EFFECT OF TIME-TEMPERATURE AND AMYLOSE CONTENT OF RICE ON THE COLOR AND TEXTURE OF RICE-BASED EMERGENCY CANNED FOOD

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ABSTRACT

Rice-Based Emergency Canned Food (RB-ECF) was made from rice and chicken as the main ingredients. The product was made to meet the required daily energy level of 2100 kcal to be able to be consumed directly in emergency condition. The product was packed in 307 x 113 silver enamel can and canned in retort at 250°F (Tr) with CUT = 21 minutes. The product's weight was 200 gram per can with a total energy value of 639.42 kcal. The total energy value was calculated from fat (49.63%), protein (11.26%), and carbohydrate (39.11%).

Rice with different amylose content (19.50% -Cisadane, 23.88% -IR 64 and 28.24% -IR 42) were used to make RB-ECF. Thermal processing was carried out by different time-temperature schedules to achieve 15 and 20 minutes sterilized value (Fo). Objective analysis of the products showed that amylose content and Fo value affected the color and texture of the products.

INTRODUCTION

Emergency food product is a processed food for emergency situations, which can be consumed directly and meet the daily nutritional needs. The main characteristics desired are good palatibility, safe to consume, easy to distribute, and contain sufficient nutrients daily needs. Ideally, contribution of calories from protein, fat and carbohydrate respectively is 10-15%, 35-45% and 40-50% (Zoumas et al, 2002).

Rice (Oryza sativa) is consumed dailybecause it is the staple food for most Indonesian people, thus development of a rice-based emergency canned food (RB-ECF) is appropriate. Starch is the major

component of rice and consequently play an important role in food product quality. Functional properties of starch **have** considerable effect on the quality of starch-based product [Bhattacharyya et al, **2004;** Kaur et **al,** 2005). Processing time needed to achieve **a** certain sterilized value at retort commercial sterilization will significantly change the color and texture of food canned. Retort sterilization will normally disrupt starch structure which **leads** to *a* soft, mushy texture not **well-regarded** by consumers. **Past** research showed that apparent amylose content **was** the **best** overall indicator for predicting canning stability (Patindol et al, 2007).

The objective of this **study** was to observe the effect of different time–temperature schedules to achieve **sterilized** value (Fo) **and amylose** content of rice on the color and **texture of** the RB-ECF.

MATERIAL AND METHODS

Rice with different amylose **content** (Cisadane, IR **64** and IR **42)** and other **ingredients** were procured from Pasar Bogor. The starch **and** amylose content **of rice was determined** by **DNS method** and iodometry method respectively (both as described by **Apriyantono et** al, 1989); and amylopectin **content** obtained as the **difference** of starch content with amylose content (Table 1).

RB-ECF **was prepared as** shown in **Figure 1,** with **rice** and chicken **as** the main ingredients. Product was canned in silver enamel can, 307 x **113** in size. Weight of product **was** 200 **gram** per can with the total energy value **was 639.42 kcal**. Distribution energy from fat, protein and carbohydrate **were 49.63,** 11.26 and **39.11%.** Thermal **processing was carried** out **by** different time–temperature **schedules at** 250°F to **achieve** 15 and 20 minutes sterilized value (Fo) was shown in **Table** 2.

Color analysis of product **was** made using chromameter (Minolta **CR-200)** for L value, a value and b **value.** Texture profile analysis **was performed at** room temperature by **using** TA-XT2 texture analyzer. Hardness, springiness, cohesiveness, gumminess, chewiness and adhesiveness were **determined.**

Table 1. Starch, amylose and amylopectin content from several types of rice (g/100 g)

Type of rice	Starch	Amylose	Amylopectin	Classified of amylose content*
Cisadane	85.85	19.50	66.35	Low (2-19% amylose)
IR 64	83.46	23.88	59.58	Intermediate (20.25% arnylose)
IR 42	85.08	28.24	56.84	High (25-33% amylose)

