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Title: Epazote solar drying under different conditions: kinetics, modeling, and colorimetry

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Editorial label ECORFAN: 607-8695
BECORFAN Control Number: 2022-01
BECORFAN Classification (2022): 131222-0001

Pages: 11
RNA: 03-2010-032610115700-14

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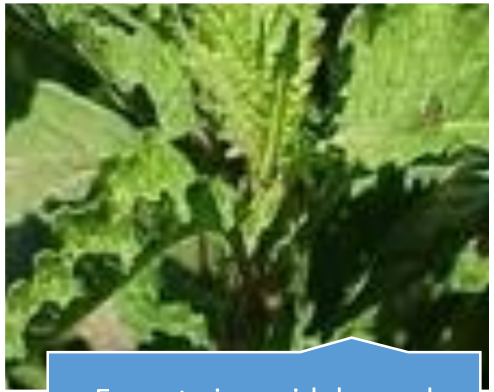
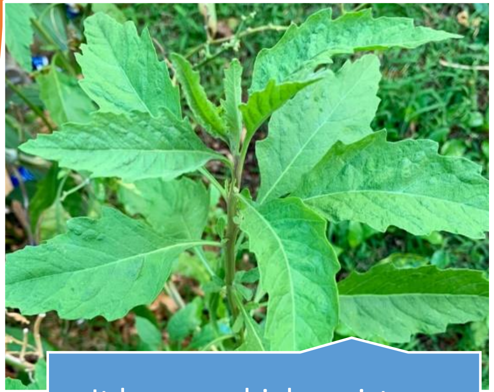
Introduction



Epazote is a widely used plant in Mexico

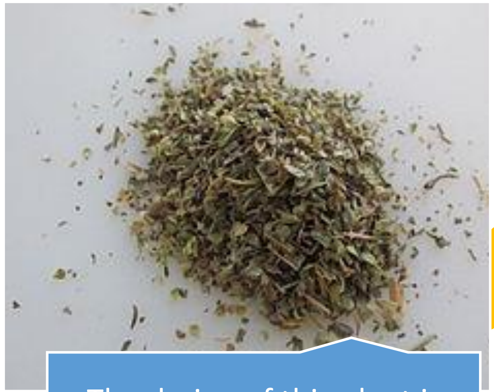
Used to flavor meals or infusions in traditional medicine

It is a plant rich in flavonoids and natural antioxidants



It has very high moisture content

Perishable



The drying of this plant is proposed

Introduction

Industrial drying requires a high energy consumption, using gas or electricity, promoting climate change and high costs

Open solar drying is a very old technology, is economic and simple method

Presents problems such as pollution, exposure to weather conditions, long drying times

Methodology

It is proposed to use a solar dryer and test two different types of materials to compare their efficiencies

