CHAPTER 5 DISCUSSION

5.1 Experiment I: Effect of drying methods on rice quality

5.1.1 Moisture content of paddy (%)

The final moisture content of re–wetted paddy, 2 different MC levels, achieved to 12.40–12.87% by sun drying or hot air oven drying at 60°C. The duration for sun drying (38–40 °C) of the paddy with 26 and 28% MC was 6 and 8 h, respectively. In case of hot air oven at 60°C, it took around 7– 8 h for 26% MC paddy and about 8–9 h for the 28% MC. This suggests that hot air drying at 60°C would be able to an alternative drying method when the initial MC of paddy was about 26–28%.

5.1.2 Colour of paddy, brown rice and milled rice

The colour of paddy, brown rice and milled rice indicated by L*, a*, b* and h° values were not obviously different among the tested samples (Table 4.1.1, 4.1.2, 4.1.4) because the differences of MC and drying temperatures were relatively small. The paddy colour, however, became slightly dark brown, low L* and h° values (Table 4.1.1) in the paddy with 28% MC + oven drying. Similarly, the brown rice became brown yellow, indicated by higher b* value (Table 4.1.2). The milled rice colour presented the increase of yellowness (higher a* and b* values) (Table 4.1.4). This means hot air oven at 60°C accelerated the changes of the colour in the rice. The Maillard's reaction or chemical browning reaction is enhanced by elevated temperature and water in food products (John et al., 2012). Therefore, the high temperature at 60°C during drying would increase this reaction compared to drying at 38–40°C under the sunshine. In addition, the paddy with 28% MC + sun drying or oven drying presented lower L* and b* values compared to the paddy with 26% MC. This implied that the initial moisture content of paddy before drying effected to the colour change in the paddy and probably related to browning reaction. But, this incidence did not observe to be significant in brown and milled rice (Table 4.1.2 and 4.1.4.).

5.1.3 Determination to detect grains of brown rice

1) Head yield of brown rice (%)

Generally, high MC of paddy and temperature of drying reduced head rice yield (IRRI 2009). The head yield of 'Suphan Buri 1' brown rice was lower in the paddy with the initial MC of 28% than that with 26% (Table 4.1.3). The grains with high MC during harvesting would be cracked during drying, especially drying with high temperature, resulting to higher broken grains and lower head yield (IRRI, 2009). Fissures in riced kernels usually lead to cracking of the grain during the milling process and thus reduce the head rice recovery (Vellupillia and Pandey, 1990). Head yield is strongly related to internal cracking or fissuring and it can be reduced the head rice yield. In general, the yield of whole kernels varies widely, depending on many factors such as: variety, grain type, chalkiness and cultural practices; other factors are drying and milling conditions (Luh et al., 1991).

2) Chalky grains (%)

Chalky in the rice grains is strongly correlated with variety, cultural practices and postharvest treatments. The chalky may also be influenced by early harvesting because the grain is not fully developed (Hoshikawa, 1995). Drying at low temperatures and moisture contents does not affect to chalkiness. Our results revealed that drying with hot air oven at 60°C reduced chalky appearance compared to the sun drying (Table 4.1.3). Suggesting the gelatinization might be occurred during drying high MC paddy at 60°C. This result would be an advantage for oven drying compared to sun drying.

3) Cracked grains (%)

The cracked grains by sun drying increased because an overexposure to fluctuating temperature and humidity conditions,which may lead to development of cracking in individual kernels (Dong and Zhihuai, 2003). The cracked grains may lead to broken rice during milling. The percentage of broken after milling depended on the drying conditions, because drying often induced stress and cracks in the grains, causing breakage during milling. Improper drying, such as a fast process at high temperature, can produce kernel fissure, which structure weaken the kernel and make it more susceptible to breakage during the subsequent hulling and milling process (Zecchi et al., 2008). This explanation is not respected to our results because of low temperature drying within one day. Though, cracked kernels of brown rice at the MC of 26% by sun drying were higher than other treatments; it was less than 2% and would not effect to market price (Table 4.1.3). Therefore, drying the paddy with 26–28% MC by the hot air oven at 60 °C is able to replace the sun drying.