* IRRI, 2009

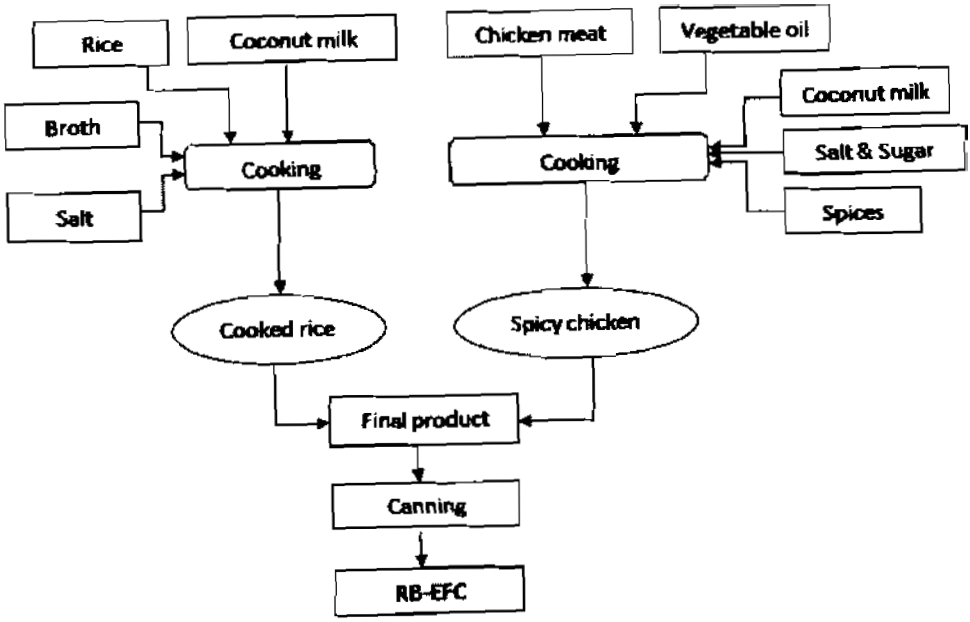

Figure 1. Preparation of Rice-Based Emergency Food Canned (RB-ECF)

Table 2. Processing time [minutes)

Type of rice	Processed time (minutes)	
	Fo = 15	Fo = 20
Cisadane	52	58
IR 64	49	57
IR 42	50	56

Come Up Time (CUT) = 21 menit

RESULTS AND DISCUSSION

Color Properties

RB-ECF color was significantly **affected** by amylose content of rice and processing time (Figure **2-3).** Amylose content affected the brightness value (L value) and a-value, but they insignificantly affected **b-value** of RB-ECF. L-value of product increased with increasing **amylose** content, and **blueness** (-a value) were vice **versa.** According to Hariyadi (2006), **rice** with high amylose **tend** to absorb more water and expand bigger when they were cooked **and** made **their** color becomes brighter.

Processing time **affected** the color of product. This result is in accord **with** Bhattacharya (1996), who **found** that pressure and steaming time had marked effects on product's Hunter color. The decrease of the brightness was more pronounced at longer processing **time. Severe** cooking had less **effect** on yellowness (b value) than on blueness (-a value). The color change has been hypothesized to be caused mainly by non enzymic browning of the Maillard **reactions** (Lamberts et al. 20061.

Figure 2. Visualization of RB-ECF **(A:** low amylose - 15 **minutes** (Fo); B: intermediate arnylose - 15 **minutes; C: high amylose** - 15 **minutes;** D: low amylose – 20 minutes; E: **intermediate amylose** – 20 minutes; F: high amylose - 20 minutes]

Texture Properties

Hardness and stickiness is the most important physical properties of RB-ECF **among** all the physical properties, which makes significant influences in increasing consumer **acceptability.** Amylose content strongly influences hardness and stickiness [adhesiveness) of rice product. Figure 4 showed the hardness and gumminess of product increased as amylose **content** increased, were adhesiveness vice versa. Rice with a high arnylose content tends to cook firm and

dry, whereas rice with a intermediate amylose content tends **to be** softer **and stickier** and **rice** with a low amylose content is **quite** soft and sticky. This result agree with Bhattacharya et al (1999) that concluded that apparent amylase content **was highly** correlated with rice noodle hardness, gumminess, and **chewiness.** This result is also in line with Ong and Blanshard (2002) that found that hard cooking rice tended to **have a** higher arnylose content (or amylose:amylopectin ratio) **and** more **longer** chain amylopectin than soft cooking rice, which feature is thought to encourage more extensive intra and/or inter molecular interactions with other components in rice grain, such as protein, lipid and non-starch polysaccharides and results in a firmer texture. **Slightly** decreasing of hardness and increasing of stickiness were found when processing time was increased. It **was probably** due to deformation of the grain and **exposed** endosperm after grain splitting sharply changed hardness **and** stickiness values. Increasing time sterilisation also induced **high** gelatinization, wich **resulted** in a softer **and stickier texture** in **the** product.