The materials used are

- Titanium oxide
- Polyethylene

Methodology

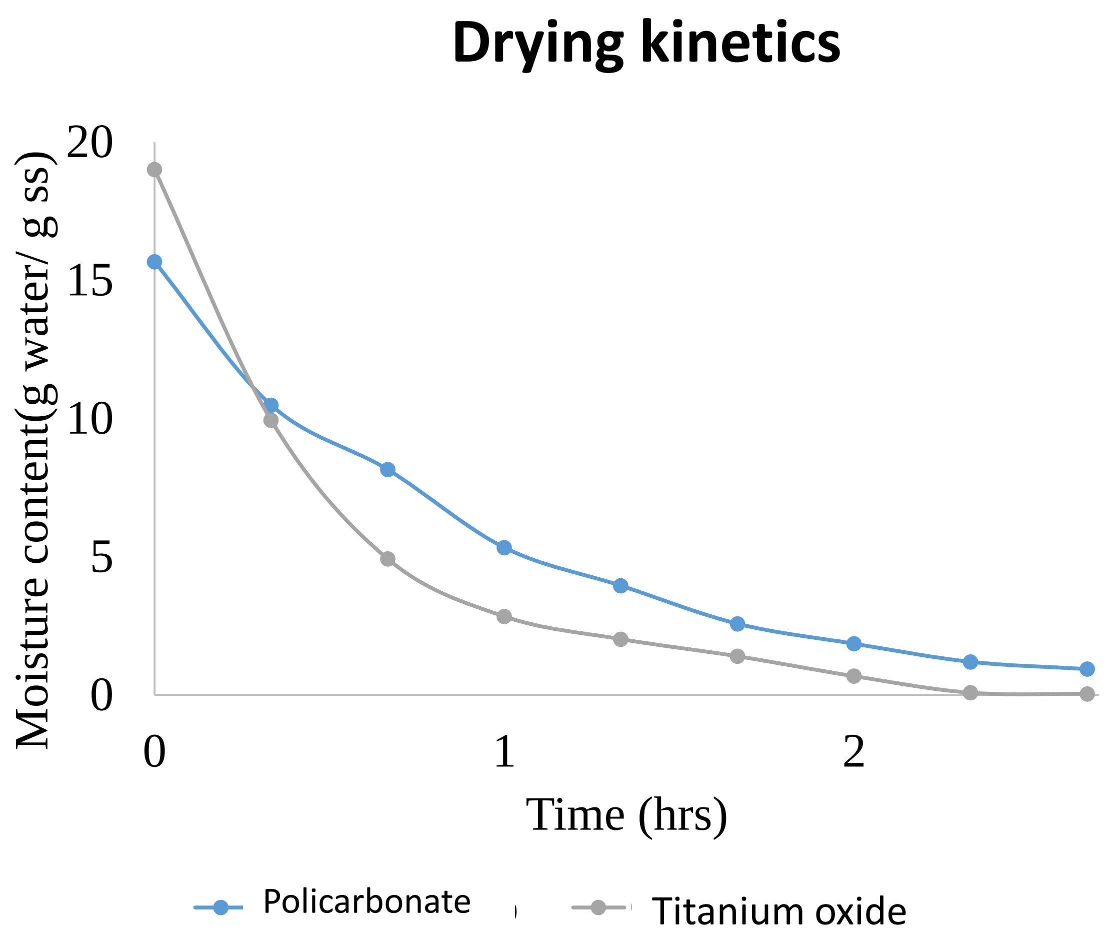
- Drying kinetics
- Inside and ambient temperatures
- Moisture content and
- Colorimetric study were monitored

