.0 Modified 40 Finx00 C 0.997 0.040 18.852 0.0257 14.0 Modified 40 Finx00 C 0.997 0.014 6.038 0.017 14.0 Modified 40 Finx00 C 0.997 0.016 4.289 0.011 1.0 Modified 50 Finx00 C 0.997 0.016 4.289 0.011 1.0 Modified 50 Finx00 C 0.997 0.016 4.289 0.011 1.0 1.0 Modified 50 Finx00 C 0.997 0.016 4.289 0.014 7.0 3.0 Modified 50 Finx00 C 0.997 0.016 4.0861 0.041 7.0 3.0 Modified 40 Finx00 C 0.997 0.016 </td <td>Approximation of</td> <td>40 °Brix/60 °C</td> <td>0.998</td> <td>0.010</td> <td>2.540</td> <td>0.012</td> <td>1.0</td>	Approximation of	40 °Brix/60 °C	0.998	0.010	2.540	0.012	1.0
Bol Braveb CC 0.999 0.009 5.833 0.010 1.0 Modified 40 Braveb CC 0.984 0.039 15.559 0.042 17.0 Modified 50 Braveb CC 0.984 0.039 15.559 0.044 19.0 Too Terms 50 Braveb CC 0.989 0.013 15.009 0.032 17.0 Midili 40 Braveb CC 0.989 0.013 4.989 0.011 3.0 Midili 50 Braveb CC 0.999 0.016 4.889 0.018 3.0 Midili 50 Braveb CC 0.997 0.016 4.889 0.018 3.0 Motion 50 Braveb CC 0.997 0.016 4.889 0.018 3.0 Motion 50 Braveb CC 0.997 0.016 4.889 0.016 3.0 Motion 50 Braveb CC 0.997 0.016 4.889 0.016 3.0 Motion 40 Braveb CC 0.997 0.016 8.041 0.041 1.3	Diffusion	50 °Brix/50 °C	0.997	0.014	4.743	0.016	3.0
Modified Henderson & Pabis 40 Trix/S0 °C 0.984 0.039 9.061 0.042 17.10 Henderson & Pabis 50 Trix/S0 °C 0.977 0.046 18.852 0.052 27.0 Honderson & Pabis 50 Trix/S0 °C 0.989 0.033 15.009 0.037 14.0 How Terms 50 Trix/S0 °C 0.989 0.013 4.033 0.017 3.0 Midili 50 Trix/S0 °C 0.989 0.016 4.033 0.011 1.0 Midili 50 Trix/S0 °C 0.989 0.016 4.088 0.018 3.0 Midili 50 Trix/S0 °C 0.986 0.018 4.088 0.018 3.0 Midili 50 Trix/S0 °C 0.984 0.044 18.651 0.045 3.0 Newton 50 Trix/S0 °C 0.984 0.044 18.651 0.045 3.0 Page 40 Trix/S0 °C 0.984 0.041 15.0 10.0 17.0 10.0 Page 40 Trix/S0 °C 0.997 0.016		50 °Brix/60 °C	0.999	0.009	5.833	0.010	1.0
Modified Henderson & Pabis 50 Thm:60 °C 0.934 0.989 0.034 0.033 15.059 0.044 0.044 0.8852 19.044 0.052 19.044 0.052 19.044 0.052 19.044 0.052 19.045 19.044 0.052 19.045 19.044 0.052 19.045 19.052 27.0 0.052 20.052 27.0 0.052 20.052 27.0 0.052 20.052 27.0 0.053 20.052 27.0 0.053 20.055 20.051 20.055 20.051 20.055 20.051 20.055 20.015 20.055 20.015 20.055 20.015 20.055 20.015 20.055 20.015 20.055 20.015 20.055 20.017 20.055 20.017 20.055 20.017 20.055 20.017 20.055 20.017 20.055 20.017 20.055 20.017 20.055 20.017 20.056 20.017 <th20.056< th=""> 2</th20.056<>		40 °Brix/50 °C	0.986	0.036	9.661	0.042	17.0
Periodersin & Falls Bit Mary Cor 0.989 0.033 15.009 0.037 14.0 Montain Stress Bit Mary Cor 0.999 0.003 15.009 0.033 14.0 Two Terms Bit Mary Cor 0.999 0.003 1.306 0.0111 1.0 Midmi Bit Mary Cor 0.999 0.003 4.283 0.0115 2.0 Midmi Bit Mary Cor 0.999 0.016 4.488 0.0118 3.0 Midmi Bit Mary Cor 0.997 0.0116 4.488 0.0118 3.0 Midmi Bit Mary Cor 0.997 0.016 4.488 0.0118 3.0 Midmi Bit Mary Cor 0.991 0.044 1.8651 0.0451 3.0 Mary Cor 0.986 0.035 27.045 0.036 1.30 Page Distry Kor 0.997 0.0164 2.6473 0.041 1.0 Page Distry Kor 0.998 0.033 27.045 0.036 <th3.3< th=""></th3.3<>	Modified	40 °Brix/60 °C	0.984	0.039	15.059	0.044	19.0
Bit No.0 0.999 0.033 15.009 0.037 14.0 Two Terms 40 Trix/S0 °C 0.997 0.014 6.039 0.017 3.0 Midli 50 Trix/S0 °C 0.999 0.009 1.306 0.011 1.0 Midli 40 Trix/S0 °C 0.999 0.001 5.332 0.009 1.0 Midli 40 Trix/S0 °C 0.997 0.016 3.868 0.018 3.0 Midli 50 Trix/S0 °C 0.996 0.014 5.668 0.018 3.0 Momento 0.997 0.016 3.869 0.018 3.0 3.0 Momento 0.998 0.044 18.651 0.045 3.0 3.0 Momento 0.997 0.016 8.094 0.017 3.0	Henderson & Pabis	50 °Brix/50 °C	0.977	0.046	18.852	0.052	27.0
Hor Terms Hor Terms <t< td=""><td></td><td>50 °Brix/60 °C</td><td>0.989</td><td>0.033</td><td>15.009</td><td>0.037</td><td>14.0</td></t<>		50 °Brix/60 °C	0.989	0.033	15.009	0.037	14.0
Two Terms 30 Brik/80 °C 0.998 0.009 1.300 0.011 1.0 Midili 40 Brik/80 °C 0.998 0.008 5.392 0.009 1.0 Midili 40 Brik/80 °C 0.997 0.016 3.869 0.018 3.0 Midili 50 Brik/80 °C 0.997 0.016 3.869 0.018 3.0 Midili 50 Brik/80 °C 0.996 0.019 5.088 0.022 5.0 Midili 60 °C 0.996 0.040 25.478 0.041 17.0 Mexton 50 Brik/80 °C 0.994 0.044 18.651 0.045 3.0 Page 40 Brik/80 °C 0.997 0.016 8.094 0.017 3.0 Page 40 Brik/80 °C 0.998 0.032 27.045 0.036 1.3 Henderson & Pabis 50 Brik/80 °C 0.998 0.032 20.612 0.034 12.0 Midedreso 0.997 0.016 8.293 0.017 3.0 <tr< td=""><td></td><td>40 °Brix/50 °C</td><td>0.997</td><td>0.014</td><td>0.039</td><td>0.011</td><td>3.0</td></tr<>		40 °Brix/50 °C	0.997	0.014	0.039	0.011	3.0
Box Bit Work C C 0.989 0.013 4.23 0.019 2.0 Midili 40 Bit Work C C 0.997 0.016 4.889 0.018 3.0 50 Bit Work C C 0.997 0.016 4.889 0.018 3.0 50 Bit Work C C 0.996 0.019 5.088 0.022 5.0 50 Bit Work C C 0.998 0.014 5.481 0.016 3.0 More Mark Son C C 0.998 0.044 18.651 0.045 3.0 Newton 40 Bit Work C C 0.9981 0.044 26.015 0.055 30.0 60 Bit Work C C 0.9981 0.044 26.015 0.036 13.0 40 Bit Work C C 0.9987 0.016 8.094 0.017 3.0 60 Bit Work C C 0.9987 0.016 8.094 0.017 3.0 60 Bit Work C C 0.9987 0.016 8.044 0.011 1.0 40 Bit Work C C 0.9989 0.006 4.720 0.012 4.0 </td <td>Two Terms</td> <td>40 °Brix/60 °C</td> <td>0.999</td> <td>0.009</td> <td>1.300</td> <td>0.015</td> <td>1.0</td>	Two Terms	40 °Brix/60 °C	0.999	0.009	1.300	0.015	1.0
Midlii 40 Brix/60 °C 0.997 0.016 3.832 0.009 1.0 Midlii 40 Brix/60 °C 0.997 0.016 3.689 0.018 3.0 S0 Brix/80 °C 0.996 0.019 5.068 0.022 5.0 Midlii 50 Brix/80 °C 0.996 0.014 5.481 0.016 3.0 Midlii 40 Brix/80 °C 0.994 0.044 18.651 0.045 3.0 S0 Brix/80 °C 0.994 0.044 18.651 0.045 3.0 S0 Brix/80 °C 0.994 0.046 26.478 0.035 3.0 S0 Brix/80 °C 0.997 0.016 8.094 0.017 3.0 A0 Brix/80 °C 0.998 0.034 12.643 0.036 1.3 Henderson & Pabis 50 Brix/80 °C 0.998 0.032 26.612 0.034 12.0 Mo Brix/80 °C 0.988 0.032 26.612 0.034 12.0 Mo Brix/80 °C 0.9897 0.016 8.444		50 °Brix/50 °C	0.998	0.013	4.283	0.015	2.0
Midlii 40 Bit/30 C 0.997 0.016 3.869 0.018 3.0 BD Brit/80 C 0.996 0.019 5.068 0.022 5.0 BO Brit/80 C 0.998 0.014 5.481 0.016 3.0 Mexton 40 Brit/50 C 0.998 0.044 8.651 0.045 3.0 Newton 40 Brit/50 C 0.991 0.044 8.651 0.045 3.0 Page 40 Brit/50 C 0.997 0.055 27.045 0.036 13.0 Page 40 Brit/60 C 0.997 0.016 8.094 0.017 3.0 A0 Brit/60 C 0.9997 0.016 4.720 0.012 0.4 A0 Brit/60 C 0.9997 0.016 8.299 0.017 3.0 A0 Brit/60 C 0.9997 0.016 8.299 0.012 0.4 B0 Brit/60 C 0.998 0.032 2.0612 0.034 12.0 B0 Brit/60 C 0.9981 0.022 2.286 0.031		50 °Brix/60 °C	0.999	0.008	5.392	0.009	1.0
Midlin 40 BIX 00 °C 0.996 0.016 3.893 0.018 3.0 50 Bix/50 °C 0.996 0.014 5.481 0.016 3.0 Mexion 60 °C 0.998 0.014 5.481 0.045 3.0 Newton 40 Bix/50 °C 0.984 0.044 18.651 0.045 3.0 So Bix/50 °C 0.997 0.064 26.015 0.055 30.0 50 Bix/50 °C 0.997 0.016 8.094 0.017 3.0 40 Bix/50 °C 0.997 0.016 8.238 0.017 3.0 40 Bix/50 °C 0.997 0.016 8.238 0.017 3.0 50 Bix/50 °C 0.999 0.032 2.0.612 0.034 12.0 40 Bix/50 °C 0.999 0.032 2.0.612 0.034 12.0 50 Bix/50 °C 0.999 0.032 2.0.612 0.034 12.0 50 Bix/50 °C 0.999 0.015 1.9.80 0.016 2.0 5		40 °Brix/50 °C	0.997	0.016	4.889	0.018	3.0
