1st International Conference on Food, Environment and Culture
May 15-18, 2017 Benguet State University, La Trinidad, Benguet, Philippines

PRODUCTION OF EXTRUDED INSTANT RICE SUPPLEMENTED WITH AROMATIC PANDAN LEAF EXTRACT

Miss Jittimon Wongsa

Dudsadee Uttapap, Buddhi Lamsal, Chureerat Puttanlek and Vilai Rungsardthong

Department of Agro-Industrial, Food and Environmental Technology,
Faculty of Applied Science,
Food and Agro-Industry Research Center,
King Mongkut's University of Technology North Bangkok, Bangkok, Thailand

THE ATTRACTIVENESS OF THE INSTANT RICE

Rice is the staple food
of more than half
of the world's population

www.irri.org (2016)

Regular rice requires **~20 mins** cooking

Instant rice needs less than **5 mins**

5 minutes

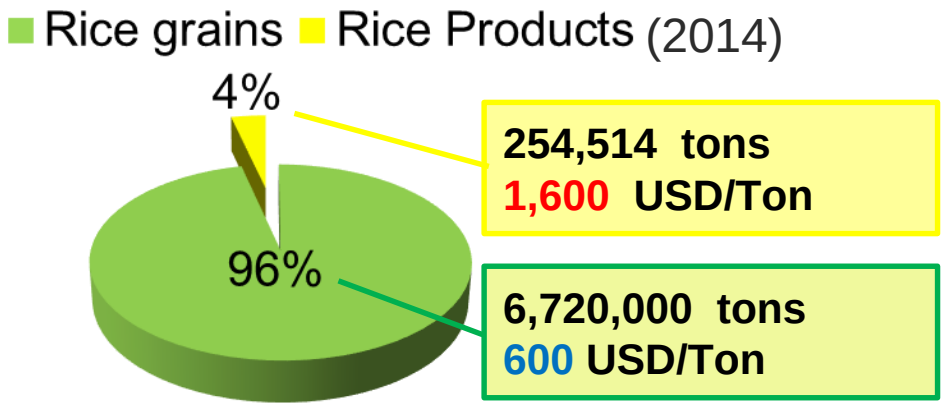
- **Easy cooking**
- **Light weight**
- **Long shelf life**

Top 5 rice exporters 2016

Rank	Country	US$ billion
1	India	5.3
2	Thailand	4.4
3	US	1.9
4	Vietnam	1.4
5	Pakistan	0.9

www.thairiceexporters.or.th (2017)

Thailand is one of the leader rice exporters
Thai jasmine rice is the most popular rice



