

# Effect of Sonication Pre-Treatment and Drying Temperature on Avocado Seeds (*Persea americana*) Drying Kinetics and Flour Quality



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PORTO

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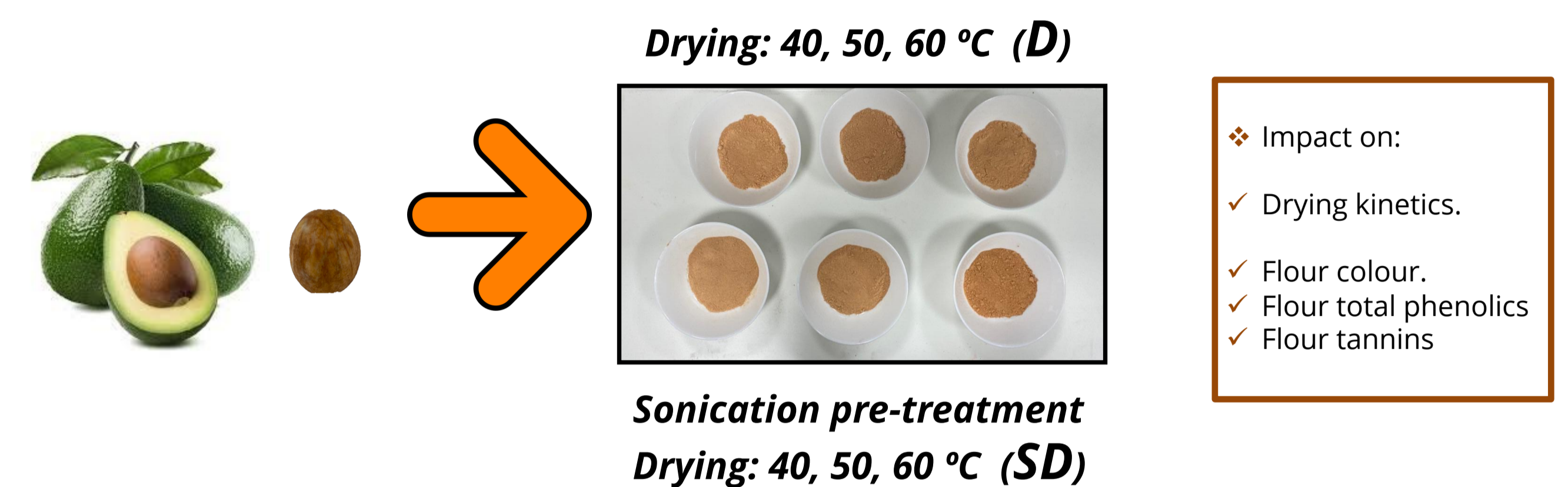
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## Introduction

- Avocado (*Persea americana*) seeds are a by-product of avocado processing industries and represent 12 to 21% of the fruits. By 2030, an annual production of 12 million tons is expected.
- Seeds are a rich source of bioactive compounds and can be processed into flour.
- Sonication presents the potential to inactivate microorganisms, modify physical properties, improve some characteristics like colour, texture, and nutritional content, and remove some undesirable compounds such as antinutritional compounds.