4) Defect grains (%)

The defect grains of brown rice will be removed before packing the rice for selling because it could reduce market price. The defect grains did not increase significantly in paddy with 26–28% MC + sun drying by either sun shine or oven at 60°C (Table 4.1.3). The defect grains can be from insect invasion and/or fungal infection and through natural biochemical changes in the paddy (IRRI, 2002d). Therefore, the paddy with 26–28% MC would be dried with temperature beyond 60°C.

5.1.4 Determination to detect milled rice grains

1) Head yield of milled rice (%)

Rice is primarily consumed as an, intact kernel and, therefore, production quality is larger measured by head rice yield of milled rice. Minimizing head rice yield is a major concern. The head yield of white or milled rice was not significantly affected by MC and drying method (Table 4.1.5). However, the lower MC of paddy presented the greater head yield. This results are in agreement with Cooper et al. (2008) who reported that higher head yield of milled rice could be obtained from the low MC of paddy and then dried by low temperature.

A. Chalky grains (%)

The minimum percentage of chalky is considered to be a good quality of rice (Shilpa et al., 2010). The chalky of milled rice presented non-significantly different among the tested samples (Table 4.1.5). This means those 2 levels of MC and drying methods could be employed Hoshikawa, (1995) reported that drying did not increased chalky grains but could affected by harvesting time because the grains was not fully development.

B. Cracked grains (%)

The yield of milled rice is strongly related to internal cracking or fissuring, because the kernel has previously been weakened to milling processes. The cracked grain was induced by rapid moisture absorption or desorption (Cnossen et al., 2003). The cracked grains of 28% MC + oven drying were significantly increased, but it was less than 1% (Table 4.1.5). However, this result indicated that the MC 28% + oven drying might reduce head yield.

C. Defect grains (%)

The defect grains of milled rice were not significantly different among the re–wetted and dried paddy. IRRI (2009) demonstrated that major factors increased defect grain of milled rice caused by insect and fungi invasion in the field and during storage the high MC of paddy.

5.1.5 Amylose content (%)

The amylose content of the 28% MC + oven drying or sun drying was significantly higher than that of the 26% + oven drying or sun drying (Table 4.1.6). The result indicated that low MC of 26% in the paddy would probably be more suitable for biochemical reactions involved with amylose digestion leading to the reduction of amylose content Mehdizadeh et al. (2009) reported that amylose content did not affect by drying and storage, which was different from our results. The decreace of amylose content also affected the swelling power and retrogradation of molecules of amylose (Areerat et al, 2011).

5.1.6 Elongation ratio (mm)

Jocelyn et al, (1991) described the elongation ratio of cooked rice was also highly depended on grain size and shape and amylose content. And, the rich amylose content varieties, the cooked rice was more expanded and elongated during cooking. The elongation ratio of the tested paddy was not significantly different (Table 4.1.6). The results suggested that ‘Suphan Buri’ 1 with 26-28% MC could be dried by both drying methods.

5.1.7 Water absorption (%)

The result of water absorption presented the same tend as elongation ratio (4.1.6); that was drying the paddy with MC of 26–28% gave similar quality of cooked rice. Grain size and shape largely determine the market acceptability of rice, while cooking quality is influenced by the properties of starch The 'Suphan Buri 1' variety expands more in size and more absorb water during cooking, because it had high amylose content. And its initial MC and drying with sun shine or hot air at 60°C did not affect to water absorption.

5.1.8 Texture of cooked rice hardness and stickiness (N)

Texture is also an important attribute of food acceptance by consumers (Jean et al., 1998). Rice texture is affected by factors such as rice variety, amylose content, and gelatinization temperature (Juliano and Perez 1983).The textures of cooked rice presented as hardness and stickiness were not influenced by MC and drying methods (4.1.7). Elaine et al., (1998) described that instrumentally measured textural properties were not significantly affected by drying conditions. However, cohesiveness or hardness was lower in rice dried at lower temperature (18°C or ambient) than in that dried at the higher commercial temperature.