THE METHODS OF PRODUCING INSTANT RICE

1. Traditional process
(Soak-cook-dry methods)

Rice Grain

↓

Soaking

↓

Cooking

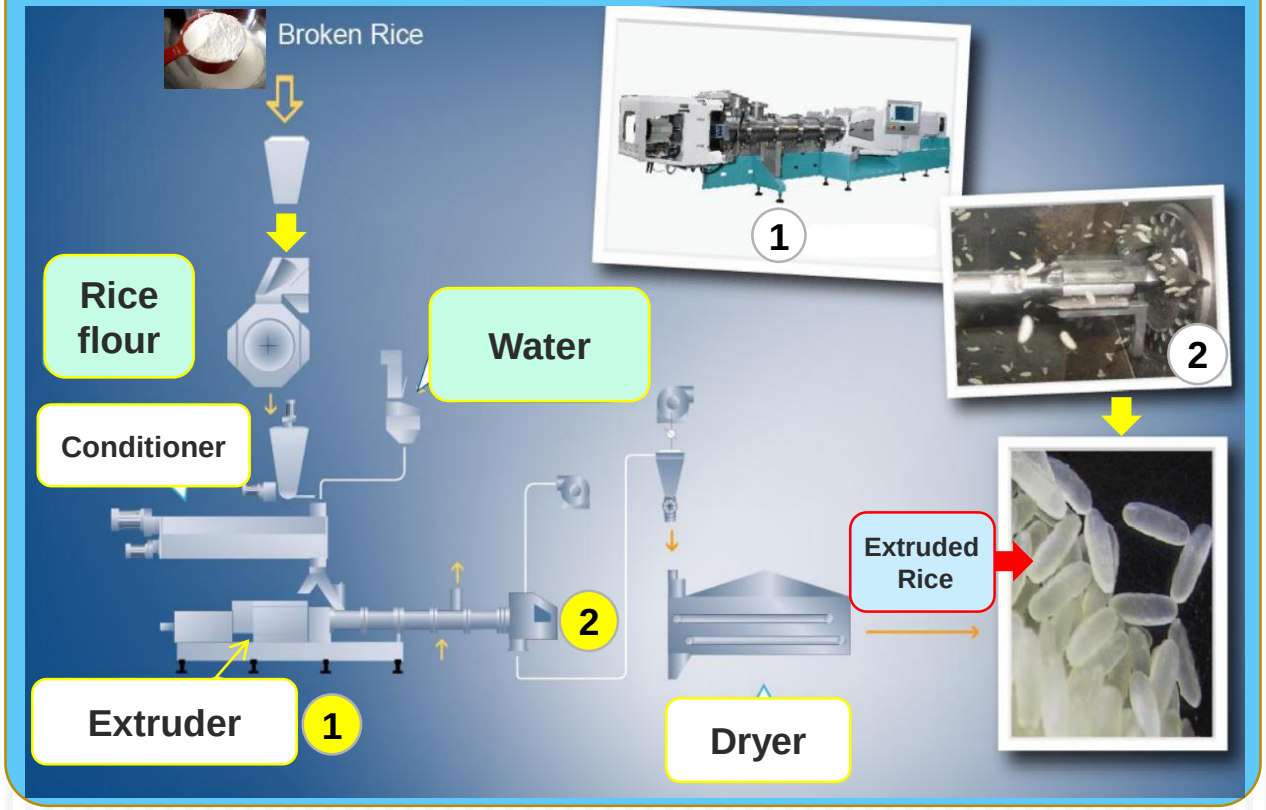
↓

Drying

↓

Instant Rice

2. Extrusion process



Extrusion cooking is a continuous process with high production capacity and low cost per product unit.

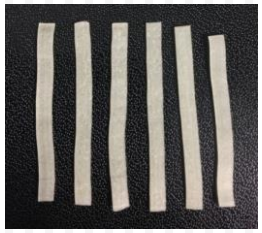
VALUE ADDED INSTANT RICE

Herbs and pandan-flavor supplemented rice product

Herbal Supplement
Rice coated with encapsulated pandan extract by spraying and dried by using fluidization technique.

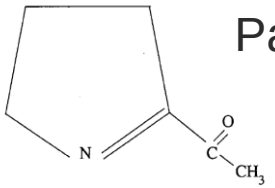
Teprungsri (2010)

Thai Jasmine Rice



Pandan-flavor supplement
Pandan flavor used for supplemented in rice noodle product.

Poolpun (2014)



Pandan flavor

2-Acetyl-1-Pyrroline (ACPY)

Rice Grains → **Instant Rice** → **Herbal Instant Rice**

By product

Broken Rice → **Extruded Instant Rice** → **Aroma Extruded Instant Rice**

OBJECTIVES

To determine optimum processing conditions and use of a monoglyceride on physical properties extruded instant rice.

To produce an aromatic extruded instant rice with the addition of natural pandan leaf extract.