Bot Bix20 C 0.998 0.019 3.000 0.022 3.0 50 Bix20 C 0.998 0.014 5.481 0.016 3.0 Mewton 40 Bix20 C 0.994 0.040 26.473 0.041 17.0 50 Bix20 C 0.984 0.040 26.473 0.041 17.0 60 Bix20 C 0.998 0.035 27.045 0.036 13.0 40 Bix20 C 0.997 0.016 8.094 0.011 1.0 90 Bix20 C 0.997 0.016 8.239 0.011 1.0 50 Bix20 C 0.9997 0.016 8.239 0.034 12.0 90 Bix20 C 0.9997 0.016 8.239 0.034 12.0 10 Bix20 C 0.9997 0.016 8.239 0.034 12.0 10 Bix20 C 0.999 0.032 2.0 612 0.034 12.0 10 Bix20 C 0.999 0.032 2.0 613 1.0 0 1.0 10 Bix20 C 0.999 0.018	Midilli	40 °Brix/60 °C	0.997	0.010	3.809	0.010	3.0
Bit Note C 0.990 0.014 3.461 0.016 3.0 Bit Note C 0.991 0.044 18.651 0.045 3.0 Mewton 40 Bit X60 °C 0.991 0.064 28.615 0.055 38.0 Page 40 Bit X60 °C 0.997 0.016 8.094 0.017 3.0 Page 40 Bit X60 °C 0.997 0.016 8.094 0.017 3.0 Medition S0 °C 0.997 0.016 8.239 0.017 3.0 50 Bit X60 °C 0.997 0.016 8.239 0.017 3.0 40 Bit X50 °C 0.997 0.016 8.239 0.034 12.643 40 Bit X50 °C 0.999 0.022 22.856 0.031 10.0 50 Bit X60 °C 0.999 0.015 10.980 0.016 2.0 Two -Term 40 Bit X60 °C 0.999 0.009 12.461 0.029 8.0 Two-Ferm 40 Bit X60 °C 0.999 0.001 12.464 0.0		50 °Brix/50 °C	0.996	0.019	0.000 5.401	0.022	0.0
Newton 40 "Brix/50 °C 0.981 0.044 18.651 0.045 3.0 Page 40 "Brix/50 °C 0.984 0.040 26.478 0.041 17.0 Page 40 "Brix/50 °C 0.988 0.035 27.045 0.036 13.0 Page 40 "Brix/50 °C 0.999 0.016 8.094 0.017 3.0 Henderson & Pabis 50 "Brix/50 °C 0.999 0.016 8.293 0.017 3.0 Henderson & Pabis 50 "Brix/50 °C 0.999 0.006 4.720 0.012 0.4 Henderson & Pabis 50 "Brix/50 °C 0.988 0.032 2.012 0.033 1.2.0 Two-Term 40 "Brix/50 °C 0.989 0.018 6.444 0.019 4.0 Two-Term 40 "Brix/50 °C 0.999 0.015 10.9980 0.016 2.0 Two-Term 40 "Brix/50 °C 0.999 0.007 12.461 0.029 8.0 Two-Term 40 "Brix/50 °C 0.999 0.0019		20 BLIX/00 C	0.998	0.014	0.481	0.016	3.0
Newton 40 'BitX'00 C 0.984 0.044 16.031 0.043 3.0 Page 40 'BitX'00 C 0.970 0.054 26.015 0.036 13.0 Page 40 'BitX'00 C 0.997 0.016 8.094 0.017 3.0 Page 40 'BitX'00 C 0.997 0.016 8.094 0.011 1.0 50 'BitX'60 C 0.997 0.016 8.239 0.017 3.0 50 'BitX'60 C 0.999 0.006 4.720 0.012 0.4 40 'BitX'60 C 0.998 0.032 2.0.612 0.034 12.0 50 'BitX'60 C 0.998 0.032 2.0.612 0.034 12.0 50 'BitX'60 C 0.991 0.029 2.2.856 0.031 10.0 two-Term 40 'BitX'60 C 0.997 0.015 0.980 0.016 2.0 two-Term 40 'BitX'60 C 0.998 0.011 11.170 0.012 3.1.0 two-Term 40 'BitX'60 C 0.999			0.001	0.044	10 00	0.045	0.0
Newton 40 "Bix00 C 0.940 2.8 #7.0 0.041 17.0 50 "Brx/60 C 0.987 0.054 26.015 0.055 3.0 Page 40 "Brx/60 C 0.998 0.010 4.084 0.011 1.0 50 "Brx/60 C 0.999 0.016 8.094 0.017 3.0 Fage 50 "Brx/60 C 0.999 0.016 4.0839 0.017 3.0 Fage 40 "Brx/60 C 0.999 0.006 4.720 0.012 0.4 Henderson & Pabls 50 "Brx/60 C 0.989 0.032 2.0512 0.033 12.0 50 "Brx/60 C 0.986 0.018 6.444 0.019 4.0 Wor-Term 40 "Brx/60 C 0.996 0.018 6.444 0.019 4.0 Wor-Term 40 "Brx/60 C 0.999 0.027 12.461 0.029 8.0 Fwo-Term 40 "Brx/60 C 0.999 0.011 11.170 0.012 3.0 Fwo-Term 40 "Brx/60 C		40 °Brix/50 °C	0.981	0.044		0.045	3.0
BO BIX30 C 0.970 0.034 26.013 0.035 0.036 0.037 Page 40 Bix/50 °C 0.997 0.016 8.094 0.017 3.0 S0 Bix/50 °C 0.997 0.016 8.094 0.017 3.0 S0 Bix/50 °C 0.997 0.016 8.239 0.017 3.0 S0 Bix/50 °C 0.999 0.006 4.720 0.012 0.4 Henderson & Pabis 50 Bix/50 °C 0.999 0.023 20.612 0.034 12.0 Henderson & Pabis 50 Bix/50 °C 0.999 0.029 22.866 0.031 10.0 Two-Term 40 Bix/50 °C 0.997 0.015 10.980 0.016 2.0 Exponential 50 Bix/50 °C 0.998 0.011 11.17.0 0.012 31.0 Two-Term 40 Bix/50 °C 0.999 0.008 10.390 0.016 2.0 Exponential 50 Bix/50 °C 0.998 0.011 11.170 0.012 31.0 Loga	Newton	40 BIIX/00 C	0.984	0.040	20.470	0.041	17.0
Page 40 *Brix/50 *C 0.986 0.033 27.043 0.036 13.0 Page 40 *Brix/50 *C 0.998 0.010 4.408 0.011 1.0 50 *Brix/50 *C 0.999 0.006 4.720 0.012 0.4 40 *Brix/50 *C 0.999 0.006 4.720 0.034 12.643 0.036 1.3 40 *Brix/50 *C 0.998 0.032 20.612 0.034 12.0 50 *Brix/50 *C 0.998 0.032 20.612 0.034 12.0 50 *Brix/50 *C 0.998 0.012 0.04 17.00 10.0 <td< td=""><td></td><td>50 °Brix/50 °C</td><td>0.970</td><td>0.054</td><td>20.015</td><td>0.000</td><td>30.0</td></td<>		50 °Brix/50 °C	0.970	0.054	20.015	0.000	30.0
Page 40 * BitX80 * C 0.997 0.016 6.094 0.011 3.0 Page 40 * BitX60 * C 0.997 0.016 8.239 0.017 3.0 S0 * BitX60 * C 0.997 0.016 8.239 0.017 3.0 Henderson & Pabis 50 * BitX50 * C 0.988 0.034 12.643 0.036 1.3 Henderson & Pabis 50 * BitX60 * C 0.989 0.022 22.856 0.031 10.0 50 * BitX60 * C 0.991 0.029 2.2356 0.031 10.0 Wor-Term 40 * BitX60 * C 0.997 0.015 10.980 0.016 2.0 Exponential 50 * BitX50 * C 0.999 0.009 12.484 0.010 1.0 Frompson 40 * BitX60 * C 0.999 0.008 8.103 0.009 1.0 Logarithmic 50 * BitX60 * C 0.999 0.033 17.578 0.034 12.0 Logarithmic 50 * BitX60 * C 0.999 0.003 2.196 0.011 <td></td> <td>50 °Brix/60 °C</td> <td>0.988</td> <td>0.035</td> <td>27.045</td> <td>0.036</td> <td>13.0</td>		50 °Brix/60 °C	0.988	0.035	27.045	0.036	13.0
Page 40 bitWoll C 0.998 0.010 4.408 0.011 1.0 Henderson & Pabis 50 BitWoll C 0.999 0.006 4.720 0.012 0.4 Henderson & Pabis 50 BitWoll C 0.999 0.006 4.720 0.012 0.4 Henderson & Pabis 50 BitWoll C 0.988 0.032 20.612 0.034 12.0 Two-Term 40 BitWoll C 0.996 0.018 6.444 0.019 4.0 two-Term 40 BitWoll C 0.996 0.018 6.444 0.019 4.0 two-Term 40 BitWoll C 0.998 0.011 11.170 0.012 31.0 two-Term 40 BitWoll C 0.998 0.011 11.170 0.012 31.0 two-Term 40 BitWoll C 0.999 0.008 8.103 0.009 4.0 totspice 0.199 0.022 12.44 0.010 1.0 1.0 totspice 0.199 0.003 17.578 0.039 1.5<		40 °Brix/50 °C	0.997	0.010	0.094	0.011	3.0
B0 BRN00 C 0.997 0.016 6.2.39 0.017 3.0 Henderson & Pabis 60 Brix/60 C 0.998 0.034 12.643 0.036 1.3 Henderson & Pabis 40 Brix/60 C 0.988 0.032 22.612 0.034 12.0 Montaine 40 Brix/60 C 0.993 0.040 17.405 0.042 18.0 Montaine 50 Brix/50 C 0.993 0.040 17.405 0.042 18.0 Montaine 40 Brix/50 C 0.997 0.015 10.980 0.016 2.0 Exponential 50 Brix/50 C 0.998 0.011 11.170 0.012 31.0 Montain/60 C 0.999 0.009 12.484 0.020 4.0 Thompson 40 Brix/60 C 0.999 0.003 13.519 0.034 12.0 Logarithmic 50 Brix/60 C 0.999 0.035 17.578 0.039 1.5 Logarithmic 50 Brix/60 C 0.999 0.032 20.613 0.035 1.0 <td>Page</td> <td>40 °Brix/60 °C</td> <td>0.998</td> <td>0.010</td> <td>4.408</td> <td>0.017</td> <td>1.0</td>	Page	40 °Brix/60 °C	0.998	0.010	4.408	0.017	1.0
