Mathematical modelling of oven drying kinetics of pretreated cassava flour

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Introduction

- Cassava (*Manihot esculenta Crantz*) is a widely available agricultural commodity and a significant source of calories in Indonesia. Cassava flour, which is processed via pretreatment and drying, is one of the derivative products of cassava.
- The application of heat during drying helps to achieve the good quality of the final product. The popular method for drying cassava in the tropical regions is sun drying.
- Some of the challenges in processing cassava flour include the presence of high-temperature heating and the reaction between sugar and protein, which can result in the Maillard reaction, which is a major concern for cassava processing in general.
- The purpose of this study was to determine the model of oven drying characteristics of pretreated cassava flour empirically and fundamentally.

Methodology

The following were experimental variations:

- DIP (soaked in distilled water for 3 days at room temperature 24°C);
- DIB (soaked in distilled water for 2 days then blanched at 100°C for 3 minutes); and
- BDI (blanched at 100°C for 3 minutes then soaked in distilled water for 2 days).

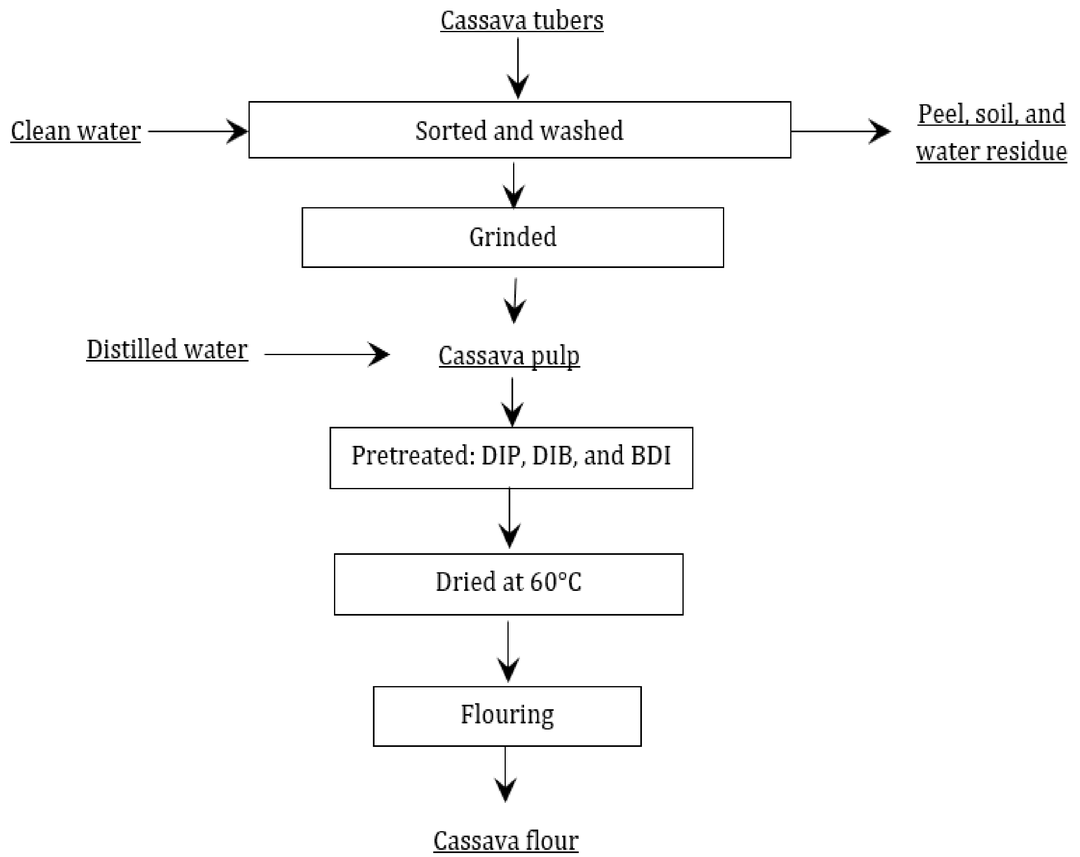

Figure 1. Flow chart of pretreated cassava flour production

Results

Table 1. Values of model constants for pretreated cassava flour

