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PRODUCTION OF EXTRUDED INSTANT RICE SUPPLEMENTED WITH AROMATIC PANDAN LEAF EXTRACT

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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



Hot water



5 minutes



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

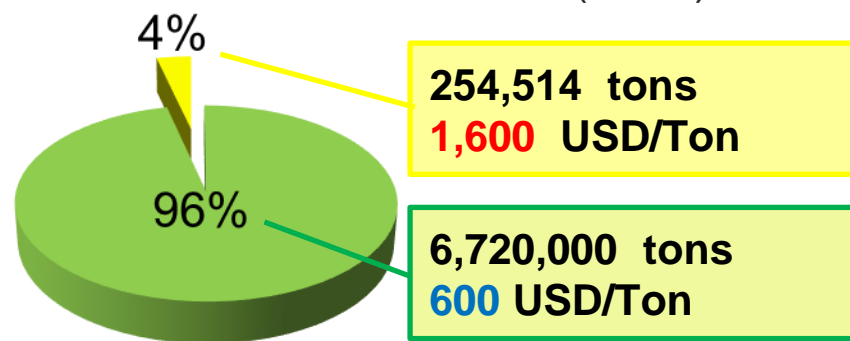
Top 5 rice exporters 2016

| 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)

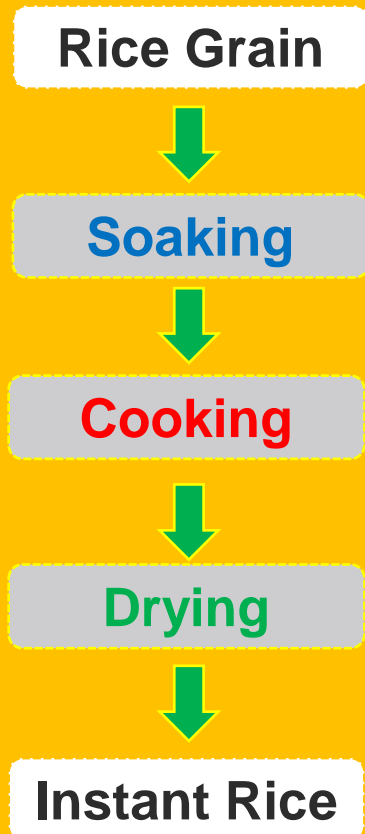
Thailand is one of the leader rice exporters
Thai jasmine rice is the most popular rice

■ Rice grains ■ Rice Products (2014)

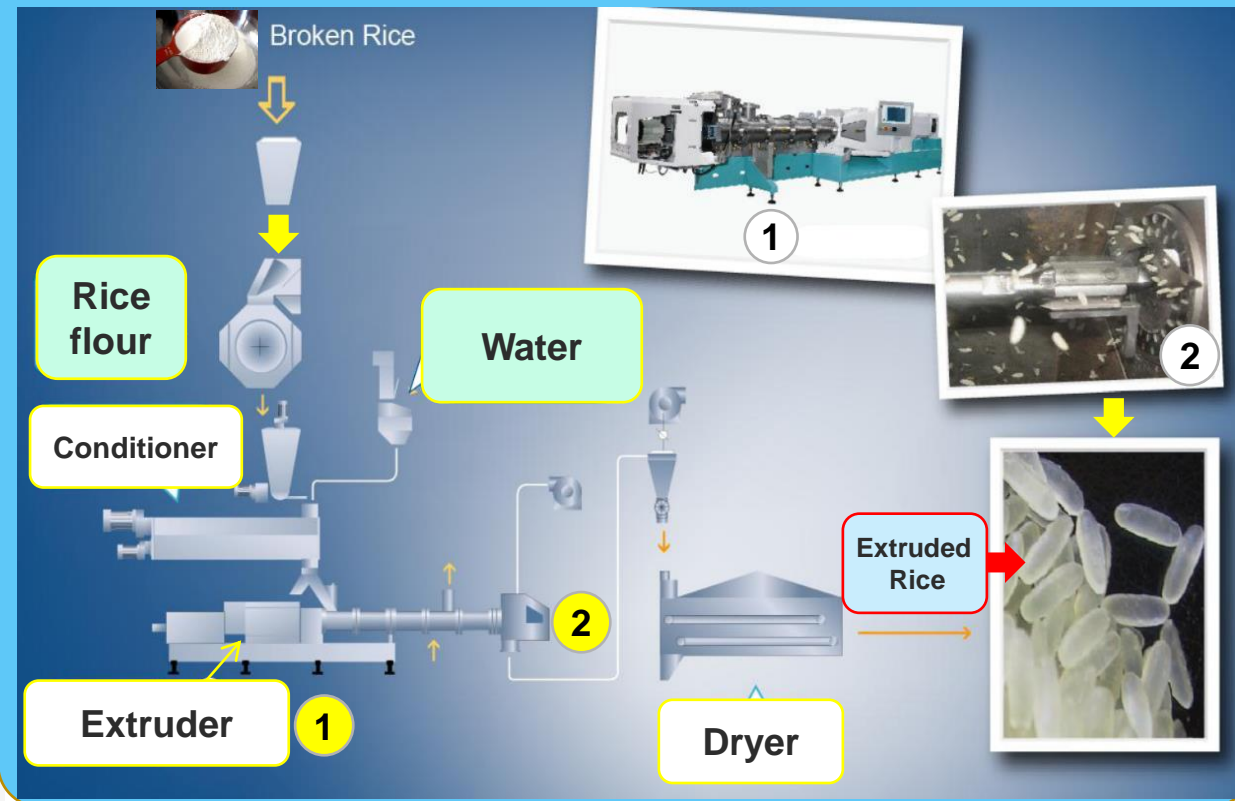


THE METHODS OF PRODUCING INSTANT RICE

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



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)