Henderson & Pabis 50° Brix/50° C 0.999 0.006 4.7.20 0.112 0.4 Henderson & Pabis 50° Brix/50° C 0.989 0.032 20.612 0.034 12.0 Two-Term 40° Brix/50° C 0.983 0.040 17.405 0.042 18.0 Two-Term 40° Brix/50° C 0.996 0.018 6.444 0.019 4.0 Exponential 50° Brix/50° C 0.997 0.015 10.980 0.016 2.0 Thompson 40° Brix/50° C 0.998 0.011 11.170 0.012 31.0 40° Brix/50° C 0.999 0.009 12.484 0.010 1.0 50° Brix/50° C 0.999 0.008 8.103 0.009 1.0 40° Brix/50° C 0.999 0.026 21.517 0.034 12.0 Logarithmic 40° Brix/50° C 0.998 0.012 5.500 0.13 2.0 Approximation of 50° Brix/50° C 0.998 0.012 5.500 0.013 2.0	0	50 °Brix/50 °C	0.997	0.016	0.239	0.010	3.0
Henderson & Pabis 40 Brix/30 °C 0.988 0.034 12.043 0.035 1.3 Henderson & Pabis 50 Brix/50 °C 0.983 0.040 17.405 0.042 18.0 50 Brix/50 °C 0.991 0.029 22.856 0.031 10.0 Wo-Term 40 Brix/50 °C 0.997 0.015 10.980 0.016 2.0 Exponential 50 Brix/50 °C 0.992 0.027 12.461 0.029 8.0 Thompson 50 Brix/60 °C 0.998 0.011 11.170 0.012 31.0 Thompson 40 Brix/50 °C 0.999 0.009 12.484 0.010 1.0 50 Brix/60 °C 0.999 0.008 8.103 0.009 1.0 Logarithmic 50 Brix/50 °C 0.999 0.011 13.519 0.034 12.0 Logarithmic 50 Brix/50 °C 0.999 0.008 8.103 0.009 1.0 Logarithmic 50 Brix/50 °C 0.999 0.012 5.500 0.013		50 °Brix/60 °C	0.999	0.006	4.720	0.012	0.4
Henderson & Pabis 40° Brix/50° C 0.389 0.032 20.012 0.034 12.0 40° Brix/50° C 0.991 0.029 22.356 0.031 10.0 50° Brix/50° C 0.997 0.015 10.980 0.016 2.0 Two-Term 40° Brix/60° C 0.997 0.015 10.980 0.016 2.0 50° Brix/50° C 0.998 0.011 11.170 0.012 31.0 50° Brix/50° C 0.9996 0.019 14.230 0.020 4.0 10° Brix/50° C 0.9996 0.019 14.230 0.021 4.0 50° Brix/50° C 0.9996 0.019 14.230 0.022 4.0 10° Brix/50° C 0.9990 0.031 13.519 0.034 12.0 Logarithmic 50° Brix/50° C 0.9990 0.032 17.578 0.039 1.5 50° Brix/60° C 0.9990 0.032 2.0213 0.026 7.0 Approximation of Drik/50° C 0.998 0.012		40 °B(IX/50 °C	0.988	0.034	12.043	0.030	1.3
B0 *Bix/80 *C 0.983 0.040 17.443 0.042 18.0 For any Construction 40 *Brix/50 *C 0.991 0.029 22.856 0.031 10.0 Move-Term 40 *Brix/50 *C 0.997 0.015 10.9800 0.016 2.0 Exponential 50 *Brix/60 *C 0.992 0.027 12.461 0.029 8.0 A0 *Brix/50 *C 0.998 0.011 11.170 0.012 31.0 A0 *Brix/50 *C 0.999 0.009 12.484 0.010 1.0 50 *Brix/50 *C 0.999 0.008 8.103 0.009 1.0 A0 *Brix/50 *C 0.999 0.026 21.517 0.029 8.0 Logarithmic 50 *Brix/50 *C 0.998 0.012 5.00 0.034 12.0 Logarithmic 50 *Brix/50 *C 0.998 0.012 5.00 0.013 2.0 Logarithmic 50 *Brix/50 *C 0.998 0.012 5.00 0.013 2.0 Logarithmic 6	Henderson & Pabis	40 °Brix/60 °C	0.989	0.032	20.012	0.034	12.0
Bor Brix/S0 °C 0.991 0.029 22.858 0.031 10.0 Two-Term 40 °Brix/S0 °C 0.992 0.015 10.980 0.016 2.0 Exponential 50 °Brix/S0 °C 0.992 0.027 12.461 0.029 8.0 Thompson 50 °Brix/S0 °C 0.998 0.011 11.170 0.012 31.0 M °Brix/S0 °C 0.999 0.009 12.484 0.010 1.0 S0 °Brix/S0 °C 0.999 0.008 8.103 0.009 1.4 A0 °Brix/S0 °C 0.999 0.018 8.103 0.009 1.0 40 °Brix/S0 °C 0.999 0.026 21.517 0.029 8.0 Logarithmic 40 °Brix/S0 °C 0.993 0.026 21.517 0.029 8.0 Logarithmic 40 °Brix/S0 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 40 °Brix/S0 °C 0.998 0.010 3.716 0.011 1.0 50 °Brix/S0 °C 0.998<		50 °B(IX/50 °C	0.983	0.040	17.405	0.042	10.0
How-Term 40 Bit/x80 °C 0.939 0.018 0.444 0.019 4.0 Exponential 50 Bit/x50 °C 0.992 0.027 12.461 0.029 8.0 Thompson 40 Bit/x50 °C 0.998 0.011 11.170 0.012 31.0 Thompson 40 Bit/x50 °C 0.999 0.009 12.484 0.010 1.0 50 Bit/x50 °C 0.996 0.019 16.449 0.021 4.0 50 Bit/x50 °C 0.999 0.008 8.103 0.009 1.0 40 Bit/x50 °C 0.999 0.0031 13.519 0.034 12.0 40 Bit/x50 °C 0.998 0.012 5.0 0.033 1.5 50 Bit/x50 °C 0.998 0.012 5.0 0.034 12.0 Approximation of 40 Bit/x50 °C 0.999 0.003 2.196 0.004 10.0 Diffusion 50 Bit/x50 °C 0.998 0.011 3.76 0.011 1.0 Approximation of 40 Bit/x50 °C 0.998		50 °Brix/60 °C	0.991	0.029	22.800	0.031	10.0
Word Billing 40 Bitx/50 °C 0.997 0.015 0.030 0.016 2.0 Exponential 50 Bitx/50 °C 0.998 0.011 11.170 0.012 31.0 40 Bitx/50 °C 0.996 0.019 14.230 0.020 4.0 50 Bitx/50 °C 0.999 0.009 12.484 0.011 1.0 50 Bitx/50 °C 0.999 0.008 8.103 0.009 1.0 50 Bitx/50 °C 0.999 0.008 8.103 0.009 1.0 cogarithmic 40 Bitx/50 °C 0.990 0.035 17.578 0.039 1.5 50 Bitx/50 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 40 Bitx/50 °C 0.998 0.012 5.500 0.013 2.0 Diffusion 50 Bitx/50 °C 0.998 0.010 3.716 0.011 1.0 50 Bitx/50 °C 0.998 0.034 12.647 0.039 15.0 Modified 40 Bitx/50 °C 0.998	Turo Torm	40 °B(IX/50 °C	0.996	0.015	0.444	0.019	4.0
EXPONENTIAL 50 Bitx/60 °C 0.992 0.027 12.401 0.029 0.00 Thompson 40 °Brix/50 °C 0.996 0.019 14.230 0.020 4.0 Thompson 40 °Brix/50 °C 0.996 0.019 14.230 0.020 4.0 Logarithmic 50 °Brix/50 °C 0.999 0.009 12.484 0.010 1.0 Logarithmic 40 °Brix/50 °C 0.999 0.008 8.103 0.009 1.0 Logarithmic 40 °Brix/50 °C 0.999 0.026 21.517 0.029 8.0 50 °Brix/50 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 9Brix/50 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 50 °Brix/60 °C 0.999 0.006 1.702 0.007 0.5 Modified 40 °Brix/50 °C 0.988 0.011 3.716 0.011 1.0 50 °Brix/60 °C 0.999 0.002 2.2856 0.033	Two-Term	40 °B(IX/00 °C	0.997	0.015	10.900	0.010	2.0
S00 BitX/50 °C 0.996 0.011 11.170 0.012 31.0 Thompson 40 °Brix/50 °C 0.996 0.019 14.230 0.020 4.0 50 °Brix/50 °C 0.996 0.019 16.449 0.021 4.0 50 °Brix/50 °C 0.999 0.008 8.103 0.009 1.0 Logarithmic 40 °Brix/50 °C 0.990 0.031 13.519 0.034 12.0 A0 °Brix/50 °C 0.994 0.023 20.213 0.026 7.0 40 °Brix/50 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 0 °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 Diffusion 50 °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 Diffusion 50 °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 Modified 40 °Brix/50 °C 0.988 0.032 20.613 0.036 1.3 Henderson & Pabis 50 °Brix	Exponential	50 °Brix/50 °C	0.992	0.027	12.401	0.029	0.U 21.0
Thompson 40 Bit/X50 °C 0.999 0.019 14.230 0.020 4.0 Thompson 50 Bit/X50 °C 0.996 0.019 16.449 0.021 4.0 50 Bit/X50 °C 0.999 0.008 8.103 0.009 1.2 Logarithmic 40 Bit/X50 °C 0.990 0.031 13.519 0.034 12.0 40 Bit/X50 °C 0.993 0.026 21.517 0.029 8.0 50 Bit/X50 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 40 Bit/X50 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 40 Bit/X50 °C 0.998 0.011 3.716 0.011 1.0 50 Bit/X60 °C 0.999 0.006 1.702 0.007 0.5 Modified 40 Bit/X50 °C 0.988 0.032 20.613 0.036 1.3 Henderson & Pabis 50 Bit/X50 °C 0.988 0.031 1.342 0.001 1.0 10 Bit/X50 °C<		30 DIIX/00 C	0.990	0.010	11.170	0.012	31.0
Thompson 440 bit/00 C 0.996 0.009 12.464 0.010 1.0 1000000000000000000000000000000000000		40 DIIX/30 C	0.990	0.019	19.200	0.020	4.0
Sob Bit/X90 °C 0.990 0.019 10.449 0.021 4.0 Logarithmic 40 °Brix/60 °C 0.999 0.008 8.103 0.009 1.0 Logarithmic 40 °Brix/60 °C 0.993 0.026 21.517 0.029 8.0 50 °Brix/60 °C 0.994 0.023 20.213 0.026 7.0 Approximation of Diffusion 50 °Brix/60 °C 0.998 0.012 5.500 0.013 2.0 Approximation of Diffusion 40 °Brix/60 °C 0.999 0.003 2.196 0.004 10.0 Diffusion 50 °Brix/60 °C 0.998 0.010 3.716 0.011 1.0 50 °Brix/60 °C 0.999 0.006 1.702 0.007 0.5 Modified 40 °Brix/60 °C 0.988 0.034 12.647 0.039 15.0 Modified 40 °Brix/60 °C 0.983 0.040 1.7407 0.045 20.0 For Brix/60 °C 0.999 0.003 1.942 0.004 0.1 1.0 </td <td>Thompson</td> <td>40 DIIX/00 C</td> <td>0.999</td> <td>0.009</td> <td>16.440</td> <td>0.010</td> <td>1.0</td>	Thompson	40 DIIX/00 C	0.999	0.009	16.440	0.010	1.0
