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Evaluation of the Effect of Slice Thickness and Drying Temperature on Selected Characteristics of Orange Fleshed Sweet Potatoes (*Ipomoea batatas* L.)

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ABSTRACT

Orange-Fleshed Sweet Potato (OFSP) is rich in beta-carotene, a precursor of vitamin A that combats Vitamin A Deficiency (VAD). High moisture content in OFSP makes it highly susceptible to spoilage and hence necessitates processing. Drying is a processing method that extends the shelf life of food products; however, high temperatures can degrade some essential nutrients. This study examined the effects of slice thickness (2, 4, 6 mm) and drying temperatures (50, 60, 70 °C) on drying kinetics and quality of OFSP. Drying parameters such as Effective Moisture Diffusivity (D_{eff}) and Activation Energy (E_a) were determined. Beta-carotene content and total colour change (ΔE) were evaluated. Drying data were fitted to six thin-layer models. Logarithmic model provided the best fit (R^2 = 0.999, χ^2 = 0.000 at 6 mm, 60 °C). D_{eff} values ranged from 2.286×10^{-7} to 3.195×10^{-6} m^2/s, and E_a ranged from 31.50 to 39.10 kJ/mol. The highest beta-carotene (29.12 mg/100 g) was retained at 6 mm, 50 °C, while the best colour (ΔE = 62.02) was at 4 mm, 60 °C. Overall, 4 mm slices offered a balance between drying efficiency and quality retention. Findings support optimized drying of OFSP to improve storage, nutrition, and food security, contributing to Sustainable Development Goals (SDG) 1, 2, and 3.

INTRODUCTION

Orange-Fleshed Sweet Potato (OFSP) is a nutrient-dense crop and an excellent source of beta-carotene (a precursor of vitamin A), which plays a vital role in combating Vitamin A Deficiency (VAD), especially in Nigeria and other Sub-Saharan African (SSA) countries. Vitamin A Deficiency can cause blindness and weaken the immune system (Amagloh and Coad, 2014). OFSP is also OFSP varieties are also known to have higher levels of phytochemicals such as flavonoids, phenolics and anthocyanins that may influence the quality and stability of processed products and also enhances human health by acting antagonistically on incidences of cancers and chronic diseases, including cardiovascular disease (CVD), type II diabetes, and impaired cognitive function (Acosta-Estrada *et al*., 2014). However, postharvest handling of OFSP remains a challenge, as the tubers are sensitive to both ambient and cold storage conditions, leading to spoilage via sprouting or chilling injuries (Sebben *et al*., 2017).

Drying has emerged as a viable method to extend the shelf life of OFSP by reducing moisture content, thereby limiting chemical, enzymatic, and microbial degradation. Hot air drying is a widely preferred drying method due to its balance of efficiency, cost, and scalability (Damtew *et al.,* 2024). Solar drying, although inexpensive, is highly weather-dependent and often results in slow, non-uniform drying and variable product quality. Oven drying relies on static heat transfer, which prolongs drying time and can cause uneven moisture removal (Rashid *et al.*, 2022). Freeze and vacuum drying offer superior product quality retention but require high capital and operational costs, making them unsuitable for large-scale processing (Rashid *et al.*, 2022). In contrast, hot air-drying employs controlled airflow and temperature to achieve faster and more uniform moisture removal, reduced energy consumption, and relatively simple equipment requirements. The drying rate is influenced by several factors, including temperature, air velocity, product thickness, and internal moisture diffusion (Fan, 2015). However, exposure to higher drying temperatures may lead to nutrient degradation. In retaining beta-carotene while ensuring drying efficiency for OFSP, this study investigated the effect of slice thickness and drying temperature on the drying kinetics and selected quality attributes of OFSP and developed an accurate mathematical model to predict the drying process of OFSP slices. The objectives of this study were to determine and evaluate the drying kinetics of OFSP slices at temperatures of 50, 60 and 70 ˚C and thicknesses 2, 4 and 6 mm; to model the drying process of OFSP slices; determine the effective moisture diffusivity (D_{eff}) and activation energy (E_a) for the drying of OFSP slices; also to determine and evaluate the quality characteristics such as beta carotene and colour of OFSP before and after drying.

METHODOLOGY

Materials

Freshly harvested, matured OFSP were procured from the International Institute of Tropical Agriculture, Research and Training Centre, Osun State (7.50 °N and 4.58 °E). The tubers were transported in good condition to the Owodunni Food Processing Laboratory, Department of Food Engineering, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, for further processing and drying experiments.

Preparation and Drying Procedure

Freshly harvested OFSP tubers were sorted, weighed, washed under running water to remove soil particles and other extraneous materials, and then drained using blotting paper to eliminate surface moisture. The tubers were sliced into uniform thicknesses of 2, 4 and 6 mm using a kitchen slicer, as described by Lee *et al*. (2019). From each thickness category, 30 g of slices were weighed and further sorted to ensure uniformity in size and shape according to AOAC (2022) standards.