Model	Treatment	n	a	b	k	k_0	k_1	SSR	R^2
Newton	DIP				0,1873			0,0899	0,8912
	BDI				0,1364			0,0888	0,9377
	DIB				0,1359			0,0921	0,9381
Logaritmic	DIP		1,0691		0,1993			0,0806	0,8792
	BDI		1,0599		0,1452			0,0801	0,9302
	DIB		1,1096		0,1519			0,0655	0,9243
Two-term	DIP		0,5345	0,5345		0,1993	0,1993	0,0806	0,8792
	BDI		0,5299	0,5299		0,1452	0,1452	0,0801	0,9302
	DIB		0,5000	0,5000		0,1993	0,1993	0,2173	0,8934
Midili	DIP	1,7173	0,9301		0,0461			0,2581	0,9343
	BDI	1,6532	0,9293		0,0327			0,0344	0,9808
	DIB	1,4604	1,0049		0,0542			0,0273	0,9693
Page	DIP	1,4928			0,0758			0,0324	0,9207
	BDI	1,4218			0,0579			0,0417	0,9692
	DIB	1,4728			0,0525			0,0273	0,9702

- The results showed that the Midilli model satisfactorily described the drying behavior of pretreated cassava flour with high coefficient of determination values (R^2 = 0.9808) and low values of sum square error (SSE = 0.02734).
- The Midili model could suitably express oven drying characteristics of pretreated cassava flour than the other models.

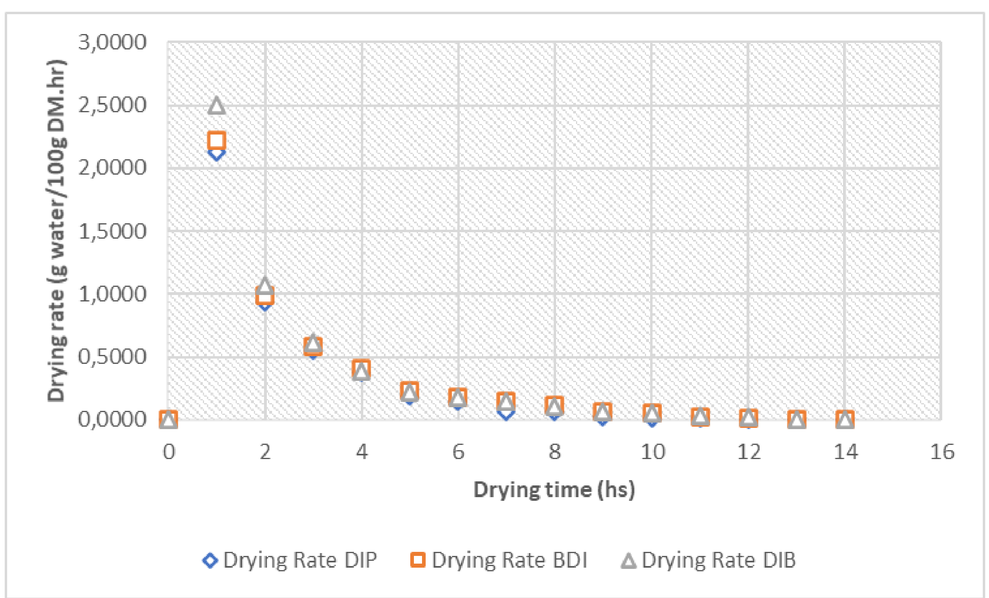

Figure 2. Drying rate of pretreated cassava flour versus drying time

Conclusion

The Midili model could suitably express oven drying characteristics of pretreated cassava flour than the other models since it has shown best accuracy to the experimental data as compared to the other models (Newton, Two-term, Logarithmic, and Page)

Acknowledgement:

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