MATERIALS AND EQUIPMENT

Materials

- Broken Rice Grains → Rice Flour
- Tapioca starch
  Supprted by Ampol Food Processing Co., Ltd. (Thailand)
- Monomuls 90-35P, the monoglyceride based on palm oil
  Purchased from Cognis Thai, Ltd. (Thailand)
- Gum arabic
  Purchased from Chemipan Corporation Co., Ltd. (Thailand)
- Pandan leaf extract
  Supprted by Food and Agro-Industry Research Center, KMUTNB (Thailand)

Equipment

- Single Screw Extruder Brabender-19/20DN (Germany)
  - Die diameter 1 mm
- Physical Properties
  - Colorimeter Hunter Lab Color Quest (USA)
  - Texture profile analysis TA-XT2, Stable Micro System (UK)
- Gas Chromatography Hewlett Packard-HP6890 (USA)

EXPERIMENTAL DESIGN : EXTRUSION PROCESS

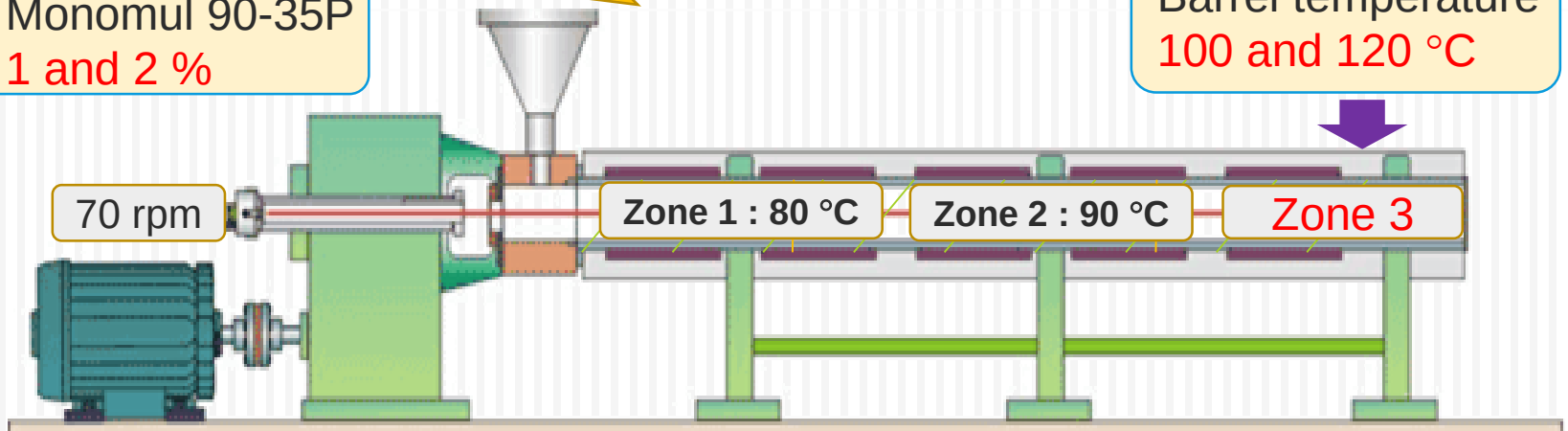
Factorial experimental design was employed to investigate the effect of Monoglyceride content (0, 1 and 2% by flour weight), Feed moisture content (25 and 30% wb) and Barrel temperature : zone 3 (100 and 120°C) on physical properties of the extruded instant rice.

Rice flour 90%
Cassava starch 10%

Monomul 90-35P
1 and 2 %

Water
(Moisture content)
25 and 30 %

Barrel temperature
100 and 120 °C



Single Screw Extruder Brabender-19/20DN (Germany)