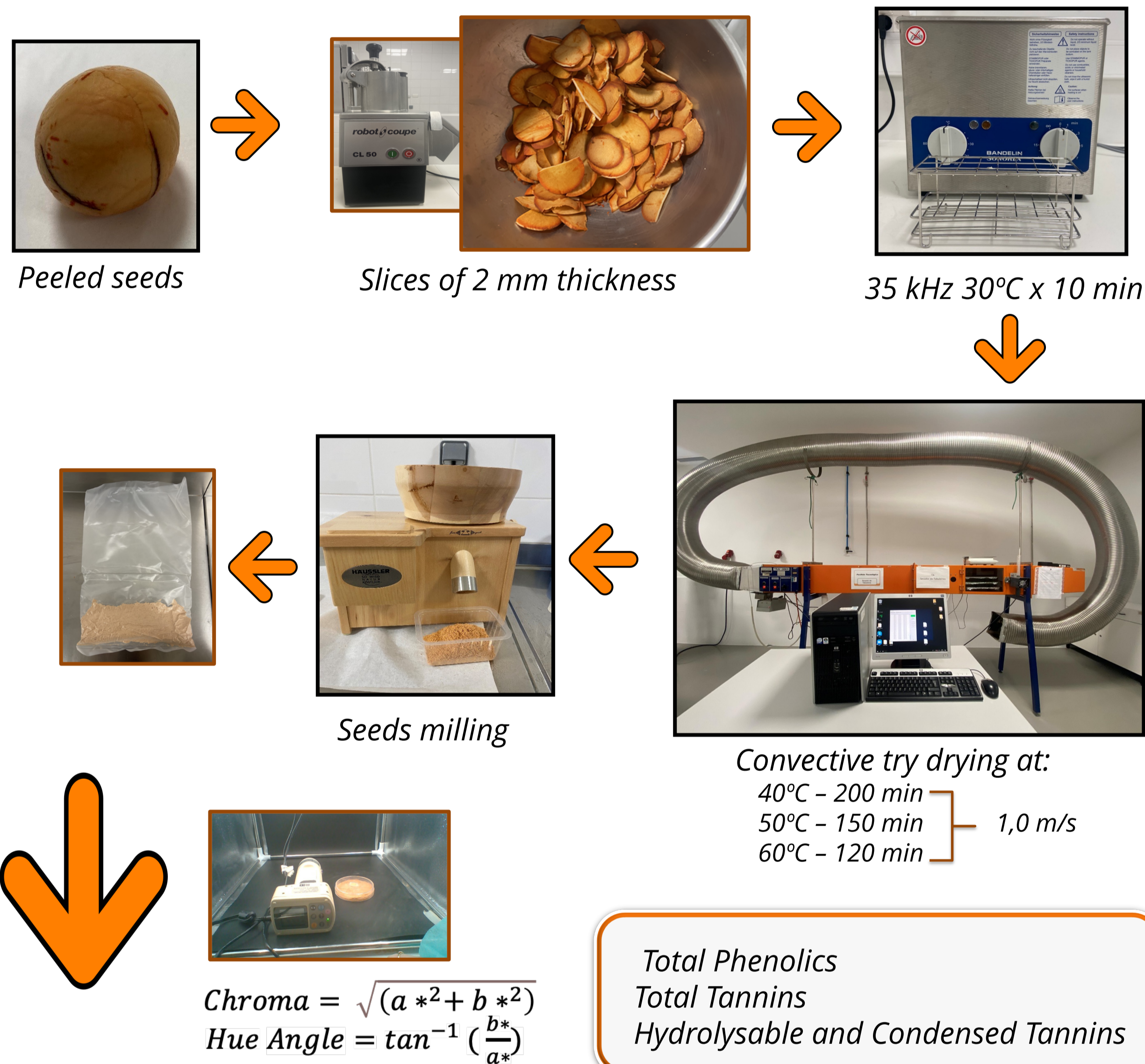
## Objectives

- Evaluate the effect of sonication pre-treatment on avocado seeds drying kinetics and flour quality.