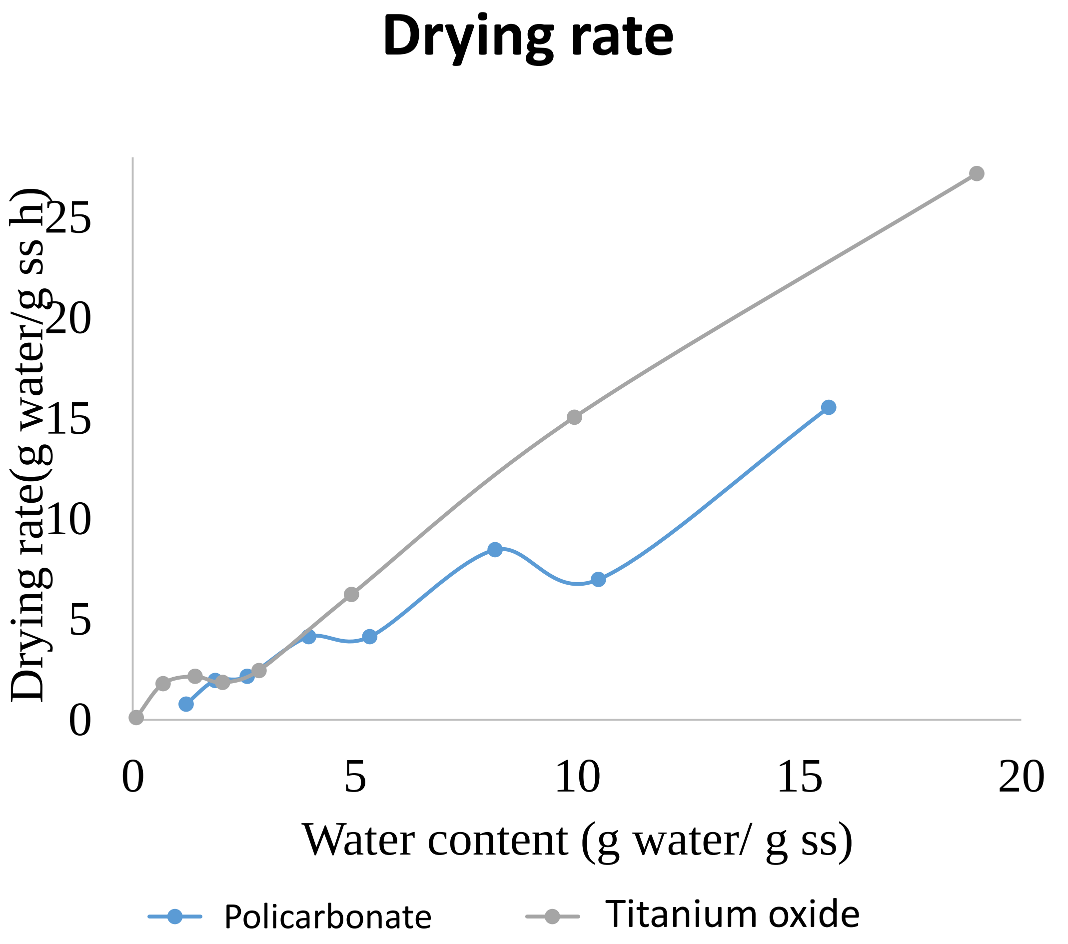
Methodology

A comparison of drying kinetics with existing mathematical models in literature was made

Model	Equation	Reference
Newton	$MR = exp\ (-kt)$	(Tunde-Akintunde, 2011)
Page	$MR = exp(-kt^n)$	(Page, 1949)
Modified page	$MR = exp((-kt)^n)$	(Diamante & Munro, 1993)
Henderson and Pabis	$MR = a\ exp(-kt)$	(Henderson & Pabis, 1961)
Logarithmic	$MR = a\ exp(-kt) + c$	(Togrul & Pehlivan, 2002)
Two-term	$MR = a\ exp\ (-kt) + b\ exp\ (-k_0 t)$	(Koua et al., 2009)
Two-term exponential	$MR = a\ exp(-kt) + (1$	(Y. I. Sharaf-Eldeen et al., 1980)
Wang and Singh	$MR = 1 + at + bt^2$	(Wang & Singh, 1978)
Weibull	$MR = exp(-(t/b)^\alpha)$	(Midilli et al., 2002)