Add Brix/S0 °C 0.999 0.000 0.103 0.103 0.003 1.0 Logarithmic 40 °Brix/S0 °C 0.993 0.026 21.517 0.029 8.0 50 °Brix/S0 °C 0.986 0.035 17.578 0.039 1.5 50 °Brix/S0 °C 0.994 0.023 20.213 0.026 7.0 Approximation of 40 °Brix/S0 °C 0.998 0.012 5.500 0.013 2.0 Approximation of 40 °Brix/S0 °C 0.998 0.010 3.716 0.011 1.0 50 °Brix/S0 °C 0.998 0.034 12.647 0.039 15.0 Modified 40 °Brix/S0 °C 0.998 0.032 20.613 0.036 1.3 Henderson & Pabis 50 °Brix/S0 °C 0.988 0.010 17.407 0.045 20.0 50 °Brix/S0 °C 0.999 0.003 1.942 0.004 0.1 Henderson & Pabis 50 °Brix/S0 °C 0.999 0.003 1.942 0.004 0.1		50 °Drix/50 °C	0.990	0.019	9 102	0.021	4.0
Logarithmic 40 °Brix/60 °C 0.990 0.031 13.319 0.034 12.0 Logarithmic 40 °Brix/60 °C 0.993 0.026 21.517 0.029 8.0 50 °Brix/50 °C 0.986 0.035 17.578 0.039 1.5 Approximation of 40 °Brix/50 °C 0.994 0.023 20.213 0.026 7.0 Approximation of 50 °Brix/50 °C 0.998 0.012 5.500 0.013 2.0 Modified 40 °Brix/50 °C 0.998 0.010 3.716 0.0011 1.0 50 °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 50 °Brix/50 °C 0.988 0.034 12.647 0.039 15.0 Modified 40 °Brix/50 °C 0.983 0.040 17.407 0.045 20.0 From Terms 50 °Brix/50 °C 0.998 0.011 5.369 0.013 2.0 Midilli 40 °Brix/50 °C 0.999 0.003 1.942 0.004 0.1		30 °DIIX/00 °C	0.999	0.000	0.103	0.009	10.0
Logarithmic 40 Bit/d0 C 0.935 0.020 21.017 0.023 0.023 Approximation of Diffusion 50 °Brix/50 °C 0.994 0.023 20.213 0.026 7.0 Approximation of Diffusion 40 °Brix/50 °C 0.998 0.012 5.500 0.013 2.0 Approximation of Diffusion 50 °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 So °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 So °Brix/50 °C 0.998 0.034 12.647 0.039 15.0 Modified 40 °Brix/60 °C 0.999 0.022 20.613 0.036 1.3 Henderson & Pabis 50 °Brix/50 °C 0.998 0.011 5.369 0.013 2.0 Two Terms 40 °Brix/60 °C 0.999 0.003 1.942 0.004 0.1 Midilli 40 °Brix/60 °C 0.999 0.001 3.635 0.011 1.0 So °Brix/60 °C 0.999 0.005 2.038 0.00		40 DIIX/30 C	0.990	0.031	01 517	0.034	12.0
Approximation of Diffusion 50 BitX/50 °C 0.994 0.023 20.213 0.026 7.0 Approximation of Diffusion 40 °Brix/50 °C 0.998 0.012 5.500 0.013 2.0 Modified 40 °Brix/50 °C 0.998 0.010 3.716 0.004 10.0 Diffusion 50 °Brix/50 °C 0.999 0.006 1.702 0.007 0.5 Modified 40 °Brix/50 °C 0.998 0.032 20.613 0.036 1.3 Modified 40 °Brix/50 °C 0.988 0.034 12.647 0.039 15.0 Modified 40 °Brix/50 °C 0.989 0.032 20.613 0.036 1.3 Henderson & Pabis 50 °Brix/50 °C 0.998 0.011 5.0 0.033 11.0 Modified 40 °Brix/50 °C 0.999 0.003 1.942 0.004 0.1 Two Terms 50 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 Midilli 50 °Brix/50 °C 0.999	Logarithmic	40 °B(1X/00 °C	0.993	0.020	21.317	0.029	0.0
Approximation of Diffusion 30° Brix/50°C 0.998 0.012 5.500 0.013 2.0 Approximation of Diffusion 40° Brix/50°C 0.998 0.010 3.716 0.011 1.0 50° Brix/50°C 0.998 0.010 3.716 0.011 1.0 50° Brix/60°C 0.998 0.006 1.702 0.007 0.5 Modified 40° Brix/50°C 0.988 0.034 12.647 0.039 15.0 Modified 40° Brix/50°C 0.989 0.029 22.856 0.033 11.0 Henderson & Pabis 50° Brix/50°C 0.998 0.011 5.369 0.013 2.0 Two Terms 40° Brix/50°C 0.999 0.003 1.942 0.004 0.1 50° Brix/50°C 0.999 0.005 2.038 0.006 0.1 Midilli 50° Brix/50°C 0.999 0.005 2.038 0.006 0.1 50° Brix/60°C 0.999 0.005 2.038 0.006 0.1 <td< td=""><td></td><td>50 °Priv/60 °C</td><td>0.960</td><td>0.035</td><td>20.212</td><td>0.039</td><td>7.0</td></td<>		50 °Priv/60 °C	0.960	0.035	20.212	0.039	7.0
Approximation of Diffusion 40 Brix/50 °C 0.999 0.003 2.196 0.004 10.0 Diffusion 50 °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 50 °Brix/50 °C 0.999 0.006 1.702 0.007 0.5 40 °Brix/50 °C 0.999 0.032 20.613 0.036 1.3 Modified 40 °Brix/50 °C 0.988 0.032 20.613 0.036 1.3 Henderson & Pabis 50 °Brix/50 °C 0.983 0.040 17.407 0.045 20.0 50 °Brix/50 °C 0.991 0.029 22.856 0.033 11.0 40 °Brix/50 °C 0.998 0.011 5.369 0.011 1.0 50 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 40 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 50 °Brix/50 °C 0.999 0.009 3.234 0.011 1.0 50 °Brix/50 °C 0.9997 0.014 4.		10 °Briv/50 °C	0.994	0.023	5 500	0.020	2.0
Approximation 440 Brix/50 °C 0.998 0.003 2.133 0.004 10.0 Diffusion 50 °Brix/50 °C 0.998 0.010 3.716 0.011 1.0 Modified 40 °Brix/50 °C 0.998 0.034 12.647 0.039 15.0 Modified 40 °Brix/50 °C 0.988 0.032 20.613 0.036 1.3 Henderson & Pabis 50 °Brix/50 °C 0.983 0.040 17.407 0.045 20.0 50 °Brix/50 °C 0.991 0.029 22.856 0.033 11.0 40 °Brix/50 °C 0.998 0.011 5.369 0.013 2.0 Two Terms 40 °Brix/50 °C 0.999 0.003 1.942 0.004 0.1 50 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 40 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 Midilli 40 °Brix/50 °C 0.999 0.009 3.234 0.016 3.0 50 °Brix/50 °C	Approximation of	40 °Briv/60 °C	0.000	0.012	2 106	0.013	10.0
Diritsion 50° Brix/50°C 0.999 0.006 1.702 0.017 1.3 Modified 40° Brix/50°C 0.999 0.006 1.702 0.007 0.5 Modified 40° Brix/50°C 0.988 0.034 12.647 0.039 15.0 Henderson & Pabis 50° Brix/50°C 0.983 0.040 17.407 0.045 20.0 50° Brix/50°C 0.991 0.029 22.856 0.033 11.0 40° Brix/50°C 0.998 0.011 5.369 0.013 2.0 fwo Terms 40° Brix/50°C 0.999 0.003 1.942 0.004 0.1 50° Brix/50°C 0.999 0.005 2.038 0.006 0.1 fwo Terms 50° Brix/50°C 0.999 0.005 2.038 0.006 0.1 Midilli 40° Brix/50°C 0.999 0.009 3.234 0.011 1.0 50° Brix/50°C 0.997 0.016 7.957 0.017 3.0 Midillii 40° B	Diffusion	40 DIX/00 C	0.999	0.003	2.190	0.004	10.0
Modified 40 °Brix/50 °C 0.393 0.000 1.702 0.07 0.37 Modified 40 °Brix/50 °C 0.988 0.034 12.647 0.039 15.0 Henderson & Pabis 50 °Brix/50 °C 0.988 0.032 20.613 0.036 1.3 Two Terms 50 °Brix/50 °C 0.983 0.040 17.407 0.045 20.0 40 °Brix/50 °C 0.991 0.029 22.856 0.033 11.0 40 °Brix/50 °C 0.999 0.003 1.942 0.004 0.1 50 °Brix/60 °C 0.999 0.003 1.942 0.004 0.1 50 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 40 °Brix/50 °C 0.999 0.009 3.234 0.011 1.0 50 °Brix/50 °C 0.997 0.014 3.934 0.016 3.0 Midilli 50 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 Modified 40 °Brix/60 °C 0.997	Dillusion	50 °Briv/60 °C	0.000	0.010	1 702	0.011	0.5
Modified 40 °Brix/60 °C 0.989 0.032 20.613 0.036 1.3 Henderson & Pabis 50 °Brix/50 °C 0.983 0.040 17.407 0.045 20.0 Two Terms 40 °Brix/50 °C 0.993 0.011 5.369 0.013 2.0 Two Terms 40 °Brix/50 °C 0.999 0.003 1.942 0.004 0.1 Midilli 40 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 Midilli 40 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 Midilli 40 °Brix/50 °C 0.999 0.009 3.234 0.011 1.0 50 °Brix/50 °C 0.999 0.010 2.899 0.012 1.0 0.012 1.0 Midilli 40 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 Mod °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 Mod °Brix/50 °C 0.997 0.016 7.40 °1.4011 0.017		10 °Briv/50 °C	0.935	0.000	12 647	0.007	15.0
