

CHAPTER 4 RESULTS

4.1 Experiment I: Effect of drying methods on rice quality

Two kg of 'Suphan Buri 1' paddy was re-wetted at the (MC) of 26% (639 ml of water) and MC of 28% (664 ml of water) was added and placed in plastic trays held in a cool room at 10°C for 15 h. Thereafter, the re-wetted paddy was dried until the MC down to about 12–14% using two methods: sun drying at 38–40°C for about 6–8 h for to meet the MC of about 12–13%. Hot air oven dryer at 60°C for 26% was around 7–8 h and 28% MC for about 8–9 h. Their qualities were measured compared with the control (non-treated).

4.1.1 Moisture content of paddy (%)

The moisture content of 'Suphan Buri 1' paddy is shown in Table 4.1.1 The MC (w.b.) of the re-wetted paddy to 26 and 28 % MC and dried by sun drying or the oven dryer reached to be 12.40–12.87 %.

4.1.2 Colour of paddy (value)

The L*, a*, b* and h° values of paddy are depicted in Table 4.1.1 The L* value (lightness) of the 28% MC + oven drying paddy exhibited significantly lowest L* value followed by the paddy with 28% MC + sun drying, 26% MC + oven drying and 26% MC + sun drying, respectively.

The a* value of all treated samples was not significantly different but they were higher than the reference paddy.

The b^* value (yellowness) of paddy with the 26% MC + sun drying was 21.14 and significantly highest compared to the other treatments, however, it was not significantly different from the reference.

The paddy in the treatment of 28% MC + oven drying had significantly lowest h° . The h° value of the other treatments presented non-significantly different.

Table 4.1.1 Effects of drying methods on MC% (w.b.) and colour (L^* a^* , b^* and h° values) of ‘Suphan Buri 1’ paddy.

Treatment	MC	Colour of paddy (value)			
	(w.b.) (%)	L^*	a^*	b^*	h°
Control	9.46 c	59.01a	4.19 b	28.72 a	81.69 a
26% MC + Sun drying	12.82 a	40.95 b	4.77 a	21.14 a	77.48 b
28% MC + Sun drying	12.87 a	39.70 bc	4.70 a	19.74 c	76.58 c
26% MC + Oven drying	12.40 b	40.65 b	4.91 a	20.51 bc	76.65 c
28% MC + Oven drying	12.67 ab	38.88 c	4.93 a	20.18 bc	76.27 c
F-test	**	*	**	**	**
C.V.	1.70	2.19	5.11	3.41	0.59

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P < 0.05$). * = statistically significant at $P < 0.05$, and ** = statistically significant at $P < 0.01$.

4.1.3 Colour of brown rice (value)

The L^* value of brown rice was influenced by the initial MC% (w.b.) and drying method. The brown rice of the paddy with 28% MC + oven drying revealed significantly higher L^* value compared to other treatments. However, the L^* value of

brown rice from the paddy with the 28% MC + sun drying was significantly lowest (Table 4.1.2).

The a^* value of brown rice was not affected by the initial moisture content and drying methods. The value of all treatments was significantly higher than that of the original sample (Table 4.1.2).

The b^* value of brown rice is depicted in Table 4.1.2 The b^* value of brown rice of 28 or 26% MC + sun drying was significantly lower compared to the other treatments including the control paddy.

Table 4.1.2 shows the h° which was lowest in the brown rice from 26% MC + sun drying. And, the brown rice from 26% MC + oven drying had the highest h° value and significantly lower than the reference paddy.

Table 4.1.2 Effects of drying methods on colour (L^* , a^* , b^* and h° values) of ‘Suphan Buri 1’ brown rice.

Treatment	Colour of brown rice (value)			
	L^*	a^*	b^*	h°
Control	65.05 bc	1.25 b	17.80 a	85.97 a
26% MC + Sun drying	66.37 ab	2.71 a	17.02 b	81.01 c
28% MC + Sun drying	63.69 c	2.42 a	16.31 b	81.75 bc
26% MC + Oven drying	67.64 a	2.42 a	18.02 a	82.84 b
28% MC + Oven drying	76.24 a	2.69 a	18.22 a	81.71 bc
F-test	**	**	**	**
C.V.	1.95	13.64	21.75	1.07

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P < 0.05$). ** = statistically significant at $P < 0.01$.