Moisture content (MC)

The moisture content of Orange Fleshed Sweet Potatoes slices was determined before and after drying using the AOAC (2022) method (Equation 1):

$$MC = \frac{w_i - w_d}{w_i} \times 100 \quad (1)$$

where MC is the moisture content, w_i is the initial mass of the sample before drying
w_d is the mass of the sample at time t. The moisture ratio during drying will be obtained by using equation 2.

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

where MR is the dimensionless moisture ratio, M, Me and Mi are the moisture content at any time t, equilibrium moisture content, and initial moisture content, respectively.

Drying rate (DR)

The Drying Rate (DR) was calculated using equation 3 (Xiao *et al*., 2009);

$$DR = \frac{M_t - M_{t+\Delta t}}{\Delta t} \quad (3)$$

where DR is drying rate (gwater/gmaterial*min)
M_t, $M_{t+\Delta t}$ are the moisture content (kg water/kg dry matter) at t and t+Δt (min) drying time, respectively.

Determination of Effective Moisture Diffusivity (D_{eff}): D_{eff} was obtained using Fick's second diffusion equation according to the method of Workneh and Oke (2013)

$$MR = \frac{8}{\pi^2} \exp\left(-\frac{\pi^2 D_{eff} t}{4L^2}\right) \quad (4)$$

where L is the thickness of the sample, t is the drying time (min).

This could be further converted into a straight line equation using equation 5

$$\text{In (MR)} = \frac{-\pi^2 D_{\text{eff}}}{4L^2} t + \ln\left(\frac{8}{\pi^2}\right) \quad (5)$$

Therefore, the effective diffusivity (D_{eff}) at each temperature was obtained from the slope of a straight line by plotting ln (MR) against drying time for the corresponding temperature data.

Calculation of the Activation Energy (E_a):
Activation energy (E_a) was calculated by using an Arrhenius equation (Aghbashlo *et al*., 2008).

$$D_{eff} = D_o exp\left(-\frac{E_a}{R(T+273.15)}\right) \quad (6)$$

where D_o is the maximum coefficient of diffusion,

E_a is the activation energy in (kJmol^{-1}); T is drying air temperature in ($^{\circ C}$) and R is the gas constant (8.3143 kJ/mol).

Colour Determination of OFSP Slices
The colour change was calculated using the colorimetric method with a visual colorimeter. The colour parameters L* (lightness), a* (redness-greenness), and b* (yellowness- blueness) were used to evaluate ΔE (total colour change) for fresh and dried OFSP slices.

Statistical Analysis
All data obtained were subjected to Analysis of Variance (ANOVA) using Statistical Package for Social Sciences (SPSS version 20). Means were separated using Duncan Multiple Range Test at 5% level of probability (Yam and Papadakis, 2004; Tarlak *et al.,* 2016)

Analytical Modeling

Experimental data derived from drying of OFSP slices were fitted into six thin-layer drying models to describe the drying behaviour of the OFSP slices. The statistical results obtained from the non-linear regression of the model which include the criteria for evaluating goodness of fit namely Coefficient of determination (R^2) and the reduced Chi square (χ^2) and the equation for all the constant of six equation used are shown in Table 1 (Tunde-Akintunde, 2012; Onwude *et al.,*2018) and these two parameters were calculated as follows;

$$R^2 = 1 - \left[\frac{\sum_{i=1}^{N}\left(MR_{\text{pre},i} - MR_{\text{exp,i}}\right)^2}{\sum_{i=1}^{N}\left(MR_{exp,i} - MR_{pre,i}\right)^2}\right] \quad (7)$$

$$\chi^2 = \frac{\sum_{i=1}^{N}\left(MR_{\text{exp},i} - MR_{pre,i}\right)^2}{N-z} \quad (8)$$

where: $MR_{exp,i}$ is the experimental moisture ratio; $MR_{pre,i}$ is the predicted moisture ratio

N is the number of observations, and *z* is the number of constants.

RESULTS AND DISCUSSION

Drying Characteristics of OFSP Slices.
The drying curves in Figures 1a-c illustrate the relationship between moisture content and drying time for OFSP slices. A continuous decrease in moisture content and drying rate was observed with increasing drying time. The time to reach Equilibrium Moisture Content (EMC) varied with temperature and slice thickness. At 50 °C, 2, 4 and 6 mm slices reached EMC at 660, 720, and 780 minutes, respectively. For 60 ºC, it took 480, 600 and 660 mins for 2, 4, and 6 mm to reach EMC, respectively. For 70 ºC, EMC was reached at 420, 480, and 540 mins for 2, 4 and 6 mm, respectively.
It was observed that the highest moisture loss occurred during the initial drying period, attributed to the evaporation of free water.