Modified 40 Brix/50 °C 0.983 0.040 17.407 0.050 1.0 Henderson & Pabis 50 °Brix/50 °C 0.983 0.040 17.407 0.045 20.0 50 °Brix/50 °C 0.991 0.029 22.856 0.033 11.0 40 °Brix/50 °C 0.998 0.011 5.369 0.013 2.0 Two Terms 40 °Brix/50 °C 0.999 0.003 1.942 0.004 0.1 50 °Brix/50 °C 0.999 0.010 3.635 0.011 1.0 50 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 40 °Brix/50 °C 0.999 0.009 3.234 0.011 1.0 Midilli 40 °Brix/50 °C 0.997 0.014 3.934 0.016 3.0 Midilli 50 °Brix/60 °C 0.997 0.016 7.957 0.017 3.0 Midilli 40 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 Midilli 50 °Brix/50 °C	Modified	40 °Brix/60 °C	0.000	0.004	20.613	0.000	13.0
Nontonion d rubbi Sob Brix/60 °C 0.091 0.029 22.856 0.033 11.0 Two Terms 40 °Brix/50 °C 0.998 0.011 5.369 0.013 2.0 Two Terms 40 °Brix/50 °C 0.999 0.003 1.942 0.004 0.1 50 °Brix/60 °C 0.999 0.010 3.635 0.011 1.0 50 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 60 °Brix/50 °C 0.999 0.009 3.234 0.011 1.0 Midilli 40 °Brix/50 °C 0.999 0.010 2.899 0.012 1.0 Midilli 50 °Brix/60 °C 0.997 0.014 3.934 0.016 3.0 50 °Brix/60 °C 0.997 0.016 7.957 0.017 3.0 Newton 40 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 Newton 50 °Brix/60 °C 0.997 0.016 7.957 0.017 3.0 S0 °Brix/50 °C <	Henderson & Pahis	50 °Brix/50 °C	0.983	0.002	17 407	0.000	20.0
Midilli Mid O Brix/50 °C 0.998 0.011 5.369 0.013 2.0 Two Terms 40 °Brix/60 °C 0.998 0.011 5.369 0.013 2.0 Midilli 50 °Brix/60 °C 0.999 0.003 1.942 0.004 0.1 Midilli 50 °Brix/60 °C 0.999 0.010 3.635 0.011 1.0 Midilli 40 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 Midilli 40 °Brix/50 °C 0.998 0.014 4.634 0.016 3.0 Midilli 40 °Brix/50 °C 0.999 0.009 3.234 0.011 1.0 So °Brix/60 °C 0.997 0.014 3.934 0.016 3.0 50 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 Newton 40 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 So °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 So °Brix/50 °C		50 °Brix/60 °C	0.991	0.029	22.856	0.033	11.0
Two Terms 40 °Brix/60 °C 0.999 0.003 1.942 0.004 0.1 50 °Brix/50 °C 0.999 0.010 3.635 0.011 1.0 50 °Brix/50 °C 0.999 0.005 2.038 0.006 0.1 Midilli 40 °Brix/50 °C 0.999 0.009 3.234 0.016 3.0 Midilli 40 °Brix/50 °C 0.999 0.014 3.934 0.016 3.0 Midilli 50 °Brix/60 °C 0.997 0.014 3.934 0.016 3.0 Midilli 40 °Brix/50 °C 0.997 0.010 2.899 0.012 1.0 Newton 70 °C 0.997 0.016 7.957 0.017 3.0 Newton 40 °Brix/60 °C 0.997 0.016 14.011 0.017 3.0 Newton 50 °Brix/60 °C 0.997 0.016 14.011 0.017 3.0 Newton 50 °Brix/50 °C 0.996 0.019 8.749 0.020 4.0		40 °Brix/50 °C	0.998	0.020	5 369	0.000	2.0
Iwo lerms 1.0 bit/00 0 0 0.000 0.000 0 0.001 1.042 0.004 0.011 0.004 0.011 50 °Brix/50 °C 0.999 0.010 3.635 0.011 1.0 50 °Brix/60 °C 0.999 0.005 2.038 0.006 0.1 40 °Brix/50 °C 0.998 0.014 4.634 0.016 3.0 Midilli 40 °Brix/50 °C 0.999 0.009 3.234 0.011 1.0 50 °Brix/60 °C 0.999 0.014 3.934 0.016 3.0 50 °Brix/60 °C 0.997 0.010 2.899 0.012 1.0 To °C 70 °C 40 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 Newton 40 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 10 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 3.0 10 °Brix/50 °C 0.996 0.019 8.749 0.020 4.0 10 °Brix/60 °C 0.993 <td rowspan="3">Two Terms</td> <td>40 °Brix/60 °C</td> <td>0.999</td> <td>0.003</td> <td>1 942</td> <td>0.010</td> <td>0.1</td>	Two Terms	40 °Brix/60 °C	0.999	0.003	1 942	0.010	0.1
Midilli 50° Brix/60°C 0.999 0.005 2.038 0.006 0.1 Midilli 40°Brix/50°C 0.998 0.014 4.634 0.016 3.0 Midilli 40°Brix/50°C 0.999 0.009 3.234 0.011 1.0 50°Brix/60°C 0.997 0.014 3.934 0.016 3.0 50°Brix/60°C 0.997 0.010 2.899 0.012 1.0 70°C 70°C 40°Brix/50°C 0.997 0.016 7.957 0.017 3.0 Newton 40°Brix/60°C 0.997 0.016 14.011 0.017 3.0 S0°Brix/60°C 0.997 0.016 14.011 0.017 3.0 3.0 50°Brix/50°C 0.996 0.019 8.749 0.020 4.0 50°Brix/60°C 0.993 0.027 14.204 0.028 8.0		50 °Brix/50 °C	0.000	0.000	3 635	0.004	1.0
Midilli Midilli <t< td=""><td>50 °Brix/60 °C</td><td>0.999</td><td>0.005</td><td>2.038</td><td>0.006</td><td>0 1</td></t<>		50 °Brix/60 °C	0.999	0.005	2.038	0.006	0 1
Midilli 40 °Brix/60 °C 0.999 0.009 3.234 0.011 1.0 50 °Brix/50 °C 0.997 0.014 3.934 0.016 3.0 50 °Brix/60 °C 0.999 0.010 2.899 0.012 1.0 70 °C 40 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 Newton 40 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 So °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 So °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 So °Brix/50 °C 0.996 0.019 8.749 0.020 4.0 50 °Brix/60 °C 0.993 0.027 14.204 0.028 8.0	Midilli	40 °Brix/50 °C	0.998	0.000	4 634	0.016	3.0
Midilli 1.0 bit/00 °C 0.000 °C 0.000 °C 0.001 °C 1.0 °C 50 °Brix/50 °C 0.997 0.014 3.934 0.016 3.0 °C 70 °C 70 °C 70 °C 70 °C 70 °C 70 °C 70 °C Newton 40 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 50 °Brix/60 °C 0.997 0.016 14.011 0.017 3.0 50 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 50 °Brix/60 °C 0.996 0.019 8.749 0.020 4.0 50 °Brix/60 °C 0.993 0.027 14.204 0.028 8.0		40 °Brix/60 °C	0.000	0.009	3 234	0.010	1.0
Newton 40 °Brix/50 °C 0.999 0.016 7.957 0.017 3.0 100 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 100 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 100 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 100 °Brix/50 °C 0.996 0.019 8.749 0.020 4.0 100 °Brix/50 °C 0.993 0.027 14.204 0.028 8.0		50 °Brix/50 °C	0.997	0.000	3 934	0.016	3.0
Newton 40 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 100 °C 0.997 0.016 14.011 0.017 3.0 100 °Brix/50 °C 0.997 0.016 14.011 0.017 3.0 100 °Brix/50 °C 0.996 0.019 8.749 0.020 4.0 100 °Brix/60 °C 0.993 0.027 14.204 0.028 8.0		50 °Brix/60 °C	0.999	0.010	2 899	0.012	1.0
Newton 40 °Brix/50 °C 0.997 0.016 7.957 0.017 3.0 10 °Brix/60 °C 0.997 0.016 14.011 0.017 3.0 50 °Brix/50 °C 0.996 0.019 8.749 0.020 4.0 50 °Brix/60 °C 0.993 0.027 14 204 0.028 8.0			0.000	0.010	70 %	0.012	1.0
Newton $40 ^{\circ}\text{Brix}/60 ^{\circ}\text{C}$ 0.997 0.016 14.011 0.017 3.0 $50 ^{\circ}\text{Brix}/50 ^{\circ}\text{C}$ 0.996 0.019 8.749 0.020 4.0 $50 ^{\circ}\text{Brix}/60 ^{\circ}\text{C}$ 0.993 0.027 14204 0.028 8.0		40 °Briv/50 °C	0 997	0.016	7 957	0.017	3.0
Newton 50 °Brix/50 °C 0.996 0.019 8.749 0.020 4.0 50 °Brix/60 °C 0.993 0.027 14 204 0.028 8.0		40 °Brix/60 °C	0.007	0.016	14 011	0.017	3.0
50 °Brix/60 °C 0.993 0.027 14 204 0.028 8.0	Newton	50 °Brix/50 °C	0.996	0.010	8 749	0.077	4 0
		50 °Brix/60 °C	0.993	0.027	14.204	0.028	8.0