Results



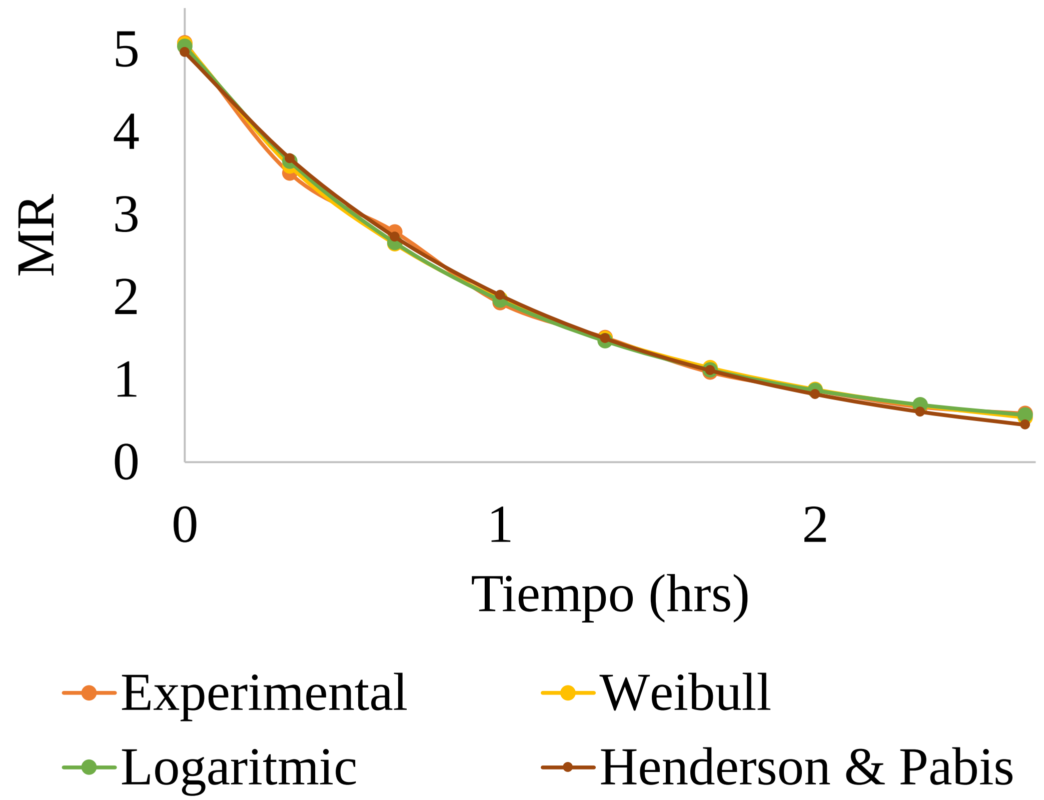


The final values of a_w for the samples were 0.597 for the titanium oxide cover and 0.533 for the policarbonate dryer

Results

Adjustment parameters with the polycarbonate dryer

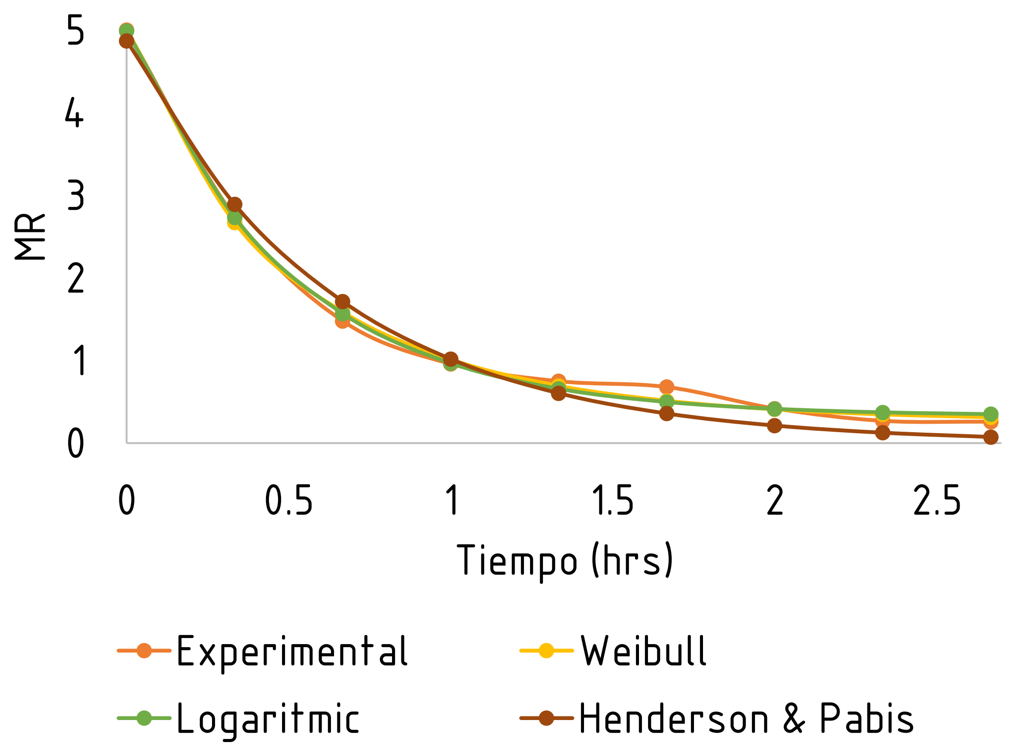
Weibull	R^2	**0.9979**
	a	8.19E-02
	b	-4.9855
	k	0.9667
	n	0.91974
Logarithmic	R^2	0.9975
	a	4.7644
	c	0.2704
	k	1.0350
Henderson and Pabis	R^2	0.9954
	a	4.9657
	k	0.8976



Results

Adjustment parameters with the titanium oxide dryer

Model	Parameter	Value
Weibull	**R^2**	**0.9969**
	a	2.60E-01
	b	-4.7484
	k	1.8404
	n	0.9097
Wang and Sing	R^2	0.9964
	a	4.6619
	c	0.3274
	k	1.98E+00
Henderson and Pabis	R^2	0.9835
	a	4.8716
	k	1.5647



Results

Polycarbonate dryer

ΔL= -3.89, Δa= 17.50, Δb= -9.10, ΔC= -10.49, ΔH= -16.70, ΔE= 20.11

Titanium oxide

ΔL= -2.78, Δa= 5.90, Δb= -6.98, ΔC= -8.46, ΔH= -3.46 y ΔE= 9.56.