Table 1: Mathematical Thin Layer Models Considered

Model name	Model	References
Newton (Lewis)	$MR = exp(-kt)$	(Tunde-Akintude, 2011)
Henderson and Pabis	$MR = aexp(-kt)$	(Tunde-Akintude and Oke, 2012)
Logarithmic	$MR = aexp(-kt) + c$	(Xanthopoulos *et al.,* 2007),
Page	$MR = \exp(-kt^n)$	(Kaleta *et al*., 2013)
Wang and Singh	$MR = 1 + \exp(-kt^n) + bt$	(Wang and Singh, 1978)
		(Sharma and Prasal, 2014)
Parabolic	$MR = a + kt + ct^2$	(Tunde Akintunde, 2011)

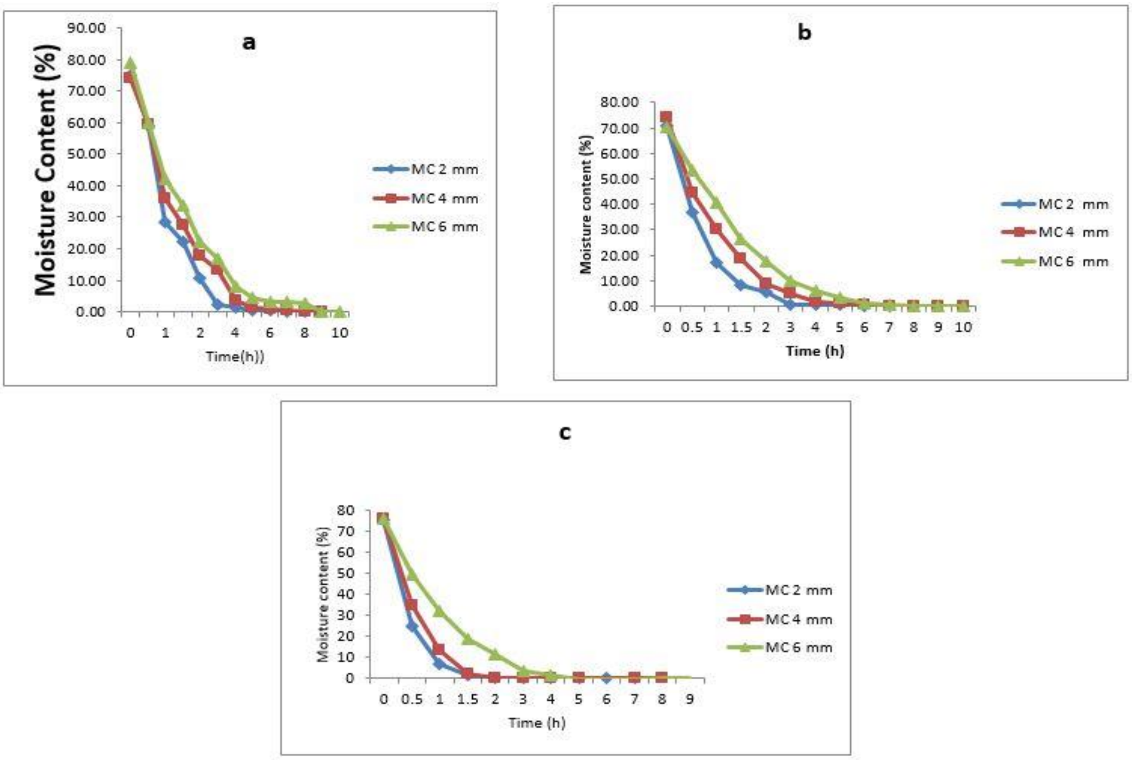

Figure 1: Drying Curves for 2, 4 and 6 mm at (a) 50 °C, (b) 60 °C and 70 °C.

As drying progressed, the rate slowed down due to the remaining bound water. The drying rate was higher at the beginning of drying when the moisture content was highest, decreasing as drying progressed, as shown in Figure 2

Effects of Thickness on Drying Rate of OFSP Slices

The effect of slice thickness on the drying rate of OFSP slices was that smaller slice thicknesses dried faster than the larger slice thicknesses, as presented in Figures 2a-c.

