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L

(DHC)

(WAC)

(RA)

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(*Phoenix dactylifera*)
(Palmaceae)

(Barreveld , 1993)

(Hashempoor,

.1999)

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(Ashraf Jahani, 2006)

(Barhi)

(Prado et al., 2000)

Doymaz,)

(2004;Doymaz, 2005; Falade& Abbo, 2007

(Hassan &

.Hobani, 2000)

)

(Falade & Abbo, 2007) (

(Kechaou et al.

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(Sayad , 2005)

1997).

$$X_R = \frac{\bar{X} - X_{eq}}{X_0 - X_{eq}} = \alpha \exp(-kt) \quad ()$$

:K

: \bar{X}

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: X_0

it Kechaou &)

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: X_{eq}

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.(Maalej,2000

$MR = \exp(-kt)$

Newton (Yaldiz et al.,2001)

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

Henderson and Pabis(Doymaz, 2004)

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

Logarithmic (Sayad , 2005)

$MR = \exp(-kt^n)$

Page (Doymaz, 2004)

$MR = \exp[-(kt)^n]$

Modified page (Togrul&Pehlivan,2004)

$MR = \exp(-k(\frac{t}{l^2})^n)$

Modified pageII (Togrul&Pehlivan,2004)

$MR = a \times \exp(-k_1t) + b \times \exp(k_2t)$

Two-term(Lahsasni et al.,2004)

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

Two-term exponential (Yaldiz et al.,2001)

$MR = 1 + a \times t + b \times t^2$

Wang and Singh(Sacilik &Elicin, 2005)

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

Approximation of diffusion (Lahsasni et al.,2004)

$MR = a \times \exp(-kt) + b \times \exp(-gt) + c \times \exp(-ht)$

Modified Henderson and Pabis (Sayad , 2005)

$MR = a \times \exp(-kt^n) + bt$

Midill – Kucuk (Lahsasni et al.,2004)

$MR = a \times \exp(-kt) + (1-a) \times \exp(-gt)$

Verma (Togrul&Pehlivan,2004)

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(AOAC ,1990)

(/ A&B)

(EK3000i A&B)

(Mettler)

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(Lewicki, 1998)

(VT50 Kimo)

$$WAC = \frac{M_r(100 - S_r) - M_d(100 - S_d)}{M_o(100 - S_o) - M_d(100 - S_d)} \quad ()$$

$$DHC = \frac{M_r \times S_r}{M_d \times S_d} \quad ()$$

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(Hassan & Hobani,

$$RA = WAC \times DHC \quad ()$$

/ 2000; Prado et al.,2000)

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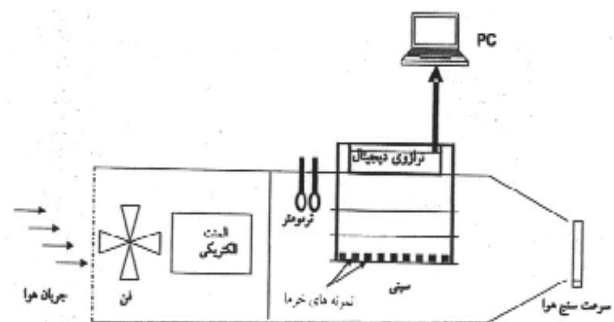
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RA WAC DHC

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2. Water Absorption Capacity
3. Holding Capacity Dry matter
4. Rehydration Ability
5. Photoshop

1. Anemometer

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(Kit &

. Papadakis , 2004)

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SAS

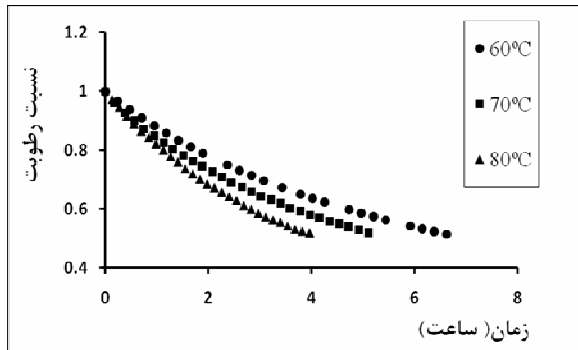
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(n k, c, b, a)

