Prediction of pasting and thermal properties of mixed flours Hom Mali rice and glutinous rice using near infrared spectroscopy

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Introduction

Glutinous rice (*Oryza sativa* L.) is one of the important economic crops of Thailand. It is a staple food for Thai people in northern and north-eastern Thailand. Khao Dak Mali 105 or Hom Mali rice varieties are very popular in Southeast Asia and widely accepted in the world due to their quality, good taste, soft texture and unique aroma. Starch from grains with varying amylose content is of interest for food processing because of the potential to modify the texture and quality of the finished product. Glutinous rice contains very limited amounts of amylose (0–4%) whereas Hom-Mali rice has an amylose content of 14–18%. The aim of this study was to investigate the pasting and thermal properties of mixed flours of Hom-Mali rice and glutinous rice with differences in amylose contents.

Materials and methods

Glutinous rice flour was blended with Hom-Mali rice flour in ratios of 100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 0:100. Thermal properties of a total of 92 samples of mixed flour were determined by using a DSC 822^e thermal analyser (Mettler Toledo, Columbus, OH). Pasting properties of the mixed flours were determined by using a Rapid Visco-Analyser (Newport Scientific, Warriewood, Australia). The peak viscosity, holding viscosity, final viscosity and pasting temperature were determined by the analysis of Thermocline for window (TCW ver. 4, Australia). NIR reflectance spectra were obtained and converted to absorbance spectra from 1100

Table 1. Result of NIR calibration and validation sets for mixed flour.

Parameter		Calibration			Validation		Prediction	
		Factor	R	SEC	SEP	Bias	SEP	Bias
Pasting properties	Peak	8	0.87	11.94	21.04	0.87	20.99	–47.30
	Trough	3	0.90	6.15	6.64	0.06	7.37	–5.66
	Breakdown	8	0.90	12.43	21.51	0.59	21.47	–23.29
	Final viscosity	3	0.97	9.06	9.86	0.09	13.20	–10.86
	Setback	10	0.98	7.86	21.65	0.31	22.23	35.87
	Peak time	2	0.89	0.00	0.46	0.01	0.51	–0.18
	Pasting temp.	16	0.99	0.05	1.27	0.03	1.97	4.90
Thermal properties	*T*o	7	0.90	0.34	0.45	0.00	0.58	–0.01
	*T*p	2	0.87	0.33	0.35	–0.00	0.74	–0.15
	*T*c	1	0.25	1.03	1.06	0.00	0.75	0.27
	Enthalpy	1	0.85	0.00	0.79	–0.00	0.67	–0.40

*T*o: onset temperature; *T*p: peak temperature; *T*c: conclusion temperature.

to 2500 nm at 2 nm intervals using an InfraAlyser 500 spectrometer (Bran + Luebbe, Norderstedt, Germany). Two replicates of each sample were scanned, using a standard cup (internal diameter 35 mm, depth 8 mm). All spectra data were transferred into JCAMP.DX format and imported into the Unscrambler 9.8 (Camo, Oslo, Norway) for data analysis. Partial least squares regression (PLSR) was used to develop the regression equations.

Results and discussion

The statistical evaluation of calibration, validation and prediction other mixed flour samples for pasting and thermal properties are summarized in Table 1.

The model performances for trough, break down, final viscosity, setback and pasting temperature and *T*o were excellent ($R > 0.9$). Peak, peak time, *T*p and enthalpy gave moderate correlation ($R \sim 0.8$) whereas *T*c could not be predicted by NIR spectroscopy ($R = 0.25$).