Conclusions

This study compares the kinetics of solar drying of epazote in a direct solar dryer made of commonly used materials with another that uses a novel material for these applications: titanium oxide.

In addition to matching the times obtained with the polycarbonate dryer, the final moisture content is lower.

The final water activity was the same in both cases.

Additionally, the highest drying rates are observed in the SIT.

However, the most important advantage found in SIT is that it provides a much higher quality product, according to the colorimetry results that are observed.

The smallest difference in color compared to fresh epazote is correlated with the preservation of the desired medicinal compounds in the epazote.

Finally, it was determined that the model that best represents both kinetics is the Weibull.

References

Blanckaert, I., Paredes-Flores, M., Espinosa-García, F. J., Piñero, D., & Lira, R. (2012). Ethnobotanical, morphological, phytochemical and molecular evidence for the incipient domestication of Epazote (Chenopodium ambrosioides L.: Chenopodiaceae) in a semi-arid region of Mexico. *Genetic Resources and Crop Evolution*, *59*(4), 557–573. https://doi.org/10.1007/s10722-011-9704-7

Castillo Téllez, M., Pilatowsky Figueroa, I., Castillo Téllez, B., López Vidaña, E. C., & López Ortiz, A. (2018). Solar drying of Stevia (Rebaudiana Bertoni) leaves using direct and indirect technologies. *Solar Energy*, *159*, 898–907. https://doi.org/https://doi.org/10.1016/j.solener.2017.11.031

Chan-Gonzálelz, J. de J., Castillo Téllez, M., Castillo-Téllez, B., Mejía-Pérez, G. A., & Vega-Gómez, C. J. (2021). Improvements and Evaluation on Bitter Orange Leaves (Citrus aurantium L .) Solar Drying in Humid Climates. *Sustainability (Switzerland)*. https://doi.org/https://doi.org/10.3390/su13169393

Diamante, L. M., & Munro, P. A. (1993). Mathematical modelling of the thin layer solar drying of sweet potato slices. *Solar Energy*, *51*(4), 271–276. https://doi.org/https://doi.org/10.1016/0038-092X(93)90122-5

Domínguez-Niño, A., Lucho-Gómez, A. M., Pilatowsky-Figueroa, I., López-Vidaña, E. C., Castillo-Téllez, B., & García-Valladares, O. (2020). Experimental study of the dehydration kinetics of chicken breast meat and its influence on the physicochemical properties. *CYTA - Journal of Food*, *18*(1), 508–517. https://doi.org/10.1080/19476337.2020.1791961

FAO. (1990). *Manual on simple methods of meat preservation*. Manual on Simple Methods of Meat Preservation. http://www.fao.org/3/x6932e/X6932E00.htm#TOC

FAO. (2007). *Dried Fruit*. https://doi.org/10.1017/S002081830000607X

Grados, N., & Cruz, G. (1996). New Approaches to Industrialization of Algarrobo (Prosopis pallida) Pods in Peru. In P. Felker & J. Moss (Eds.), *Prosopis: Semiarid Fuelwood and Forage Tree Building Consensus for the Disenfranchised*.

Henderson, S. M., & Pabis, S. (1961). Grain drying theory II: Temperature effects on drying coefficients. *Journal of Agricultural Engineering Research*, *6*(3), 169–174.

Kaya, A., & Aydin, O. (2009). An experimental study on drying kinetics of some herbal leaves. *Energy Conversion and Management*, *50*(1), 118–124. https://doi.org/10.1016/j.enconman.2008.08.024

Koua, K. B., Fassinou, W. F., Gbaha, P., & Toure, S. (2009). Mathematical modelling of the thin layer solar drying of banana, mango and cassava. *Energy*, *34*(10), 1594–1602. https://doi.org/10.1016/j.energy. Santiago-Castro, J. T. (2017). Potential application of epazote (Chenopodium ambrosioides L.) as natural antioxidant in raw ground pork. *LWT - Food Science and Technology*, *84*, 306–313

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