PHYSICAL PROPERTIES OF EXTRUDED INSTANT RICE

Moisture content (%)	Barrel temperature (°C)	Monomul 90-35P (%)	Volume expansion	Density (g/cm³)	Whiteness index	Hardness (g)	Stickiness (g•s)
25	100	0	1.54^{c}	0.53^{a}	71.24^{a}	2,108^{a}	142.25^{c}
		1	1.52^{c}	0.56^{b}	72.89^{b}	2,484^{b}	87.25^{a}
		2	1.46^{b}	0.61^{b}	73.47^{b}	2,705^{c}	63.20^{a}
	120	0	1.70^{d}	0.49^{a}	71.63^{a}	1,935^{a}	120.94^{b}
		1	1.62^{d}	0.53^{a}	72.93^{b}	2,183^{a}	72.18^{a}
		2	1.58^{c}	0.56^{b}	74.96^{c}	2,502^{b}	57.33^{a}
30	100	0	1.38^{a}	0.57^{b}	71.17^{a}	2,495^{b}	148.03^{c}
		1	1.34^{a}	0.59^{b}	72.49^{b}	2,832^{c}	91.86^{b}
		2	1.31^{a}	0.63^{c}	73.72^{b}	2,981^{c}	68.24^{a}
	120	0	1.46^{b}	0.51^{a}	71.37^{a}	2,215^{a}	128.06^{b}
		1	**1.43^{b}**	**0.55^{a}**	**72.64^{b}**	**2,684^{b}**	**75.22^{a}**
		2	1.34^{a}	0.60^{b}	73.80^{b}	2,911^{c}	63.41^{a}

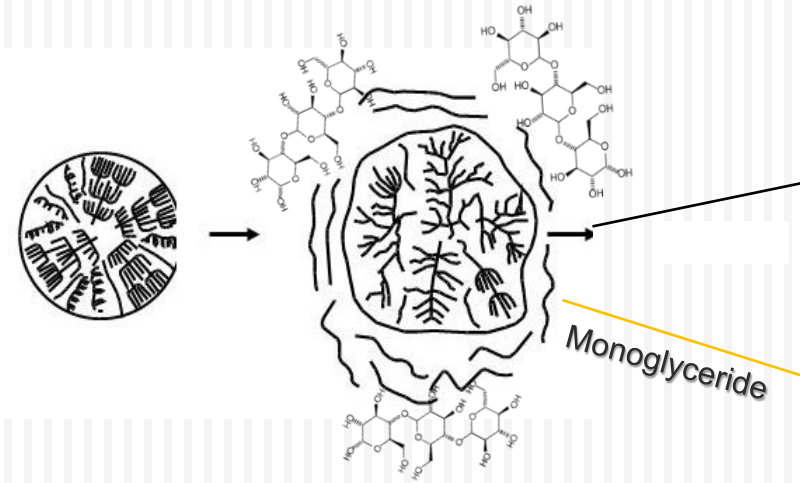
At higher moisture content : Volume expansion ↓ Density and Hardness ↑

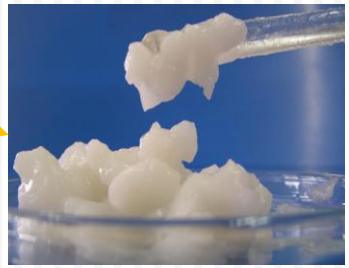
At higher temperature : Volume expansion ↑ Density, Hardness and Stickiness ↓

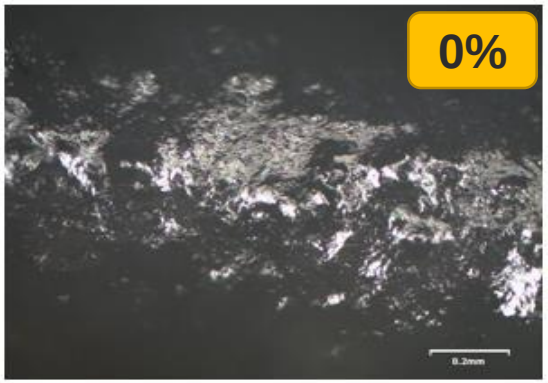
At higher M90-35P : Volume expansion and Stickiness ↓ Density, Whiteness, Hardness ↑