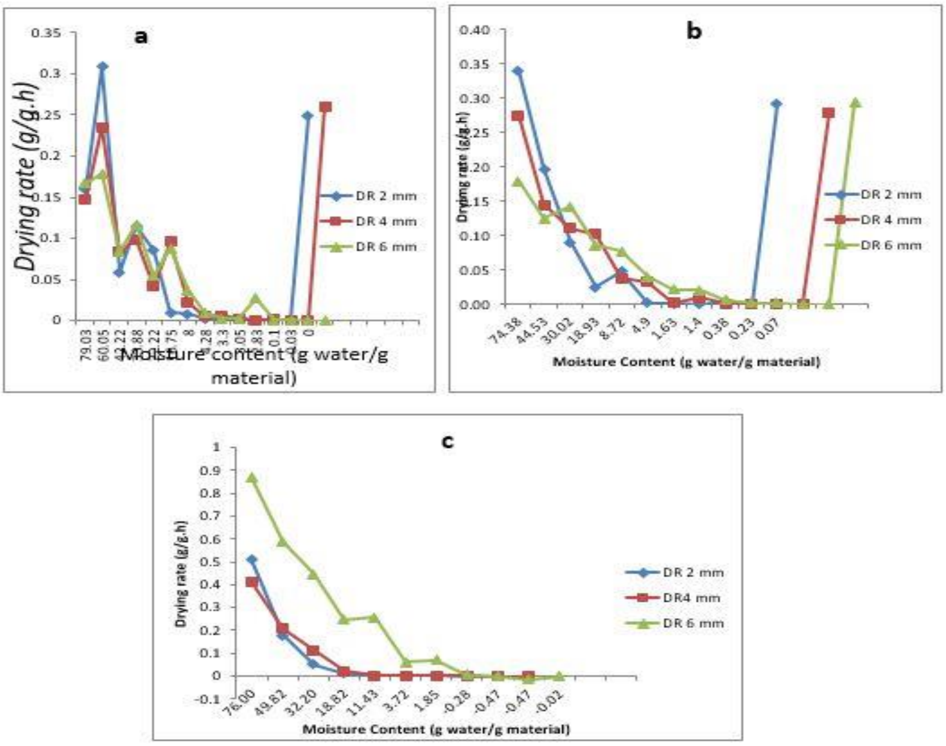

Figure 2: Drying Rate Curves for 2, 4 and 6 mm at (a) 50 °C, (b) 60 °C and 70 °C.

This is because for a smaller slice thickness, the distance that the water molecule will travel from the core to the outer layer where evaporation will take place is shorter compared to a bigger slice thickness. This implies that drying at a smaller slice thickness helps in reducing the drying time, which may reduce the cost of drying.

Effects of Temperature and Thickness on Effective Moisture Diffusivity (D_{eff})

The D_{eff} values were obtained from the slope of the linear graph of ln MR against time from Figure 3 using Equation 5. The values of D_{eff} for the drying of OFSP slices are shown in Table 2. It was observed that D_{eff} increased with an increase in temperature. This was in line with the report of Olajire *et al.* (2018) that D_{eff} increased with an increase in temperature, which occurs as a result of the fact that water diffusion, which is mainly due to a mass transport mechanism from the first phase of drying, increases with any increase in drying temperature and thickness. The D_{eff} values for 2, 4 and 6 mm of the dried OFSP at 50, 60 and 70 ℃ were 2.286×10^{-7}, 9.960×10^{-6} and 1.460×10^{-6}; 2.860×10^{-7}, 1.434×10^{-6} and 1.926×10^{-6} as well as 4.93×10^{-7}, 1.870×10^{-6} and 3.195×10^{-6}, respectively. It was clearly observed that the OFSP slices dried at 70 °C with 6 mm thickness have the highest value of moisture diffusivity, indicating that the higher the temperature and thickness, the higher the D_{eff}.

Effects of Temperature and Thickness on Activation Energy

The activation energies for the drying of OFSP slices were 38.45, 31.50 and 39.10 kJ mol-1 for 2, 4 and 6 mm, respectively and were obtained from the slopes of the plot of calculated logarithmic natural effective moisture diffusivities (In D_{eff}) against $-\frac{1}{Rg(T+273.15)}$. Figures 4a –c show the graph and it was observed that a 6 mm slice thickness required more activation energy for effective drying. Therefore, it is better to dry using a 4 mm slice thickness to reduce the activation energy, save time and energy consumption