Continues on the next page

Continuation of	of Table 1
-----------------	------------

Model	00	Temperature					
INIUUEI		R ²	MSD	P (%)	SE	χ² (x10-4)	
				70 °C			
Page	40 °Brix/50 °C	0.997	0.016	8.646	0.017	3.0	
	40 °Brix/60 °C	0.998	0.011	5.748	0.012	1.0	
	50 °Brix/50 °C	0.999	0.007	10.705	0.008	1.0	
	50 °Brix/60 °C	0.999	0.010	7.352	0.011	1.0	
	40 °Brix/50 °C	0.998	0.015	9.638	0.016	3.0	
Handaraan & Dahia	40 °Brix/60 °C	0.998	0.015	12.944	0.016	3.0	
HEHUEISUII & PAUIS	50 °Brix/50 °C	0.998	0.014	7.317	0.015	2.0	
	50 °Brix/60 °C	0.995	0.023	10.214	0.024	6.0	
	40 °Brix/50 °C	0.997	0.017	7.664	0.018	3.0	
Two-Term	40 °Brix/60 °C	0.998	0.015	12.490	0.016	3.0	
Exponential	50 °Brix/50 °C	0.999	0.008	6.161	0.009	1.0	
	50 °Brix/60 °C	0.999	0.006	6.212	0.007	1.0	
	40 °Brix/50 °C	0.997	0.015	7.137	0.017	3.0	
Thompson	40 °Brix/60 °C	0.999	0.008	6.037	0.009	1.0	
rnompson	50 °Brix/50 °C	0.999	0.011	16.197	0.012	2.0	
	50 °Brix/60 °C	0.998	0.010	13.652	0.012	1.0	
	40 °Brix/50 °C	0.998	0.013	14.501	0.015	2.0	
Logorithmio	40 °Brix/60 °C	0.998	0.012	15.520	0.014	2.0	
Logantininic	50 °Brix/50 °C	0.998	0.013	10.994	0.015	2.0	
	50 °Brix/60 °C	0.996	0.019	16.281	0.022	5.0	
	40 °Brix/50 °C	0.998	0.015	8.900	0.017	4.0	
Approximation of	40 °Brix/60 °C	0.999	0.007	5.498	0.008	1.0	
Diffusion	50 °Brix/50 °C	0.999	0.005	7.349	0.006	0.1	
	50 °Brix/60 °C	0.999	0.006	6.037	0.007	1.0	
	40 °Brix/50 °C	0.998	0.015	9.638	0.017	3.0	
Modified	40 °Brix/60 °C	0.998	0.015	12.944	0.017	3.0	
Henderson & Pabis	50 °Brix/50 °C	0.998	0.014	7.317	0.016	3.0	
	50 °Brix/60 °C	0.995	0.022	10.217	0.026	7.0	
	40 °Brix/50 °C	0.998	0.011	8.802	0.013	2.0	
Two Torme	40 °Brix/60 °C	0.999	0.006	4.541	0.007	1.0	
iwo ierms	50 °Brix/50 °C	0.999	0.006	7.319	0.007	0.1	
	50 °Brix/60 °C	0.999	0.006	5.760	0.007	0.1	
	40 °Brix/50 °C	0.998	0.014	10.848	0.016	2.0	
Midilli	40 °Brix/60 °C	0.999	0.009	6.712	0.011	1.0	
MIGIII	50 °Brix/50 °C	0.999	0.005	2.141	0.006	0.1	
	50 °Brix/60 °C	0.999	0.008	3.954	0.010	1.0	