4.1.4 Determination to detect grains of brown rice

1) Head yield of brown rice (%)

The head yield and imperfect grains of ‘Suphan Buri 1’ brown rice are shown in Table 4.1.3 The head yield of brown rice 26% MC with both methods was 50.93–51.55% which was significantly higher than the paddy with initial MC of 28% and drying either by the sun or oven dryer (Table 4.1.3).

2) Imperfect grains of brown rice (%)

A. Chalky grains (%)

The chalkiness of brown rice from the paddy with 2 different initial MC levels and dried by oven dryer was significantly lower than that by the sun drying method (Table 4.1.3). The percentage of chalkiness was also found to be lower than the initial value.

B. Cracked grains (%)

The cracked kernels of brown rice with 26% MC + sun drying were significantly highest and it was also higher than the reference paddy (Table 4.1.3).

C. Defect grains (%)

The significantly lowest of defect grains was found in the 28% MC + oven drying paddy, The other treatments showed slightly higher percentage of defect grains than the control sample (Table 4.1.3)

Table 4.1.3 Effect of drying methods on head yield of whole grains and imperfect grains of ‘Suphan Buri 1’ brown rice.

Treatment	Head yield of brown rice (%)	Imperfect grains (%)		
		Chalky (%)	Cracked (%)	Defect (%)
Control	54.26 a	3.20 a	0.59 b	0.82 a
26% MC + Sun drying	51.55 b	1.66 bc	1.59 a	1.08 a
28% MC + Sun drying	49.60 c	2.26 b	0.58 b	1.07 a
26% MC + Oven drying	50.93 b	0.63 d	0.58 b	1.03 a
28% MC + Oven drying	48.52 c	0.87 cd	0.49 b	0.46 b
F-test	**	**	**	**
C.V.	1.41	34.74	20.23	25.79

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P < 0.05$), ** = statistically significant at $P < 0.01$.

4.1.5 Colour of milled rice (value)

The L^* , a^* , b^* and h° values of ‘Suphan Buri 1’ milled rice were depicted in Table 4.1.4 The milled rice from 26% MC + oven drying presented greatest L^* value but it was not different from the 28% MC + oven drying and the control treatments. Two different MC levels of paddy and then dried by the sun shine slightly reduced the L^* value compared to the control sample.

The a^* value of milled rice was significantly highest in the paddy with 26% MC + oven drying, followed by the 28% MC + oven drying, 26% MC + sun drying, and 28% MC + sun drying, respectively.

The b^* value of milled rice significantly increased when the moist paddy (26 or 28% MC) were dried by oven dryer compared to sun drying and the control samples (Table 4.1.4).

The h° value of milled was between 89.94 to 92.14 after re-wetting and drying, which was lower than the control paddy. The 28% MC + sun drying was significantly highest compared to the other treatments. The 26% MC + sun drying, 26 or 28% MC + oven drying presented no significant different of h° value (Table 4.1.4).

Table 4.1.4 Effects of drying methods on L^* , a^* , b^* and h° values of ‘Suphan Buri 1’ milled rice.

Treatment	Colour of milled rice (value)			
	L^*	a^*	b^*	h°
Control	71.22 ab	- 0.65 e	9.41 d	93.99 a
26% MC + Sun drying	70.07 b	- 0.19 c	11.57 b	90.74 c
28% MC + Sun drying	70.01 b	- 0.38 d	10.56 c	92.14 b
26% MC + Oven drying	73.15 a	0.28 a	13.29 a	90.86 c
28% MC + Oven drying	71.83 ab	0.05 b	12.45 a	89.94 c
F-test	*	**	**	**
C.V.	2.16	49.74	4.97	0.91

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P < 0.05$). * = statistically significant at $P < 0.05$, and ** = statistically significant at $P < 0.01$.

4.1.6 Determination to detect milled rice grains

1) Head yield of milled rice (%)

The head yield of milled rice in the control treatment was 37.57%. The treated paddy, two MC levels and 2 drying methods, did not significantly affect to the head yield of milled rice. However, the paddy with 26% MC and dried by both drying methods presented slightly higher head yield of milled rice than the paddy with 28% MC (Table 4.1.5).