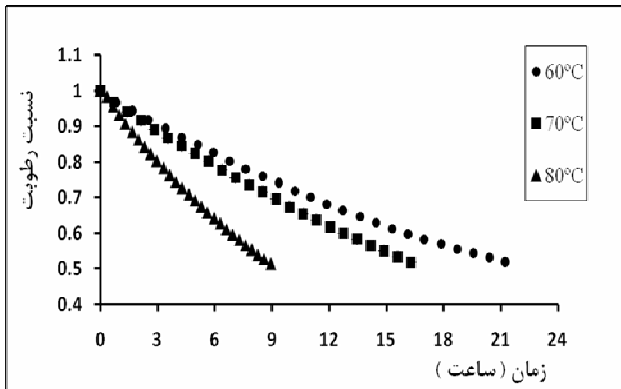
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(Kechaou & Maalej, 2000; Falade & Abbo, 2007;
.Amellal, & Benamara, 2008)



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RMSE

(Lahsasni et al., 2004; Togrul & Pehlivan, 2004)

$$RSME = \left[\frac{1}{N} \sum_{i=1}^N (MR_{exp,i} - MR_{pre,i})^2 \right]^{\frac{1}{2}} \quad ()$$

$$\chi^2 = \frac{\sum_{i=1}^N (MR_{exp,i} - MR_{pre,i})^2}{N - n} \quad ()$$

:

: $MR_{exp,i}$

: $MR_{pre,i}$

:n

:N

1. MATLAB
2. Square Error Root Mean

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WAC

DHC

DHC

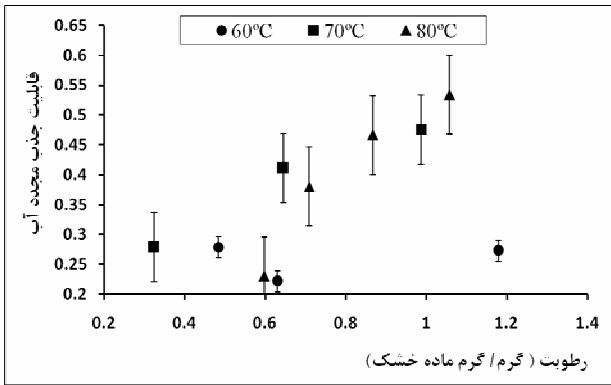
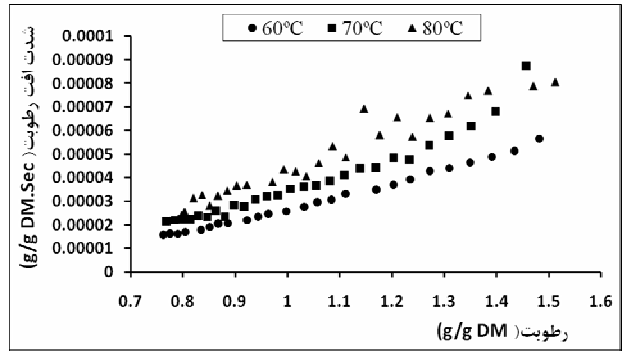
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DHC

WAC

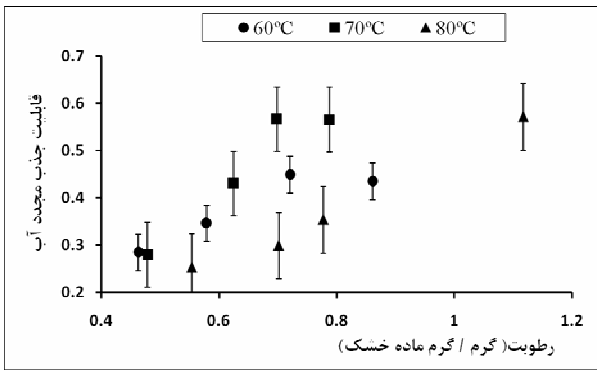
WAC

DHC



(Kechaou & Maalej, 2000; Falade & Abbo, 2007; Amellal, & Benamara, 2008)

