

*

(// : // :)

% /	% /					LSU
% /	% /	% /			% /	% /
/	/	% /	% /	/	/	/
						% /

(ISO Standard 11520)

(Sahin,

.& Dincer, 2004)

(Elias, &

Copeland, 2001; Giner, & Gely, 2005; Jakubowska & Szpryngiel, 2008).

(Chen *et al.*, 2002; Dincer & Sahin, 2004; Gazor & Minaee, 2008)

(Fatouh *et al.*, 2006)

(Imanmehr *et al.*, 2007)

(Sahin, &

.Dincer, 2004)

%

(Homayonifar & Malekdar, 2006)

(Mills, 1996)

(Sahin, &

.Dincer, 2004)

LSU

SAS

%

/

(Mazandaran Meteorological Office, 2009)

/	°C	ST63
/	°C	PC9400II
/	m/s	AM4838
%	%	DT-3
/	% / %	GMK-303RS
%	%	

(ASAE Standards,

d.b

.2007)

(Barthet

& Daun, 2005).

()

(Aghbashlo *et al.*, 2009)

(Hanna *et al.*, 2007)

(Soxhlet

method)

()

()

(Akpinar *et al.*, 2006; Ceylan *et*

()

.*al.*, 2007)

LSU (continous)

(Leyte State University)

(El-Sebaai *et al.*, 2002)

()

(Akola & C.O.E., 1990)

()

(Corzo *et al.*, 2008)

$$EU = \dot{m}_{ai} h_{ai} + \dot{m}_{PF} h_{PF} - \dot{m}_{ao} h_{ao} - \dot{m}_{PD} h_{PD} - \dot{Q}_{defl} \quad ()$$

LSU

$$h_{da} = c_{pda}(T - T_{ref}) + h_{fg}w = (1.004 + 1.88w)(T - T_{ref}) + h_{fg}w \quad ()$$

$$\dot{m}_a = \rho_a V_a A_{dc} \quad ()$$

$$h_p = C_p (T_p - T_{ref}) \quad ()$$

$$w = 0.622 \frac{\phi P_{vs}}{P - \phi P_{vs}} \quad ()$$

$$C_p = 4.187X_m + 1.424X_c + 1.549X_p + 1.675X_f + 0.837X_a \quad ()$$

$$\dot{Q}_{defl} = \dot{Q}_{aol} \Rightarrow U_{def} A_{def} (T_{mdef} - T_{ref}) = \dot{m}_{ai} C_{ai} (T_{ai} - T_{ao}) \quad ()$$

()

$$\Rightarrow U_{def} = \frac{\dot{m}_{ai} C_{ai} (T_{ai} - T_{ao})}{A_{def} (T_{mdef} - T_{ref})}$$

$$EUR = \frac{EU}{\dot{m}_{ai} (h_{ai} - h_{ref})} \quad ()$$

...

:

LSU

()

()

/	*	/	**	/	**	/	ns
/	ns	/	ns	/	ns	/	**
/	ns	/	*	/	***	/	**
/		/		/		/	
/		/		/		/	

x

ns % % % / * ** ***

/		/		/		/	
/		/		/	**	/	
/		/	**	/	*	/	

ns % % % / * ** ***

()	(°C)	(h)	(t)	(m/s)	(°C)	
/		/	/			%
/		/	/			%
/		/	/			%
/		/	/	/		%
/		/	/	/		%
/		/	/	/		%
/		/	/	/		%
/		/	/	/	/	%
/		/	/	/		%

()

(Hanna et al.,

.2007)

.(Crassaerts et al., 2010)

(Mills, 1996)

LSU ()

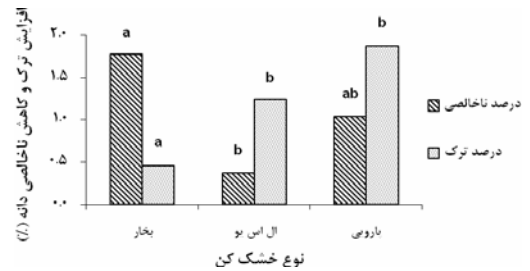
()

(2008) Jakubowska & Szpryngiel

(Mills, 1996; Dong *et al.*,

.2009)

()



Bruce, *et al.*

()

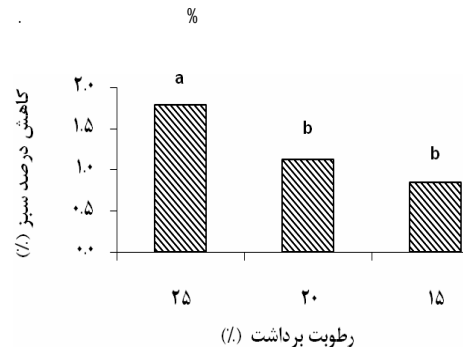
Jakubowska &

(2005) Giner & Gely. (2001)

LSU

(2008) Szpryngiel.