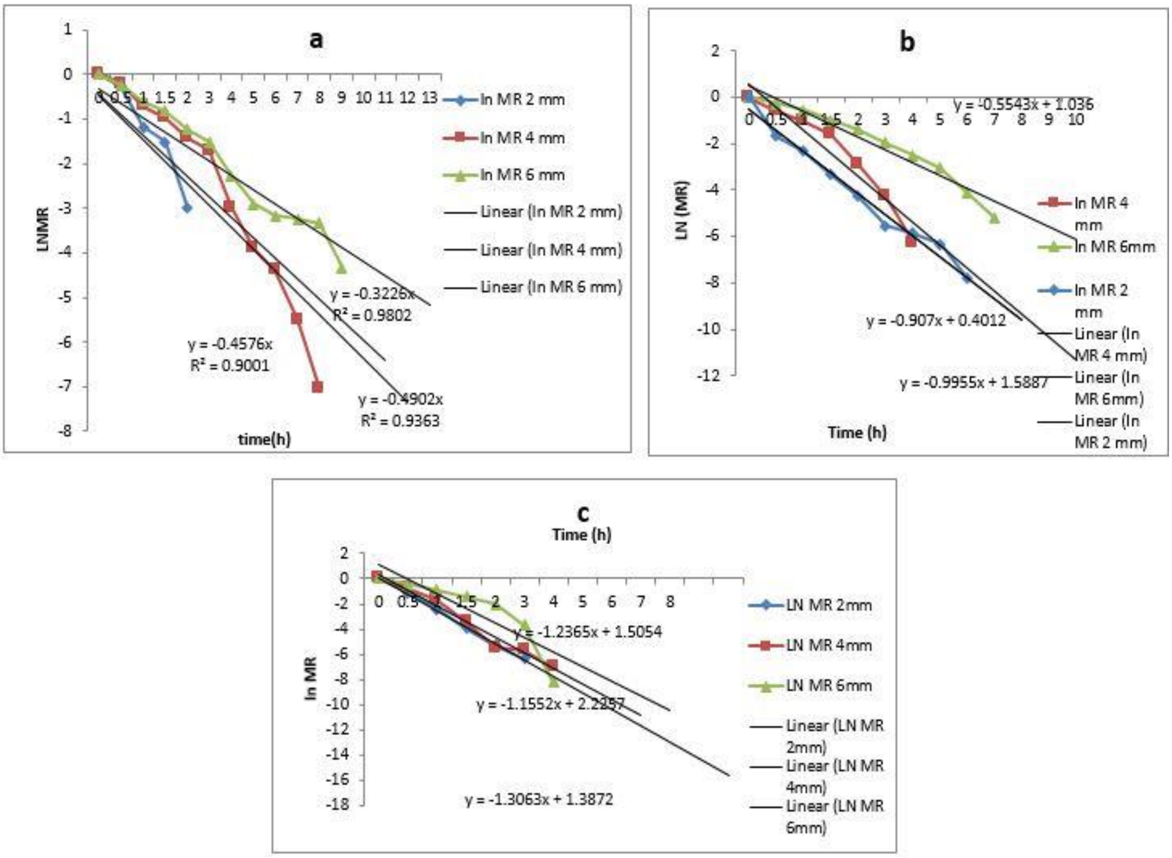

Figure 3 a-c: Effective Moisture Diffusivity (m^2/s) for 2, 4 and 6 mm at (a) 50 °C, (b) 60 °C and 70 °C

Table 2: Effective Moisture Diffusivity (m^2/s) of the Drying of the OFSP

Drying Temperature (°C)	**Slice thickness (mm)**	**Effective Moisture Diffusivity ($\times 10^{-7}$)(m^2/s)**	**In(D_{eff})**
50	2	2.285	-15.2917
	4	9.960	-13.8195
	6	14.625	-13.4354
60	2	2.860	-15.0673
	4	14.340	-13. 455
	6	19.260	-13.1601
70	2	4.930	-14.5228
	4	18.700	-13.1896
	6	31.970	-12.6533

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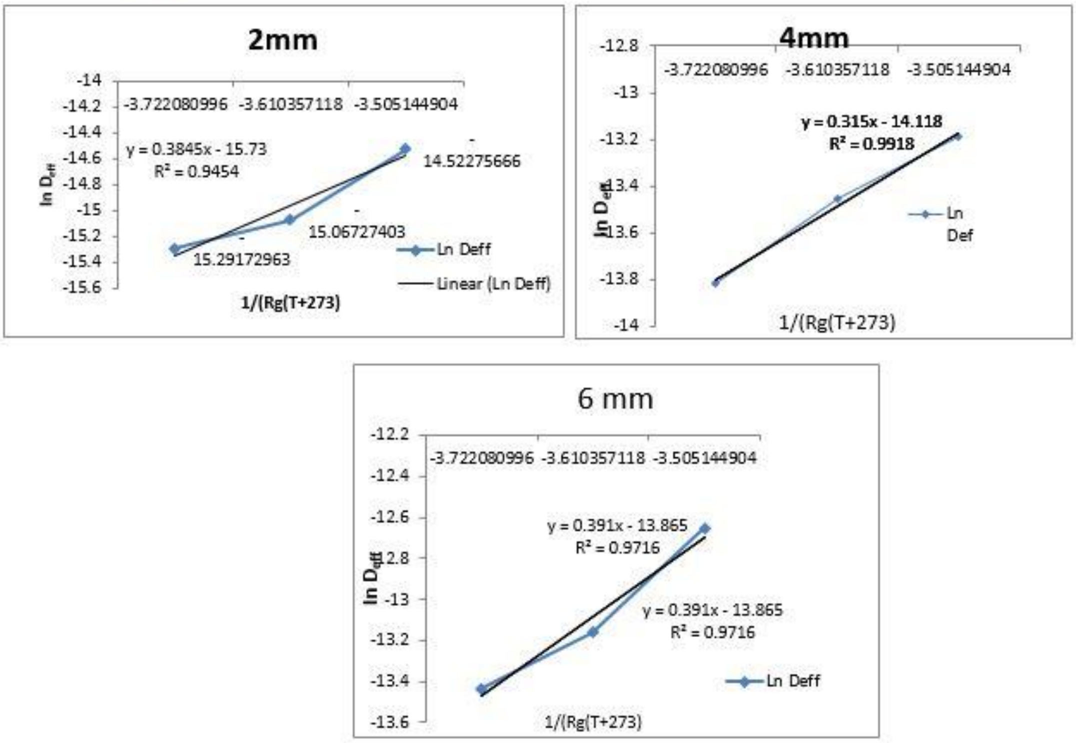