## Materials & Methods

### Sample Preparation



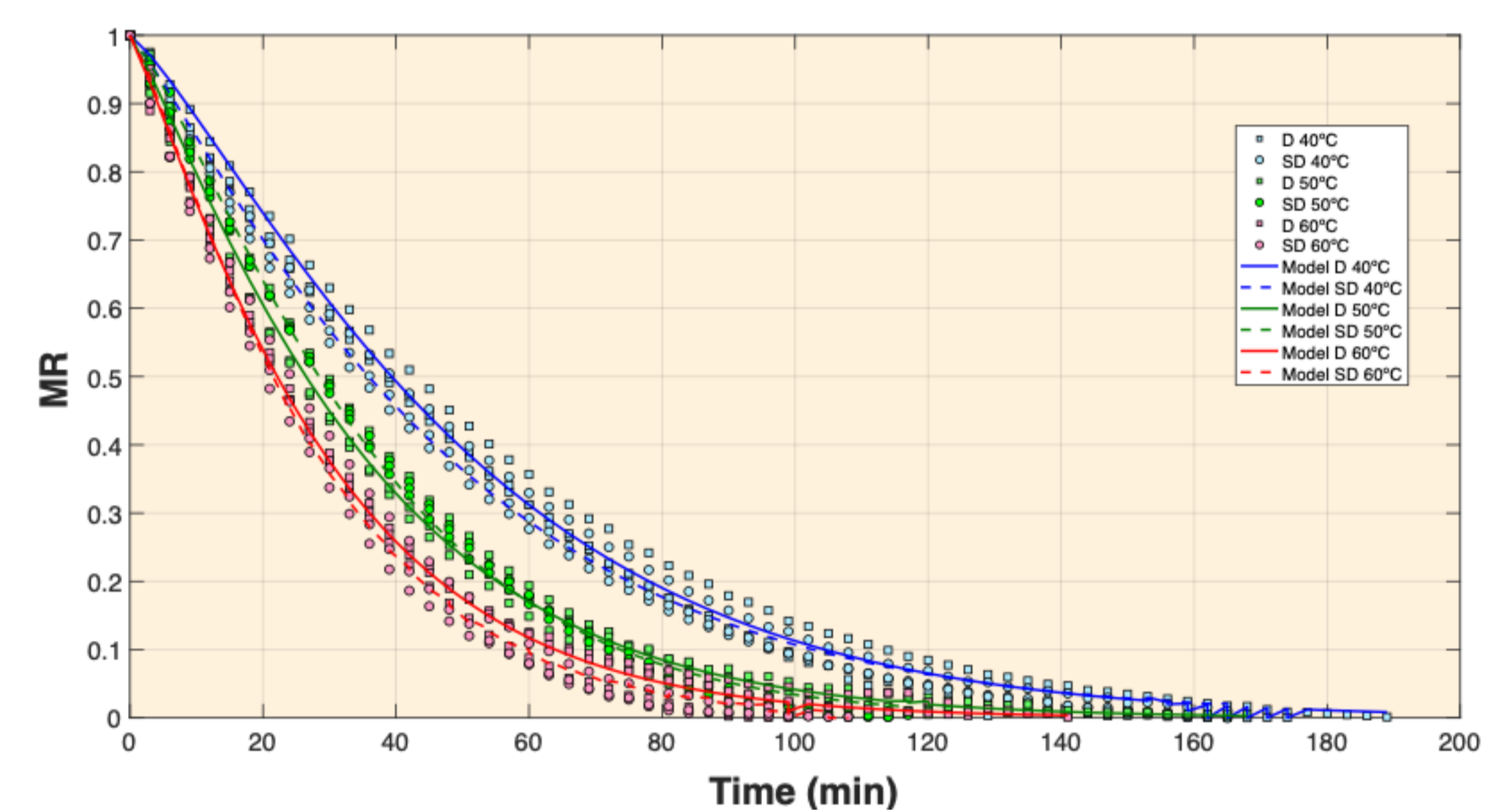
$$MR = \frac{M_t - M_e}{M_0 - M_e} \quad MR = \exp(-kt)^n \quad \text{Modified Page model}$$

### Data Analysis

Three replicates; ANOVA + Post-hoc tests; non-linear regression; SPSS software

## Results & Discussion

### Drying Kinetics



Experimental and Modified Page model-predicted drying curves without (D) and with sonication (SD)

Model	Treatments	Temperatures	Parameters	R <sup>2</sup>	R <sup>2</sup> adj	RSME
D		40	k 0.019±0.0001 n 1.230±0.0275	0.994	0.993	0.090
		50	k 0.026±0.0003 n 1.148±0.0256	0.995	0.994	0.061
		60	k 0.033±0.0001 n 1.132±0.0213	0.997	0.996	0.029
Modified Page (II)		40	k 0.020±0.0002 n 1.141±0.2175	0.995	0.994	0.063
		50	k 0.027±0.0001 n 1.267±0.022	0.997	0.996	0.027
		60	k 0.034±0.0005 n 1.195±0.353	0.994	0.994	0.056
S+D		40	k 0.020±0.0002 n 1.141±0.2175	0.995	0.994	0.063
		50	k 0.027±0.0001 n 1.267±0.022	0.997	0.996	0.027
		60	k 0.034±0.0005 n 1.195±0.353	0.994	0.994	0.056