% / /



()

(EU)

()

()

(EU)

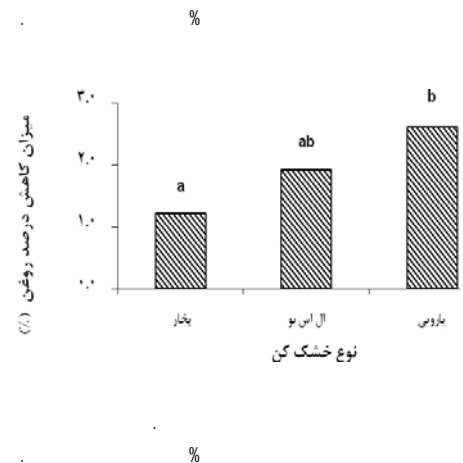
(EUR)

(Akpınar *et al.*,

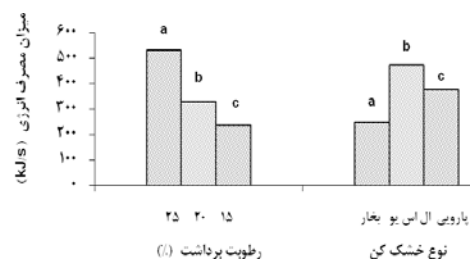
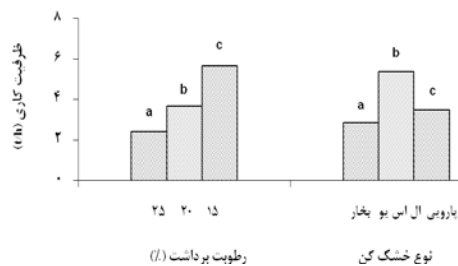
.2006; Corzo *et al.*, 2008; Aghbashlo *et al.*, 2009)

()

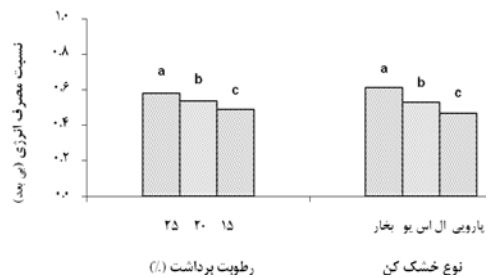
()



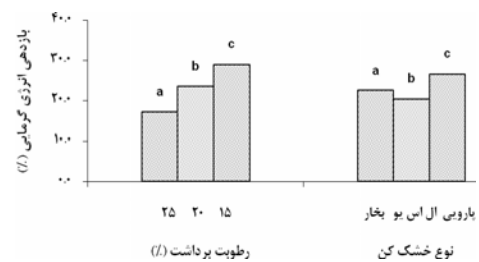
(t/h)		(%)		(kJ/s)	
/	***	/	***	/	**
/	***	/	***	/	***
/	***	/	***	/	***
/	***	/	***	/	***
/		/		/	
/		/		/	
ns % % % /				* ** ,***	



(2002) Chen *et al.* ()
 / /
 % / % /



()
 (Calisir *et al.*, 2005;
 Homayonifar & Malekdar, 2006)



% /

LSU

LSU

/ / /

/ / /

/ / !

/ /

/ /

dc	(m/s)	V_a	(m^2)	A
def	$(kg\ water / kg\ dry\ air)$	w	$(kJ/kg\ C^\circ)$	c
eff	(%)	X_a	(kJ/s)	EU
F	(%)	X_c	()	EUR
i	(%)	X_m	(kJ/kg)	h
l	(%)	X_p	(kJ/kg)	h_{fg}
mv	(%)	X_f	(kg/s)	\dot{m}
o	(kg/m^3)	ρ	(kPa)	P
P	(%)	φ	(kPa)	P_{vs}
a			(kJ/s)	\dot{Q}
	$(^\circ C)$	T		ref
		D		U_{def}