Figure 4a-c: Effective Moisture Diffusivity (m^2/s) for 2, 4 and 6 mm

Effect of Temperature and Thickness on Beta-carotene Content

The beta-carotene content of fresh OFSP was 29.97 mg/100g. After drying, the beta-carotene content varied significantly depending on slice thickness and temperature, as shown in Table 2. OFSP with 6 mm slice thickness dried at 50 °C retained the highest beta-carotene content (29.12 mg/100g). In contrast, the lowest beta-carotene content was observed in 2 mm slices dried at 70 °C (18.56 mg/100g). Notably, drying at 50 °C resulted in higher beta-carotene retention, particularly in 4 and 6 mm. These findings are consistent with previous studies, which reported that high temperatures can lead to beta-carotene degradation (Krishanan *et al.,* 2025). Additionally, it was observed that beta-carotene content increased as slice thickness increased, but decreased with an increase in drying temperature. Effect of Temperature and Thickness on Colour Retention of OFSP Slices

The fresh OFSP slices had L*, a*, and b* values of 36.29, 32.36 and 68.88, respectively. However, dried OFSP slices showed considerably lower values for all parameters; the colour retention of dried orange fleshed sweet potatoes was significantly influenced by drying temperatures and thickness, as represented in Table 4.

The best colour retention was observed in 4 mm thick slices dried at 60 °C, followed by 2 mm thick slices dried at 50 °C. Notably, lightness (L*) decreased with drying time across all thickness and temperature levels. The increase in a* value suggested the occurrence of Maillard browning, leading to the formation of dark compounds that reduced luminosity. These findings are consistent with previous studies (Olajire *et al.*, 2018), which reported similar trends in colour degradation due to thermo-labile pigment breakdown.

Table 3: Beta Carotene Content of the OFSP Slices

Drying Temperature (°C)	Slice Thickness (mm)	Beta -Carotene (ug/g)
50	2	22.98±0.07[d]
50	4	25.35±0.01[g]
50	6	29.16±0.06[h]
60	2	22.96±0.02[e]
60	4	22.40±0.02[d]
60	6	24.10±0.02[f]
70	2	18.54±0.03[a]
70	4	20.12±0.00[b]
70	6	20.43±0.01[c]
Fresh sample		29.97±0.01[i]

Means within the same column with different alphabet (s) are significantly different at $p< 0.05$

Table 4: Colour Changes of the dried OFSP slices

Drying Temperature (°C)	Slice Thickness (mm)	L*	a*	b*	ΔE
50	2	19.69±12.09[bcd]	6.04±1.29[ab]	33.49±8.98[ab]	43.62±0.01[i]
	4	29.25±3.49[ab]	8.35±1.28[abc]	26.36±8.98[a]	6.07±0.01[a]
	6	33.38±6.10[abc]	8.64±5.29[abc]	27.95±.60[a]	11.45±.03[d]
60	2	37.08±4.91[bcd]	9.02±1.13[abc]	24.35±0.50[a]	7.16±0.00[b]
	4	15.45±4.02[cd]	14.69±11.22[bc]	42.28±42.21[ab]	62.02±0.01[j]
	6	23.55±10.18[b]	17.41±0.00[c]	56.89±6.68[ab]	17.22±0.14[g]
70	2	12.91±1.68[abcd]	4.48±1.20[a]	25.29±23.53[a]	33.40±0.14[h]
	4	30.04±5.29[a]	11.47±1.69[abc]	32.49±2.74[ab]	8.75±0.01[c]
	6	45.81±10.08[abc]	10.27±.85[abc]	19.70±2.43[a]	14.72±0.01[f]
Fresh	Sample	36.29±4.58[d]	32.36±1.77[d]	68.88±6.71[b]	11.7682±0.01[e]

Means within the same column with different alphabet(s) are significantly different at $p< 0.05$

Evaluation of the Drying Model of OFSP Slices

The optimum model for predicting thin-layer drying characteristics was chosen based on the highest R^2 value and lowest χ^2 value. The R^2 and χ^2 values for dried OFSP at 50, 60 and 70 °C were 0.562-0.998 and 0.001-0.300; 0.356-0.999 and 0.018-0.406; as well as 0.140-0.998 and 0.000-0.384, respectively, as represented in Table 5a-c. The logarithmic model gave the highest R^2 value of 0.999 and the lowest χ^2 value of 0.000 at 6 mm thickness and drying temperature, 60 °C. The Logarithmic model optimally fitted the drying data for all slice thicknesses and these findings are consistent with the report of Workneh and Oke (2013) during the drying of tomato slices.