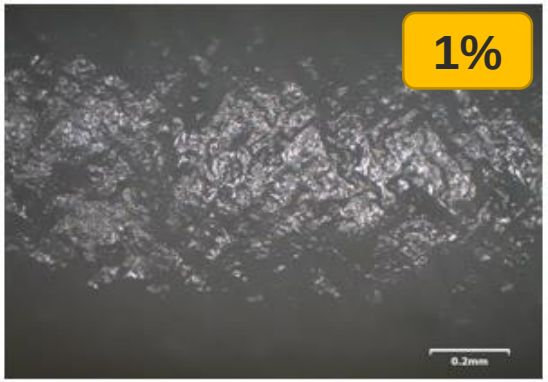
EFFECT OF MONOGLYCERIDE ADDITION ON EXTRUDED INSTANT RICE SURFACE MORPHOLOGY

The ability of monoglyceride to form water-insoluble complexes with amylose, prevent leaching of amylose during gelatinization, inhibits swelling of starch granules heated in water, and reduces the water-binding capacity of starch, is thought to result in reduced stickiness.









The use of Monomuls 90-35P at 1% showed smooth surface and did not stuck into a clump when rehydrated.

EXPERIMENTAL DESIGN : PANDAN LEAF EXTRACT SUPPLEMENT

Rice flour and tapioca starch (90/10 w/w) blended with monoglyceride 1 % and **gum arabic 2 %** w/w in a mixer

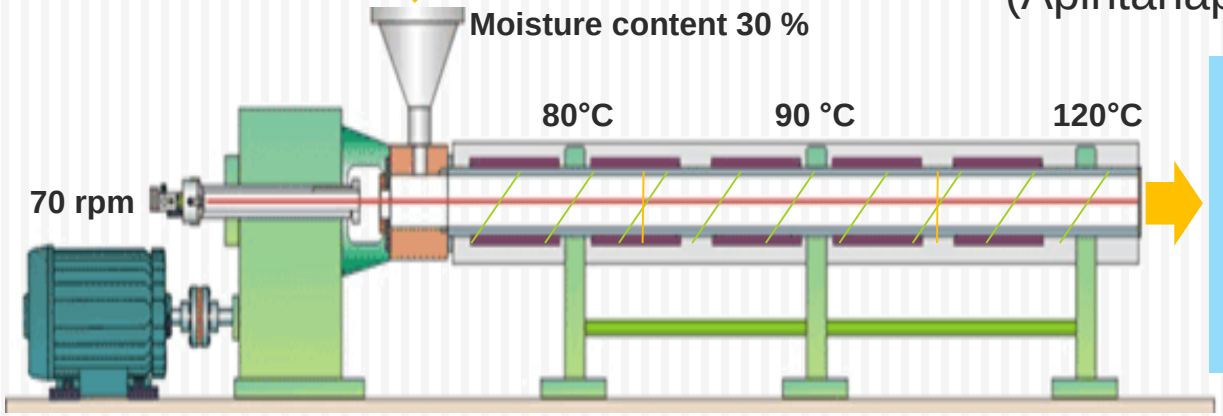
Improve the textural properties and aroma retention

Wang *et. al.,* (2011)

Flour blend was supplemented with **pandan leaf extract** at 6, 12, 18 and 24 g/100 g flour blend with adjusted **pH = 4**

Aroma retention

(Apintanapong and Noomhorm (2003)