REFERENCES

- ASAE of Standards (2007) Moisture measurement- unground grain and seeds, *ASAE S352.2 FEB03. ASAE standards*, PP 582-583.
- Aghbashlo, M., Kianmehr, M. H. & Arabhosseini, A. (2009) Performance analysis of drying of carrot slices in a semi-industrial continuous band dryer. *Journal of Food Engineering*, 91, 99–108.
- Akola, T. & C.O.E. (1990) *Design and study of grain dryer*. Dipakshirbhate Publisher, India. P: 101.
- Akpinar, E. K., Midilli, A. & Bicer, Y. (2006) The first and second law analyses of thermodynamic of pumpkin drying process. *Journal of Food Engineering*, 72 (4), 320–331.
- Barthet, V. J. & Daun, J. K. (2005) Effect of Sprouting on the quality and composition of canola seed and oil. *Journal of the American Oil Chemists' Society*, 82 (7), 511-517.
- Bruce, M., Farrent, J. W., Morgan, C. L. & Child, R. D. (2002) Determining the oilseed rape pod strength needed to reduce seed loss due to pod shatter. *Biosystems Engineering*, 81, 79-184.
- Calisir, s., Marakoglu, T., Ogut, H. & Ozturk, O. (2005) Physical properties of rapeseed (*Brassica napus oleifera* L.). *Journal of Food Engineering*, 69(1), 61-66.
- Ceylan, I., Aktas, M. & Dogan, H. (2007) Energy and exergy analysis of timber dryer assisted heat pump. *Applied Thermal Engineering*. 27, 216–

- Chen, G., Anderson, J. A., Bannister, P. & Carrington, G. C. (2002) Monitoring and performance of a commercial grain dryer. *Biosystems Engineering*, 81(1), 73-83.
- Corzo, O., Bracho, N., Vasquez, A. & Pereira, A. (2008) Energy and exergy analyses of thin layer drying of coroba slices. *Journal of Food Engineering*, 86, 151-161.
- Craessaerts, G., Saeys, W., Missotten, B. & De Baerdemaeker, J. (2010) Identification of the cleaning process on combine harvesters, Part II: A fuzzy model for prediction of the sieve losses. *Biosystems Engineering*, 105 (4), 93-104.
- Dong, R., Lu, Z., Lio, Z., Nishiyama, Y. & Cao, W. (2009) Moisture distribution in a rice kernel during tempering drying. *Journal of Food Engineering*, 91, 126-132.
- Dincer, I., & Sahin, A. Z. (2004) A new model for thermodynamic analysis of a drying process. *International Journal of Heat and Mass Transfer*, 47(4), 645-652.
- Elias, S. G. & Copeland, L. O. (2001). Physiological and harvest maturity of canola in relation to seed quality. *Agronomy Journal*, 93, 1054-1058.
- El-Sebaei, A. A., Aboul-Enein, S., Ramadan, M. R. I. & El-Gohary, H. G. (2002) Empirical correlations for drying kinetics of some fruits and vegetables. *Energy*, 27, 845-859.
- Fatouh, M., Metwally, M. N., Helali, A. B., Shedid, M. H. (2006) Herbs drying using a heat pump dryer. *Energy Conversion and Management*, 47, 2629-2643.
- Gazor, H.R., Minaee, S. (2008) Influence of temperature and air velocity on canola drying kinetic. In: Proceedings of 5th National Congress of Agricultural Machinery and Mechanization Engineering. Ferdosi University, Mashhad, Iran. (In Farsi).
- Giner, S. A. & Gely, M. C. (2005) Sorptional parameters of sunflower seeds of use in drying and storage stability studies. *Biosystems Engineering*, 92 (2), 217-227.
- Hanna, H. M., Darren, H. J. & Graeme, R. Q. (2007) Combine effects on commingling and residual grain. *International Conference on Crop Harvesting and Processing*, 2007. American Society of Agricultural and Biological Engineers. Michigan, 25-34.
- Homayonifar, M. & Malekdar, M. (2006) Study of effective ingredient on Canola plant extention in Mazandaran province. *Journal of Economic Research*, 5 (4), 113-122. (In Farsi).
- Imanmehr, A. Gobadian, B., Minaei, S. & Faradmal, J. (2007) Determination of some physical properties of canola seed. *Journal of Agricultural Engineering Research*, 7 (29), 119-128. (In Farsi).
- ISO Standard of Agricultural Grain Drier, Determination of Drying Performance. (1997) *Standard 11520. International Organization of Standardization, Switzerland*, pp: 1315-1345.
- Jakubowska, M. K. & Szpryngiel, M. (2008) Influence on drying condition on quality properties of rapeseed. *International Agrophysics*, 22, 327-331.
- Mazandaran Meteorological Office. (2009) Annual statistics Synoptic Station of Mazandaran Meteorological Office, from <http://www.Mazandaranmet.ir/statistics>. (In Farsi).
- Mills, J. T. (1996) *Storage of canola*. Canola Council. Org. Chapter 12- Storage, Conditioning. Agricultural and Agri-Food Canada, Winnipeg, Manitoba, Canada.