2) Imperfect grains of milled rice (%)

A. Chalky grains (%)

The initial chalkiness grains were less than 3%. The chalkiness was range from 0.32–0.73% after treatment and it was not influenced by the initial MC before drying by these 2 methods in this experiment (Table 4.1.5).

B. Cracked grains (%)

The percentage of cracked grains in the control treatment was 0.7%. The drying method induced cracking; however, the cracking of paddy with 28% MC + oven drying was significantly highest (Table 4.1.5).

C. Defect grains (%)

Table 4.1.5 shows the percentage of defect grains, which were not significantly different among the treatments. The defect grains of all treatments were also lower than 1.0%.

Table 4.1.5 Effect of drying methods on head yield of whole grains and imperfect grains of ‘Suphan Buri 1’ milled rice.

Treatment	Head yield	Imperfect grains (%)		
	of milled rice (%)	Chalky (%)	Cracked (%)	Defect (%)
Control	37.57 b	2.11 a	0.70 b	0.32
26% MC + Sun drying	46.64 a	0.39 b	0.64 b	0.34
28% MC + Sun drying	43.20 a	0.55 b	0.67 b	0.22
26% MC + Oven drying	46.04 a	0.32 b	0.33 c	0.23
28% MC + Oven drying	44.72 a	0.73 b	0.92 a	0.41
F-test	**	**	**	ns
C.V.	6.19	44.83	13.40	58.41

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P < 0.05$). The absence of letters indicates statistical non-significance: ns = no significance, and ** = statistically significant at $P < 0.01$.

4.1.7 Amylose content (%)

Amylose content of ‘Suphan Buri 1’ milled rice is about 28–29%. According to Department of rice, Thailand, 2013, the Amylose content of ‘Suphan Buri 1’ is about 29%. The amylose content of milled rice from 26% MC + oven drying significantly reduced to 21.97%. The reduction was less in paddy with 26 or 28% MC + sun drying and 28% + oven drying, respectively (Table 4.1.6).

4.1.8 Elongation ratio (mm)

The initial elongation ratio of milled rice was 1.24. After treatment, the initial moisture content and drying methods was not significantly affected the elongation ratio, which was 1.40–1.42 mm (Table 4.1.6).

4.1.9 Water absorption (%)

The water absorption was not significantly different among the treated paddy samples. However, the water absorption of milled rice from 28% MC + oven drying was the lowest (Table 4.1.6).

Table 4.1.6 Effect of drying methods on cooking characteristics (amylose content elongation and water absorption) of ‘Suphan Buri 1’ milled rice.

Treatment	Cooking characteristics		
	Amylose content (%)	Elongation ratio (mm)	Water absorption (%)
Control	28.02 a	1.24 b	155.58 a
26% MC + Sun drying	24.22 c	1.42 a	119.91 b
28% MC + Sun drying	26.27 b	1.40 a	122.10 b
26% MC + Oven drying	21.97 d	1.41 a	116.50 b
28% MC + Oven drying	28.75 a	1.40 a	112.00 b
F-test	**	**	**
C.V.	2.29	3.41	6.02

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P < 0.05$). ** = statistically significant at $P < 0.01$.

4.1.10 Texture of cooked rice hardness of stickiness (N)

The hardness of cooked rice was 32.68–33.59 N, which was not significantly different among treated paddy samples (Table 4.1.7). the stickiness of cooked rice in all treated samples was not significantly different. However, the stickiness of cooked rice was significantly reduced by re-wetting and drying compared to the original value (Table 4.1.7).

Table 4.1.7 Effects of drying methods on texture of the cooked rice hardness and stickiness of ‘Suphan Buri 1’ milled rice.

Treatment	Texture of cooked rice (N)	
	Hardness (N)	Stickiness (N)
Control	33.01 a	- 1.52 b
26% MC + Sun drying	32.68 a	- 0.39 a
28% MC + Sun drying	32.87 a	- 0.59 a
26% MC + Oven drying	32.98 a	- 0.72 a
28% MC + Oven drying	33.59 a	- 0.48 a
F-test	ns	**
C.V.	3.96	51.57

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P < 0.05$). The absence of letters indicates statistical non-significance: ns = no significance, ** = statistically significant at $P < 0.01$.