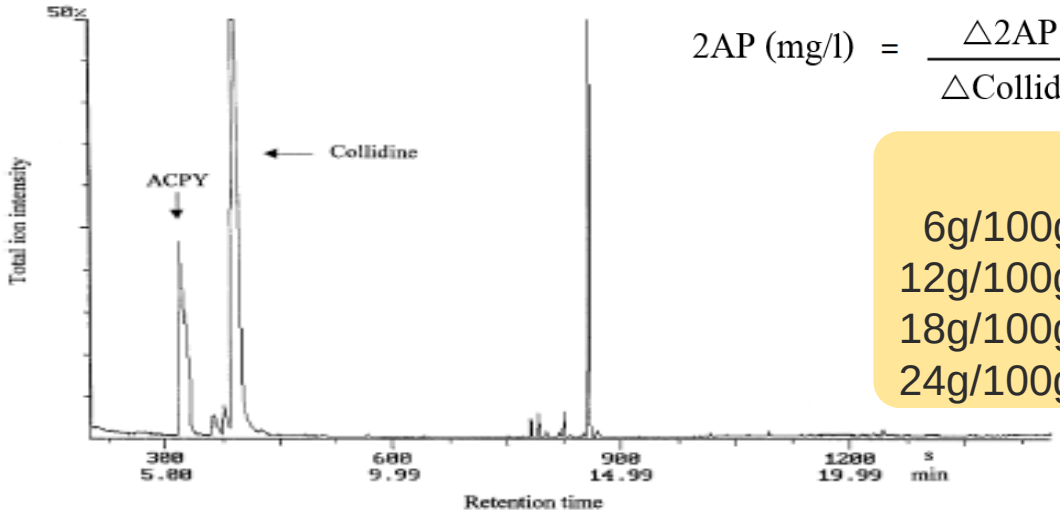


The extruded instant rice was dried by hot air dryer at 45°C for 4 h and kept in polyethylene bags until further analysis

2-ACETYL-1-PYRROLINE (ACPY OR 2AP) ANALYSES

1. Gas Chromatography

The experiment and calculation were following the method from Poolpun, (2014)

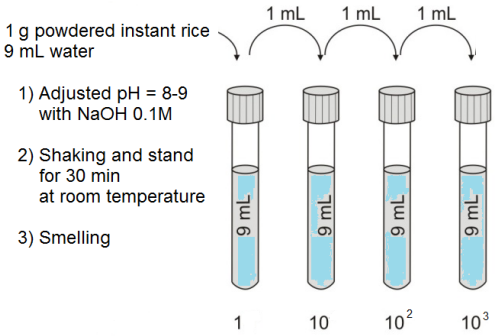


$$2AP\ (mg/l) = \frac{\triangle 2AP}{\triangle Collidine} \times \frac{[Collidine]}{1000} \times \frac{1000}{100} \times 1.3$$

	0 day	90 days
6g/100g flour	150 ppm	52 ppm
12g/100g flour	300 ppm	65 ppm
18g/100g flour	450 ppm	102 ppm
24g/100g flour	600 ppm	151 ppm