Table 5a: Statistical results obtained on the modeling of dried OFSP slices at 50 °C

Drying Temperature (°C)	Slice Thickness (mm)	Model	χ2	R^2	Constants
50	2	Newton	0.027	0.562	k = 0.005
		Page	0.007	0.896	k = 0.102 n = 0.433
		Henderson and Pabis	0.021	0.679	a = 0.765 k = 0.003
		Logarithmic	0.001	0.985	a = 0.791 c = 0.244 k = 0.015
		Wangh and Singh	0.024	0.639	a = -0.004 b = 4.28E-06
		Parabolic	0.257	0.975	a = 2.90E-06 b = -0.003 c = 0.792
	4	Newton	0.021	0.630	k = 0.004
		Page	0.004	0.930	k = 0.073 n = 0.471
		Henderson and Pabis	0.015	0.755	a = 0.786 k = 0.003
		Logarithmic	0.000	0.993	a = 0.760 c = 0.259 k = 0.011
		Wangh and Singh	0.014	0.751	a = -0.003 b = 3.34E-06
		Parabolic	0.280	0.869	a = 2.36E-06 b = -0.002 c = 0.825
	6	Newton	0.029	0.764	k = 0.004
		Page	0.009	0.956	k = 0.052 n = 0.538
		Henderson and Pabis	0.023	0.838	a = 0.830 k = 0003
		Logarithmic	0.005	0.998	a = 0.773 c = 0.238 k = 0.010
		Wangh and Singh	0.025	0.829	a = -0.004 b = 3.70E-06
		Parabolic	0.300	0.907	a = 2.71E-06 b = -0.003 c = 0.851

Table 5b: Statistical results obtained on the modeling of dried OFSP slices at 60 °C

Drying Temperature (°C)	Slice Thickness (mm)	Model	χ2	R^2	Constants
60	2	Newton	0.047	0.465	k = 0.014
		Page	0.037	0.966	k = 0.442 n = 0.213
		Henderson and Pabis	0.036	0.535	a = 0.736 k = 0.007
		Logarithmic	0.039	0.999	a = 0.762 c = 0.2389 k = 0.038
		Wangh and Singh	0.018	0.356	a = -0.007 b = 1.40E-05
		Parabolic	0.263	0.666	a = 8.46E-06 b = -0.004 c = 0.718
	4	Newton	0.032	0.497	k = 0.011
		Page	0.004	0.938	k = 0.287 n = 0.286
		Henderson and Pabis	0.030	0.577	a = 0.737 k = 0.005
		Logarithmic	0.000	0.997	a = 0.772 c = 0.234 k = 0.028
		Wangh and Singh	0.041	0.430	a = -0.006 b = 1.06E-05
		Parabolic	0.257	0.708	a = 6.54E-06 b = -0.004 c = 0.734
	6	Newton	0.013	0.825	k = 0.007
		Page	0.003	0.967	k = 0.063 n = 0.551
		Henderson and Pabis	0.012	0.863	a = 0.006 k = 0.873
		Logarithmic	0.000	0.999	a = 0.777 c = 0.229 k = 0.015
		Wangh and Singh	0.010	0.886	a = -0.006 b = 1.06E-05
		Parabolic	0.406	0.930	a = 8.38E-06 b = -0.005 c = 0.885

Table 5c: Statistical results obtained on the modeling of dried OFSP slices at 70 °C

Drying Temperature (°C)	Slice Thickness (mm)	Model	χ2	R^2	Constants
70	2	Newton	0.041	0.140	k = 0.006
		Page	0.004	0.927	k = 0.252 n = 0.270

	Henderson and Pabis	0.025	0.518	a = 0.663 k = 0.002
	Logarithmic	0.000	0.998	a = 0.715 c = 0.291 k = 0.024
	Wangh and Singh	0.035	0.343	a = -0.005 b = 6.21E-06
	Parabolic	0.269	0.697	a = 3.62E-06 b = -0.003 c = 0.732
4	Newton	0.026	0.515	k = 0.005
	Page	0.003	0.947	k = 0.119 n = 0.398
	Henderson and Pabis	0.017	0.708	a = 0.754 k = 0.003
	Logarithmic	0.000	0.998	a = 0.720 c = 0.280 k = 0.015
	Wangh and Singh	0.019	0.679	a = -0.004 b = 5.68E-06
	Parabolic	0.311	0.843	a = 3.80E-06 b = -0.003 c = 0.806
6	Newton	0.030	0.725	k = 0.004
	Page	0.008	0.953	k = 0.054 n = 0.518
	Henderson and Pabis	0.021	0.821	a = 0.833 k = 0.003
	Logarithmic	0.005	0.998	a = 0.719 c = 0.292 k = 0.011
	Wangh and Singh	0.022	0.870	a = -0.004 b = 4.83E-06
	Parabolic	0.384	0.925	a = 3.69E-06 b = -0.003 c = 0.882

CONCLUSION

Drying of OFSP ensures year-round availability, accessibility and increased shelf life. This study examined drying rate, effective moisture diffusivity, activation energy, model fitting, beta-carotene retention, and colour. Drying of OFSP using a 4 mm slice thickness saves time and reduces energy consumption. Dried OFSP with 6 mm and 50 °C and 4 mm and 60 °C gave the best retention of betacarotene and colour, respectively. The logarithmic model was the best-fit model that described the drying processes of OFSP.

REFERENCES

Acosta-Estrada, B.A., Gutiérrez-Uribe, J.A., and Serna-Saldívar, S.O. (2014). Bound Phenolics in Foods, a Review. *Food Chemistry Journal*, 152: 46–55.