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(Kechaou & Maalej, 2000; Falade & Abbo, 2007)

(DHC)

(WAC)

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RA DHC WAC

RA DHC WAC

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DHC WAC

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RA DHC WAC

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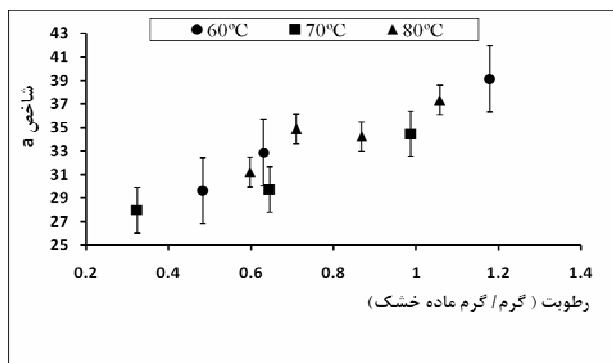
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b a

(Hamdi

a

& Hamdi,1991; Amellal & Benamara, 2008)



b

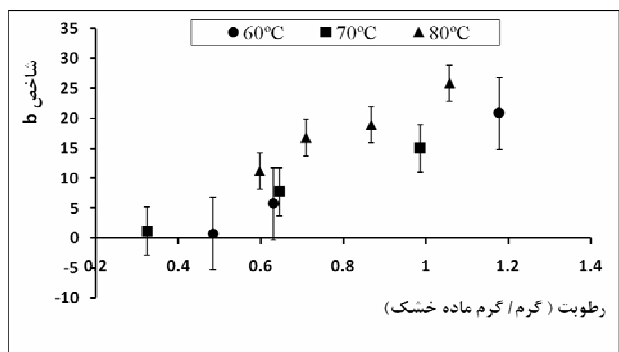
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(a,b,c,k,n)

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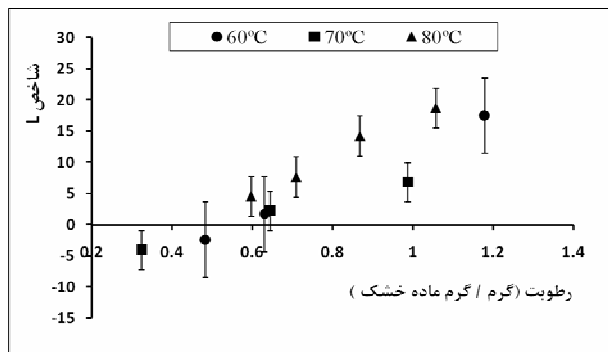
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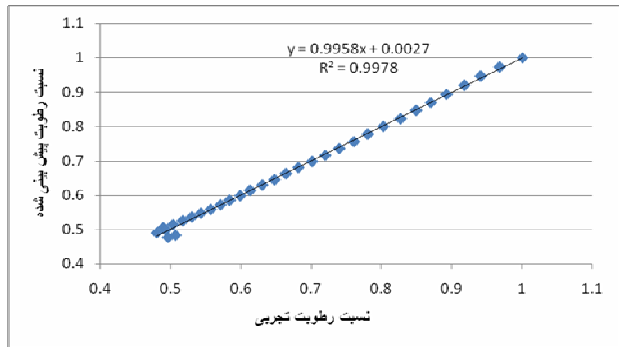
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WAC .