- Modified page II model fitted better D and SD experiments
- Sonication pre-treatment allowed to reduce drying time
- Sonication pre-treatment improved drying rate at each temperature

### Impact on avocado seed flour quality

Treatment	Temperature (°C)	L*	a*	b*	Chroma	Hue angle
D	40	39.22±0.55 <sup>a</sup>	8.30±0.57 <sup>b</sup>	11.58±0.23 <sup>bc</sup>	14.26±0.35 <sup>a</sup>	54.42±2.00 <sup>bc</sup>
	50	36.19±0.48 <sup>c</sup>	9.66±0.12 <sup>a</sup>	11.73±0.45 <sup>bc</sup>	15.20±0.36 <sup>a</sup>	50.48±1.10 <sup>a</sup>
	60	34.02±0.42 <sup>d</sup>	8.78±0.43 <sup>b</sup>	12.41±0.15 <sup>d</sup>	15.20±0.35 <sup>a</sup>	54.75±1.11 <sup>bc</sup>
S+D	40	39.13±0.62 <sup>a</sup>	8.37±0.18 <sup>b</sup>	10.97±0.39 <sup>a</sup>	13.81±0.34 <sup>ab</sup>	52.62±1.10 <sup>ab</sup>
	50	34.09±0.50 <sup>d</sup>	7.55±0.22 <sup>c</sup>	11.40±0.23 <sup>ab</sup>	13.68±0.21 <sup>a</sup>	56.52±1.00 <sup>c</sup>
	60	30.32±0.88 <sup>e</sup>	8.52±0.21 <sup>b</sup>	12.15±0.35 <sup>cd</sup>	14.85±0.26 <sup>a</sup>	54.94±1.12 <sup>bc</sup>

- Sonication pre-treatment did not affect significantly the colour
- Sonicated dried samples presented higher preservation of total phenolics and condensed tannins

Avocado seed flour phytochemical content express in mg TA eq/g dried flour

Treatments	Temperature	Total Phenolics	Total Tannins	Hydrolysable Tannins	Condensed Tannins
D	40	10.517±1.02 <sup>ab</sup>	11.026±0.7 <sup>ab</sup>	1.080±0.39 <sup>a</sup>	9.946±0.98 <sup>bc</sup>
	50	12.652±1.40 <sup>b</sup>	12.346±1.78 <sup>b</sup>	3.115±0.54 <sup>b</sup>	9.231±0.82 <sup>bc</sup>
	60	9.357±0.82 <sup>a</sup>	9.245±0.27 <sup>a</sup>	3.049±0.28 <sup>a</sup>	6.196±0.93 <sup>a</sup>
S+D	40	11.137±1.88 <sup>ab</sup>	11.061±1.72 <sup>ab</sup>	3.047±0.42 <sup>b</sup>	8.014±0.98 <sup>bc</sup>
	50	10.550±0.95 <sup>ab</sup>	11.139±1.36 <sup>ab</sup>	2.503±1.15 <sup>a</sup>	8.636±0.67 <sup>ab</sup>
	60	12.747±1.53 <sup>b</sup>	12.469±1.19 <sup>b</sup>	3.181±0.35 <sup>b</sup>	9.289±1.54 <sup>c</sup>

## Conclusions

- Sonication pre-treatment of avocado seed slices drying allowed to slightly increase the drying rate and reduce drying time at all tested temperatures.
- Sonication pre-treatments of avocado seeds flour presented a better preservation of total phenolics only at 60°C.
- The color of the flour was not very significantly affected by sonication pre-treatment.

## Acknowledgements

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