Aghbashlo M. K., Arabhosseini M. H. and Nazghelichi T. (2008). Modelling the Carrot Thin-layer Drying in a Semi-Industrial Continuous Bed Dryer. *Journal of Food Science*. 29(5): 528-538.

Amagloh, F.K. and Coad, J. (2014). Orange-Fleshed Sweet Potato-Based Infant Food is a Better Source of Dietary Vitamin A than a Maize-Legume Blend as Complementary Food. *Food and Nutrition Bulletin*, 35(1):51–59.

Association of Official Analytical Chemists (AOAC) International. (2022). Determination of Moisture Content in Slices for Drying: Oven Method. AOAC International 2022 Annual Meeting and Exposition.

Damtew, A., Habtamu, G.M., Dejene T.B., and Dadi, T.L. (2024). Major Nutritional Content of Orange Fleshed Sweet Potato (OFSP) and Its Importance: Review. *Global Academic Journal of Agriculture and Biosciences.* 6(1): 1-7.

Fan, K., Chen, L., He, J., and Yan, F. (2015). Characterization of Thin Layer Hot Air Drying of Sweet Potatoes (*Ipomoea batatas L.*) Slices. *Journal of Food Process Preservation*. 39:1361–1371.

Henderson S.M., and Pabis S. (1961). Grain drying theory I: Temperature effect on Drying Coefficient. *Journal Agricultural Engineering Research*, 7: 85–9.

Kaleta A., Gornicki K., Winiczenko R and Chojnacka A. (2013). Evaluation Of Drying Models of Apple (Var. Ligol) Dried in a Fluidized Bed Dryer. *Energy conversion and Management,* 1167-1168: 179-185.

Lee, D., Lee, J.H., Shin, Y.S., Cho, B.H., and Han, C.S. (2019). Far Infrared Drying Characteristics of the Microwave-Steamed Sweet Potato. *Journal of Biosystematic Engineering*. 44: 187–93.

Ojo S.E. (2022). Effect of Pretreatments and Drying Temperatures on Selected Quality and Drying characteristics of Two varieties of Cayenne Pepper (*Capsicum Frutescens L.*). Unpublished M.Tech Research

Olajire A.S., Tunde-Akintunde T.Y. and Ogunlakin G.O. (2018). Drying Kinetics and Moisture Diffusivity Study of Okra Slice. *Journal of Food Processing Technology,* 9: 751.

Onwude, D.I., Hashim, N., Abdan, K., Janius, R., Chen, G. and Kumar, C. (2018). Modelling of Coupled Heat and Mass Transfer for Combined Infrared and Hot-Air Drying of Sweet Potato. *Journal of Food Engineering*. 228: 12-24.

Oyefeso B. O. and Raji A. O. (2021). Effective Moisture Diffusivity and Activation Energy of Tannia Cormels: Influence of Temperature, Pretreatment and Slice Thickness. *Nigerian Journal of Technology,* 40: 140-145

Rashid, M.T., Ma, H., Safdar, B., Jatoi, M.A., Wali. A., Sarpong, F. and Zhou, C. (2019) Synergy of Ultrasound and Osmotic Dehydration in Improving Drying Kinetics and Quality of Dried Sweet Potato (*Ipomea batatas L.*). 70:72–81.

Sebben, J.A., Trierweiler, L.F., and Trierweiler, J.O. (2017). Orange-Fleshed Sweet Potato Flour Obtained by Drying in Microwave and Hot Air. *Journal of Food Processing and Preservation* 41(1): 1-8

Sharma, G.P. and Prasad, S. (2014). Effective Moisture Diffusivity of Garlic Cloves Undergoing Microwave-Convective Drying. *Journal of Food Engineering*. 65: 609–617.

Tunde-Akintunde, T.Y. and Oke, M.O. (2012). Thin-Layer Drying Characteristics of Tiger Nut (*Cyperus Esculentus*) Seeds. *Journal of Food Processing and Preservation.* 36(5): 457-464

Wangh C. Y., and Singh R. P. (1978). A Single Layer Drying Equation for Rough Rice ASAE Paper. 3001-3004.

Workneh, T.S. and Oke, M.O. (2013). Thin Layer Modelling of Microwave-Convective Drying of Tomato Slices. *International Journal of Food Engineering*. 9(1): 75–90

Xanthopoulos G., Lambrinos G., and Manolopoulou H. (2007). Evaluation of Thin-layer Models for Mushroom (Agaricus bisporus) Drying. *Drying Technology*. 25: 1471–1481.

Xiao, H.W., Lin, H., Yao, X.D., Du, Z.L., Lou, Z. and Gao, Z.J. (2009). Effects of different pretreatments on drying kinetics and quality of sweet potato bars undergoing air impingement drying. *International Journal of Food Engineering*. 5: 19

Zhang M., Tang I., Mujumdar A. and Wang, S. (2006). Trends in microwave-related drying of fruits and vegetables. *Journal of Food Science and Technology*. (17): 524 -534.