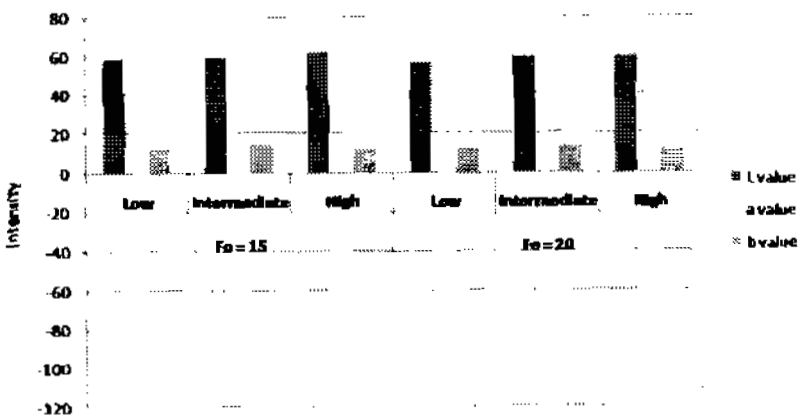

Figure *3.* **Effect** of amylose **amylose** content of rice and time processing (Fo) on color of RB-ECF

The springiness value of product varied from 0.901 until 1.006 mm, where amylose content made a small variation in springiness. This results were in agreement with a **previous** report by Cheng et *al.* (2005). Interaction of amylose content and processing time affected

springiness value differently. At the Fo was 15 minutes, the springiness of product increased as amylose content increased. The springiness value decreased with increasing amylose content at the longer time processing (Fo = 20 minutes). The different of amylopectin structures may explain why rices can have different springiness properties.

Amylose content had positive impact and strongly influenced the hardness and stickiness of rice product. Figure 4 showed the hardness and gumminess of product increased as amylose content increased. Chewiness refers to number of chews required to masticate product before it was suitable for swallowing or the amount of work required to chew the sample for sensory evaluation. It was observed that amylose content had main effects on chewiness, Chewiness increased with the increase in arnylose content, but not affected by processing time (Figure *4).*

CONCLUSION

The results demonstrate that time schedulling (processing time) of thermal processed and amylose content of rice distinctly affected color and texture of RB-ECF. These treatment affected the brightness value (L value) and a-value, but they insignificantly affected b-value of product. At product texture, amylose content strongly influences hardness. gummines, chewiness and stickiness (adhesiveness] whereas time schedulling affected hardness, gumminess and adhesiveness values.

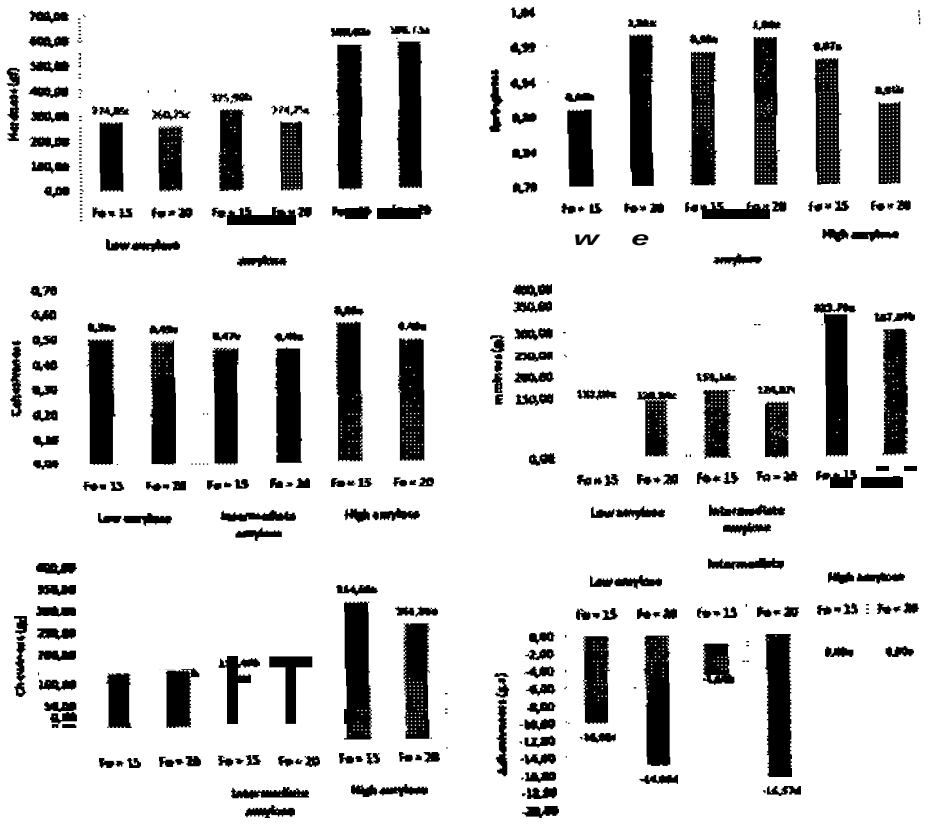

Figure 4. Effect of amylose content of rice and time processing (Fo) on texture of RB-ECF (hardness, springiness, cohesiveness, gumminess, **chewiness** and adhesiveness/stickiness)

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