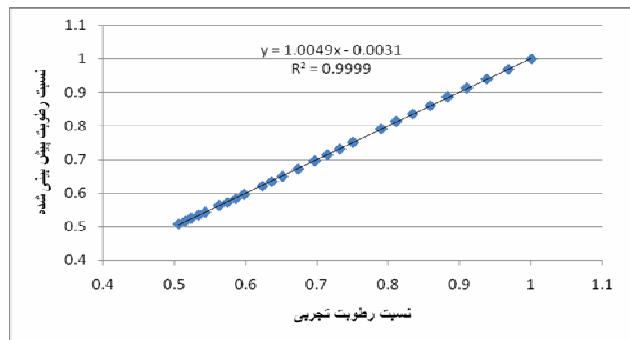
RA

DHC

DHC

b

a L



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REFERENCES

- Amellal, H. & Benamara, S. (2008). Vacuum drying of common date pulp cubes. *Drying Technology*, 26, 378- 382.
- AOAC. (1990). Official methods of analysis of the Association of Official Analytical Chemists. No. 934. 06, Arlington, Virginia, USA.
- Ashraf Jahani, A. (2006). *Date palm fruit life*. Tehran: Agricultural sciences.(In Farsi)
- Barreveld, W.H. (1993). *Date palm products*. FAO Agricultural Service Bulletin No. 101, Rome.
- Doymaz, I. (2004). Convective air drying characteristic of thin layer carrots. *Journal of Food Engineering*, 61, 359-364.
- Doymaz, I. (2005). Drying characteristics and kinetics of okra. *Journal of Food Engineering*, 69, 275-279.
- Falade, K.O. & Abbo, E. S. (2007). Air- drying and rehydration characteristics of date palm(Phoenix dactylifera L.) fruits. *Journal of Food Engineering*, 79, 724- 730.
- Hamdi, S. & Hamdi, M. (1991). Artificial maturation and drying of Deglet Nour dates. *Fruits*, 46(5), 587-592.
- Hashempoor, M. (1999). *Date palm handbook (General)*. Karaj: Agricultural education.(In Farsi)
- Hassan, B. H. & Hobani, A.I. (2000). Thin- layer drying of dates. *Journal of Food Process Engineering*, 23(3), 177- 189.
- Kechaou, N., Bagane, M., Maalej, M. & Kapseu, C. (1997). Empirical approach of drying kinetics of dates. *Sciences des Aliments*, 16(6), 593- 606.
- Kechaou, N. & Maalej, M. (2000). A simplified model for determination of moisture diffusivity of date from experimental drying curves. *Drying Technology*, 18(4), 1109- 1125.
- Kit, L.Y. & Papadakis, P.S.(2004). A digital imaging method for measuring and analyzing color of food surfaces. *Journal of Food Engineering*, 61,137-142.
- Lahsasni, S., Kouhila, M. & Mahrouz, M.(2004). Thin layer convective solar drying and mathematical modeling of prickly pear peel (*Opuntia ficus indica*). *Journal of Food Engineering*, 29, 211-224.
- Lewicki, P. P. (1998). Some remarks on rehydration of dried foods. *Journal of Food Engineering*, 36,81-87.
- Prado, M. E. T., Alonso, L.F.T., & Park, K.J.(2000). Shrinkage of dates (*Phoenix Dactylifera L.*) during drying. *Drying Technology*, 18(1), 295- 310.
- Sacilik, K. & Elicin, A. K. (2005). The thin layer drying characteristics of organic apple slices. *Journal of Food Engineering*, 12, 101-115.
- Sayad, M. (2005). Effect of air temperature and velocity on thin layer drying kinetics of apples slices. M.S. thesis, Tabriz University.
- Togrul, I. T. & Pehlivan, D. (2004). Modelling of thin layer drying kinetic of some fruits under open- air sun drying process. *Journal of Food Engineering*, 65, 413-425.
- Yaldiz, O., Ertekin, C. & Uzun, H. I. (2001). Mathematical modeling of thin layer solar drying of sultana grapes. *Energy*, 26, 457-465.