Diffusion and Midilli, also had high R² values, above 0.995, and low MSD, P, SE and χ^2 , below 0.021, 8.199%, 0.023 and 5.0 x 10⁻⁴, respectively, indicating their adequacy to represent the drying kinetics of osmotically pre-dehydrated papaya cubes.

Table 2 presents the effective diffusion coefficients (D_{ef}) and convective mass transfer coefficients (h_w) obtained for the drying of the samples, subjected to the temperatures of 50, 60 and 70 °C. The increase in convective drying temperature

(50-70 °C) causes the increment in D_{ef} values. In addition, it was observed that samples subjected to the solutions with the same temperature, but with higher sucrose concentration, in particular for the drying temperature of 70 °C, offer greater resistance to external mass transfer, which in turn may be related to the reduction of h_w . This behavior may be associated with increased concentration of soluble solids during the OD, on the surface of the sample (Rodríguez et al., 2015; Sangeeta

Table 2. Effective diffusion coefficients (D _{ef}) and convective mass transfer coefficients (h _w) obtained in convective drying,	, at
temperatures (Temp) of 50, 60 and 70 °C, of osmotically pre-dehydrated (OD) papaya cubes	

OD	Temp (°C)	h_w (m s ⁻¹)	D_{ef} (m ² s ⁻¹)	Bi	R ²	χ ²
	50	5.697 × 10 ⁻⁷	8.440 × 10 ⁻¹⁰	6.750	0.996	6.571 × 10 ⁻³
40 °Brix/50 °C	60	7.411 × 10 ⁻⁷	1.097 × 10 ⁻⁹	6.750	0.998	3.944×10^{-3}
	70	3.910 × 10 ⁻⁷	$3.910 imes 10^{-6}$	0.001	0.998	4.885×10^{-3}
40 °Brix/60 °C	50	6.553 × 10 ⁻⁷	$9.709 imes 10^{-10}$	6.750	0.997	5.746×10^{-3}
	60	9.742 × 10 ⁻⁷	1.443 × 10 ⁻⁹	6.750	0.999	2.050×10^{-3}
	70	5.845×10^{-7}	4.031 × 10 ⁻⁹	1.450	0.998	2.850×10^{-3}
50 °Brix/50 °C	50	1.201×10^{-6}	9.611×10^{-10}	12.500	0.996	7.161×10^{-3}
	60	1.138 × 10 ⁻⁶	$1.059 imes 10^{-9}$	10.750	0.998	3.577×10^{-3}
	70	5.622×10^{-7}	2.444×10^{-9}	2.300	0.999	$6.693 imes 10^{-4}$
50 °Brix/60 °C	50	6.661×10^{-7}	1.268 × 10 ⁻⁹	5.250	0.997	4.561×10^{-4}
	60	$9.273 imes 10^{-7}$	$1.766 imes 10^{-10}$	5.250	0.998	2.811×10^{-4}
	70	6.680×10^{-7}	1.979 × 10 ⁻⁹	3.375	0.999	1.605×10^{-4}

Bi - Biot number; χ^2 - Chi-square

& Hathan, 2016; Goula et al., 2017), capable of forming, at high temperatures (\geq 70 °C), a dense and poorly permeable layer, increasing the resistance to heat transfer to the samples and establishing an additional barrier to the water exit from its interior (Munhoz et al., 2014; Corrêa et al., 2017). Similar results have been reported in strawberry (Garcia-Noguera et al., 2010) and plum (Dehghannya et al., 2016).

It is observed that the Biot number (Bi) was within the range from 0.001 to 12.500 (Table 2), which, according to Kaya et al. (2010), is indicative of the existence of internal and external resistances to water transfer, being considered the most realistic case in practical applications. It should be pointed out that Bi tended to decrease with the elevation in the drying temperature, especially at 70 °C, indicating that there is a higher resistance to mass flow on the surface of the samples (Silva et al., 2013).

The solution of the Fick's second law equation (Eq. 18), for all OD treatments, considering convective boundary condition, showed, even in Biot number << 1 (Bi = 0.001; R² = 0.998; χ^2 = 4.885×10^{-3}), adequate fit to the experimental data of drying kinetics of the samples ($R^2 > 0.996$ and $\chi^2 < 7.161 \times 10^{-3}$) (Table 2), which ensures the physical representativeness of the values of D_{ef} and h_{w} .

CONCLUSIONS

1. Among the fitted mathematical models, the Two Terms model was selected as the most adequate for drying kinetics of osmo-dehydrated papaya cubes.

2. The effective diffusivity in the samples increased with the increase of air temperature, whereas the convective mass transfer coefficient showed a less defined trend.

ACKNOWLEDGMENTS

The authors thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the financial support.

LITERATURE CITED

- Chen, Q.; Bi, J.; Chen, R.; Liu, X.; Wu, X.; Zhou, M. Comparative study on drying characteristic, moisture diffusivity, and some physical and nutritional attributes of blanched carrot slices. Journal of Food Process and Preservation, v.41, p.1-8, 2017. https://doi. org/10.1111/jfpp.13201
- Corrêa, J. L. G.; Rasia, M. C.; Mulet, A. J.; Cárcel, A. Influence of ultrasound application on both the osmotic pretreatment and subsequent convective drying of pineapple (Ananas comosus). Innovative Food Science and Emerging Technologies, v.41, p.284-291, 2017. https://doi.org/10.1016/j.ifset.2017.04.002
- Costa, C. F.; Corrêa, P. C.; Vanegas, J.D. B.; Baptestini, F. M.; Campos, R. C.; Fernandes, L. S. Mathematical modeling and determination of thermodynamic properties of jabuticaba peel during the drying process. Revista Brasileira de Engenharia Agrícola e Ambiental, v.20, p.576-580, 2016. https://doi.org/10.1590/1807-1929/ agriambi.v20n6p576-580

- Dehghannya, J.; Gorbani, R.; Ghanbarzadeh, B. Shrinkage of mirabelle plum during hot air drying as influenced by ultrasound-assisted osmotic dehydration. International Journal of Food Properties, v.19, p.1093-1103, 2016. https://doi.org/10.1080/10942912.201 5.1055362
- Dermesonlouoglou, E.; Chalkia, A.; Taoukis, P. Application of osmotic dehydration to improve the quality of dried goji berry. Journal of Food Engineering, v.232, p.36-43, 2018. https://doi.org/10.1016/j. jfoodeng.2018.03.012
- FAOSTAT Food and Agriculture Organization of the United Nations Statistics Division. Available on: http://faostat3.fao.org/ browse/Q/QC/E>. Access on: Apr. 2018.
- Fernandes, F. A. N.; Linhares Jr., F. E.; Rodrigues, S. Ultrasound as pre-treatment for drying of pineapples. Ultrasonics Sonochemistry, v.15, p.1049-1054, 2008. https://doi.org/10.1016/j. ultsonch.2008.03.009
- Galaz, P.; Valdenegro, M.; Ramírez, C.; Nuñez, H.; Almonacid, S.; Simpson, R. Effect of drum drying temperature on drying kinetic and polyphenol contents in pomegranate peel. Journal of Food Engineering, v.208, p.19-27, 2017. https://doi.org/10.1016/j. jfoodeng.2017.04.002
- Garcia-Noguera, J.; Oliveira, F. I. P.; Gallão, M. I.; Weller, C. L.; Rodrigues, S.; Fernandes, F. A. N. Ultrasound-assisted osmotic dehydration of strawberries: effect of pre-treatment time and ultrasonic frequency. Drying Technology, v.28, p.294-303, 2010. https://doi.org/10.1080/07373930903530402
- Gava, A. J.; Silva, C. A. B. da.; Frias, J. R. G. Tecnologia de alimentos: Princípios e aplicações. Nobel, São Paulo, 2008.
- Germer, S. P. M.; Queiroz, M. R. de.; Aguirre, J. M.; Berbari, S. A. G.; Anjos, V. D. Desidratação osmótica de pêssegos em função da temperatura e concentração do xarope de sacarose. Revista Brasileira de Engenharia Agrícola e Ambiental, v.15, p.161-169, 2011. https://doi.org/10.1590/S1415-43662011000200008
- Goula, A. M.; Kokolaki, M.; Daftsiou, E. Use of ultrasound for osmotic dehydration. The case of potatoes. Food and bioproducts processing, v.105, p.157-170, 2017. https://doi.org/10.1016/j. fbp.2017.07.008
- Haas, I. C. da S.; Toaldo, I. M.; Müller, C. M. O.; Bordignon-Luiz, M. T. Modeling of drying kinetics of the non-pomace residue of red grape (V. labrusca L.) juices: Effect on the microstructure and bioactive anthocyanins. Journal of food process engineering, v.40, p.1-11, 2017. https://doi.org/10.1111/jfpe.12568
- Henderson, S. M. Progress in developing the thin layer drying equation. Transactions of the American Society of Agricultural Engineers, v.17, p.1167-1168, 1974. https://doi.org/10.13031/2013.37052
- Henderson, S. M.; Pabis, S. Grain drying theory. II: Temperature effects on drying coefficients. Journal of Agricultural Engineering Research, v.6, p.169-174, 1961.
- Lewis, W. K. The rate of drying of solid materials. The Journal of Industrial and Engineering Chemistry, v.13, p.427-432, 1921. https://doi.org/10.1021/ie50137a021
- Kandasamy, P.; Varadharaju, N.; Kalemullah, S.; Moitra, R. Production of papaya powder under foam-mat drying using methyl cellulose as foaming agent. Asian Journal of Food and Agro-Industry, v.5, p.374-387, 2012.
- Karathanos, V. T. Determination of water content of dried fruits by drying kinetics. Journal of Food Engineering, v.39, p.337-344, 1999. https://doi.org/10.1016/S0260-8774(98)00132-0