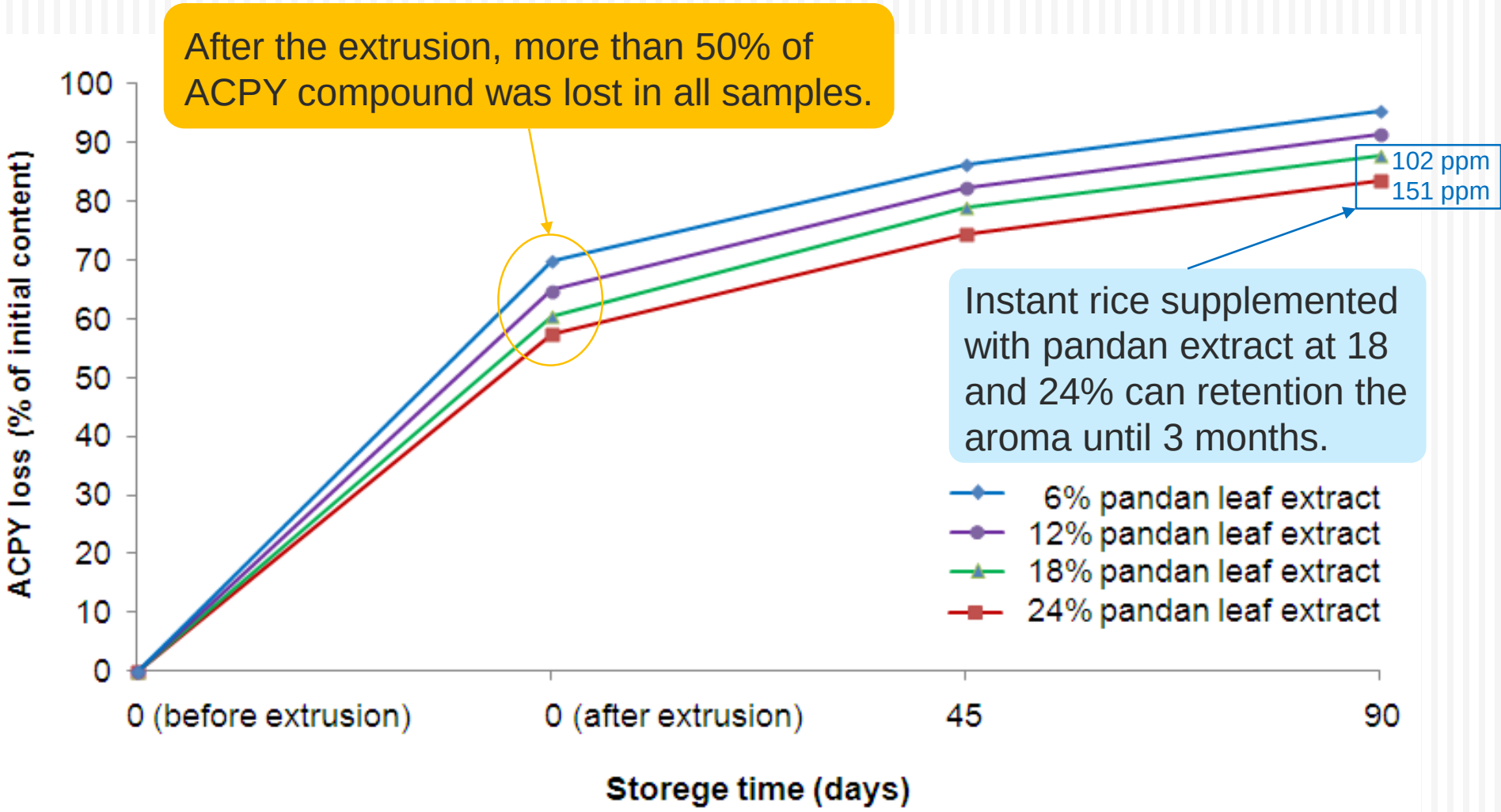
ACPY Retention time = 5.33 min

2. Aroma Sensory Measurement

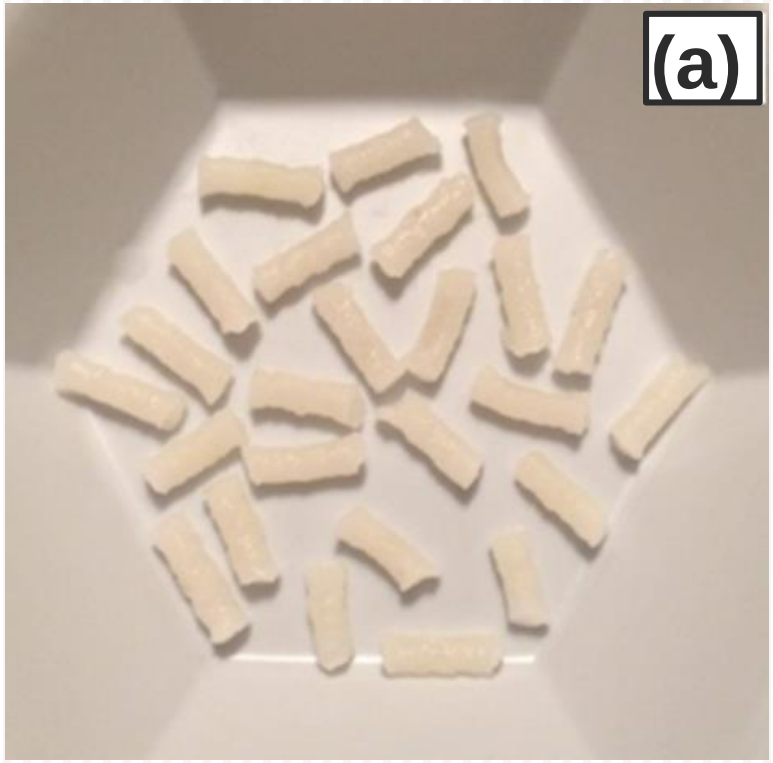


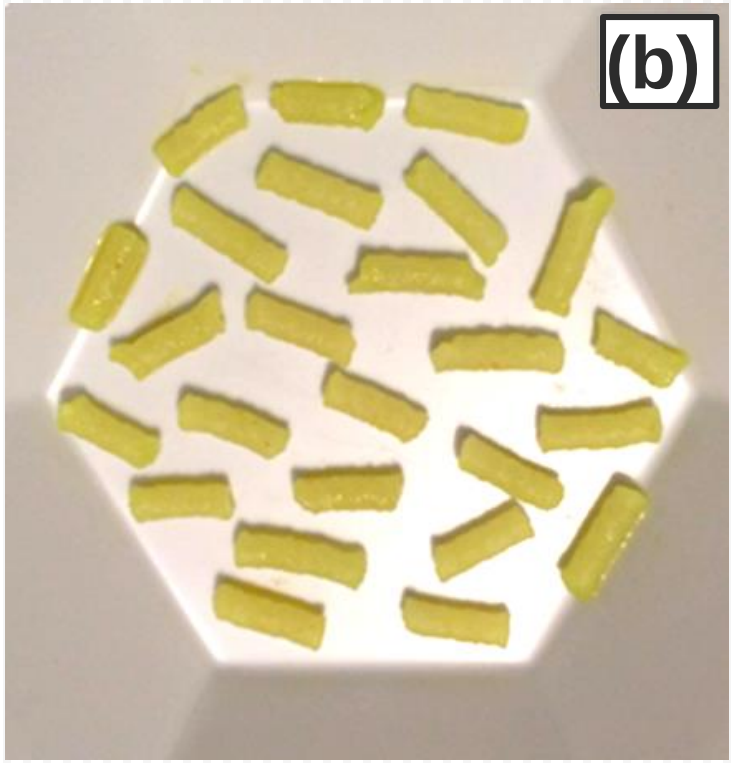
Pandan (%)	0 day				45 days			90 days
	1	10	10^2	10^3	1	10	10^2	1
6	✓							
12	✓	✓			✓			
18	✓	✓	✓		✓	✓		✓
24	✓	✓	✓	✓	✓	✓	✓	✓

THE ACPY LOSS DURING STORAGE OF EXTRUDED INSTANT RICE



APPEARANCE OF PANDAN LEAF EXTRACT SUPPLEMENTED INSTANT RICE





(a) extruded instant rice
(b) extruded instant rice supplemented with 24% pandan leaf extract

CONCLUSIONS

- Extrusion process condition, feed moisture content of 30%, screw speed of 70 rpm and a barrel temperature of 80:90:120°C produced the highest quality instant rice.
- The suitable mixed flour, rice flour blend with tapioca starch (90:10), was added with monoglyceride 1% and gum arabic 2%.
- Extruded instant rice supplemented with pandan leaf extract at 18 and 24% can retention the aroma until 3 months.

Recommendations and further study

- Study on packaging and storage conditions

ACKNOWLEDGMENTS

This research was supported by

Thailand Research Fund

Ampol Food Processing Co., Ltd.

Research and Researchers for Industries
(Student ID RRi - PHD56I0061)

King Mongkut's University of Technology North Bangkok

Thank You for Your Attention