- Kaya, A.; Aydın, O.; Dincer, I. Comparison of experimental data with results of some drying models for regularly shaped products. Heat Mass Transfer, v.46, p.555-562, 2010. https://doi.org/10.1007/ s00231-010-0600-z
- Kaushal, P.; Sharma, H. K. Osmo-convective dehydration kinetics of jackfruit (*Artocarpus heterophyllus*). Journal of the Saudi Society of Agricultural Sciences, v.15, p.118-126, 2016. https:// doi.org/10.1016/j.jssas.2014.08.001
- Kucuk, H.; Midilli, A.; Kilic, A.; Dincer, I. A review on thin-layer drying-curve equations. Drying Technology, v.32, p.757-773, 2014. https://doi.org/10.1080/07373937.2013.873047
- Mendes, G. R. L.; Freitas, C. H. de; Scaglioni, P. T.; Schmidt, C. G.; Furlong, E. B. Condições para desidratação osmótica de laranjas e as propriedades funcionais do produto. Revista Brasileira de Engenharia Agrícola e Ambiental, v.17, p.1210-1216, 2013. https:// doi.org/10.1590/S1415-43662013001100012
- Midilli, A.; Kucuk, H.; Yapar, Z. A new model for single layer drying. Drying Technology, v.20, p.1503-1513, 2002. https://doi. org/10.1081/DRT-120005864
- Munhoz, C. L.; Sanjinez-Argandoña, E. J.; Campagnolli, R.; Macedo, M. L. R. Drying of the kernel and fresh and osmotically dehydrated bocaiuva pulps. v.36, p.165-170, 2014. https://doi. org/10.4025/16843
- Orikasa, T.; Koide, S.; Okamoto, S.; Imaizumi, T.; Muramatsu, Y.; Takeda, J.; Shiina, T.; Tagawa, A. Impacts of hot air and vacuum drying on the quality attributes of kiwifruit slices. Journal of Food Engineering, v.125, p.51-58, 2014. https://doi.org/10.1016/j. jfoodeng.2013.10.027
- Özdemira, M. B.; Aktaşa, M.; Şevik, S.; Khanlari, A. Modeling of a convective-infrared kiwifruit drying process. International Journal of Hydrogen Energy, v.42, p.18005-18013, 2017. https:// doi.org/10.1016/j.ijhydene.2017.01.012
- Pacheco-Angulo, H.; Herman-Lara, E.; García-Alvarado, M. A.; Ruiz-López, I. I. Mass transfer modeling in osmotic dehydration: Equilibrium characteristics and process dynamics under variable solution concentration and convective boundary. Food and Bioproducts Processing, v.97, p.88-99, 2016. https://doi. org/10.1016/j.fbp.2015.11.002
- Page, G. E. Factors influencing the maximum rates of air drying shelled corn in thin layers. West Lafayette: Purdue University, 1949. Thesis Doctoral
- Pilatti, D.; Johann, G.; Palú, F.; Silva, E. A. da. Evaluation of a concentrated parameters mathematical model applied to drying of yerba mate leaves with variable mass transfer coefficient. Applied Thermal Engineering, v.105, p.483-489, 2016. https:// doi.org/10.1016/j.applthermaleng.2016.02.139
- Prosapio, V.; Norton, I. Influence of osmotic dehydration pretreatment on oven drying and freeze drying performance. LWT
 Food Science and Technology, v.80, p.401-408, 2017. https://doi. org/10.1016/j.lwt.2017.03.012
- Rabha, D. K.; Muthukumar, P.; Somayaji, C. Experimental investigation of thin layer drying kinetics of ghost chilli pepper (*Capsicum chinense* Jacq.) dried in a forced convection solar tunnel dryer. Renewable Energy, v.105, p.583-589, 2017. https:// doi.org/10.1016/j.renene.2016.12.091

- Rodríguez, M. M.; Rodriguez, A.; Mascheroni, R. H. Color, texture, rehydration ability and phenolic compounds of plums partially osmodehydrated and finish-dried by hot air. Journal of Food Processing and Preservation, v.39, p.2647-2662, 2015. https:// doi.org/10.1111/jfpp.12515
- Sangeeta; Hathan, B. S. studies on mass transfer and diffusion coefficients in elephant foot yam (*Amorphophallus* SPP.) during osmotic dehydration in sodium chloride solution. Journal of Food Processing and Preservation, v.40, p.521-530, 2016. https://doi. org/10.1111/jfpp.12631
- Sharaf-Eldeen, Y. I.; Blaisdell, J. L.; Hamdy, M. Y. A model for ear corn drying. Transactions of the American Society of Agricultural Engineers, v.23, p.1261-1265, 1980. https://doi. org/10.13031/2013.34757
- Silva, W. P.; Silva, C. M. D. P. S. Convective Adsorption Desorption, Versão 3.2. (2008 - 2018). Available on: http://zeus.df.ufcg.edu. br/labfit/Convective.htm>. Access on: Sep. 2018.
- Silva, W. P.; Silva, C. M. D. P. S.; Gomes, J. P. Drying description of cylindrical pieces of bananas in different temperatures using diffusion models. Journal of Food Engineering, v.117, p.417-424, 2013. https://doi.org/10.1016/j.jfoodeng.2013.03.030
- Silva, W. P.; Silva, C. M. D. P. S.; Aires, J. E. F.; Silva-Junior, A. F. Osmotic dehydration and convective drying of coconut slices: Experimental determination and description using one-dimensional diffusion model. Journal of the Saudi Society of Agricultural Sciences, v.13, p.162-168, 2014a. https://doi. org/10.1016/j.jssas.2013.05.002
- Silva, W. P.; Silva, C. M. D. P. S.; Lins, M. A. A.; Gomes, J. P. Osmotic dehydration of pineapple (*Ananas comosus*) pieces in cubical shape described by diffusion models. LWT - Food Science and Technology, v.55, p.1-8, 2014b. https://doi.org/10.1016/j. lwt.2013.08.016
- Souraki, B. A.; Ghavami, M.; Tondro, H. Correction of moisture and sucrose effective diffusivities for shrinkage during osmotic dehydration of apple in sucrose solution. Food and Bioproducts Processing, v.92, p.1-8, 2014. https://doi. org/10.1016/j.fbp.2013.07.002
- Statsoft. Statistica for Windows Computer program manual. Version 7.0 Tulsa: Statsoft Inc., 2007.
- Thompson, T. L.; Peart, R. M.; Foster, G. H. Mathematical simulation of corn drying: A new model. Transactions of the American Society of Agricultural Engineers, v.11, p.582-586, 1968. https:// doi.org/10.13031/2013.39473
- Tzempelikos, D. A.; Mitrakos, D.; Vouros, A. P.; Bardakas, A. V.; Filios, A. E.; Margaris, D. P. Numerical modeling of heat and mass transfer during convective drying of cylindrical quince slices. Journal of Food Engineering, v.156, p.10-21, 2015. https://doi. org/10.1016/j.jfoodeng.2015.01.017
- Yagcioglu, A.; Degirmencioglu, A.; Cagatay, F. Drying characteristics of laurel leaves under different conditions. In: International Congress on Agricultural Mechanization and Energy, 7, 1999, Adana. Proceedings... Adana: Faculty of Agriculture, Cukurova University, 1999, p.565-569.