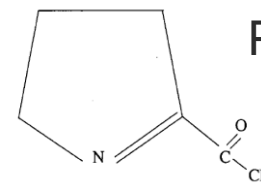
Thai Jasmine Rice



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
Supported 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
Supported by Food and Agro-Industry Research Center, KMUTNB (Thailand)

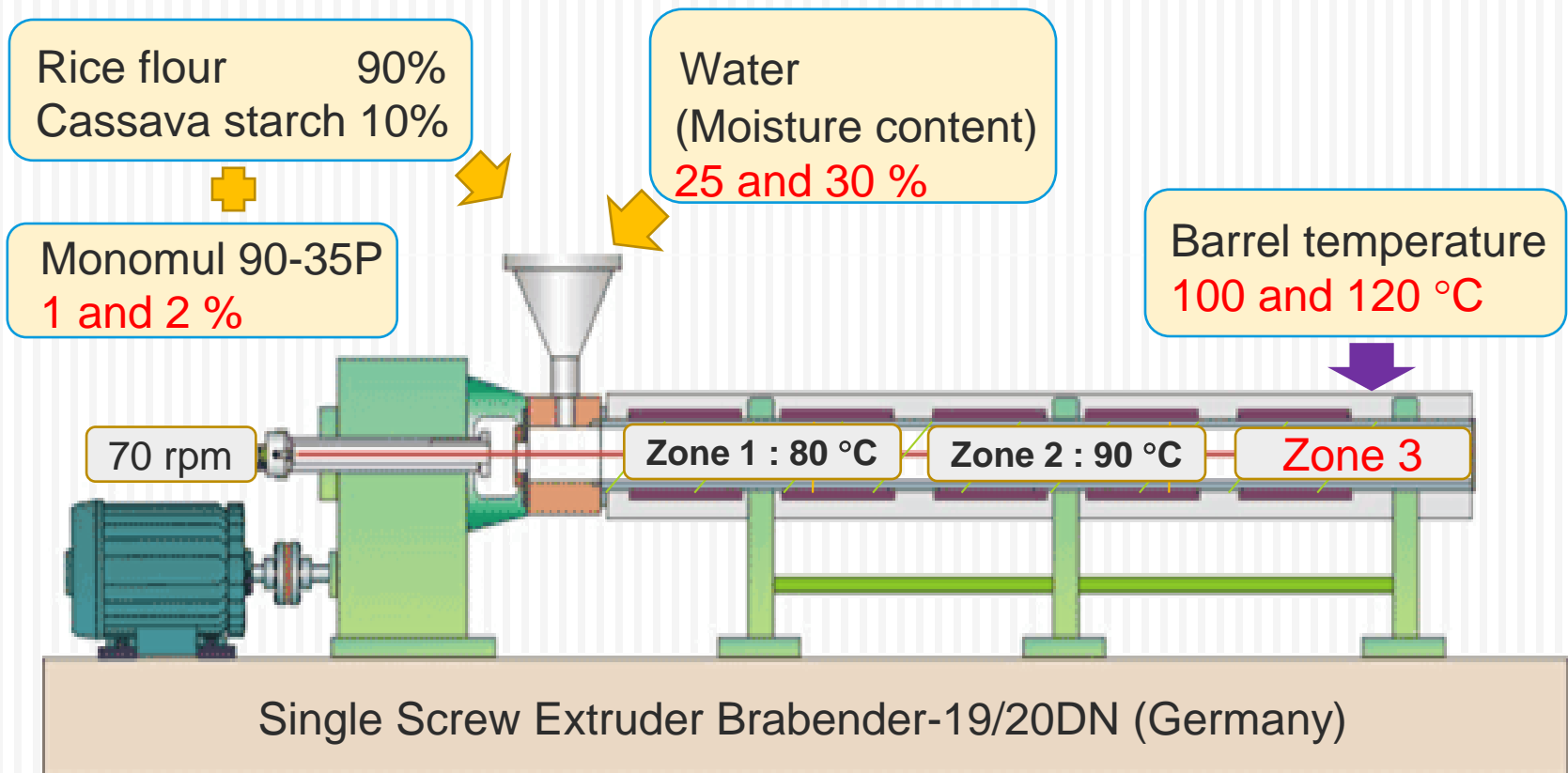
Equipment

- 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.



PHYSICAL PROPERTIES OF EXTRUDED INSTANT RICE

| Moisture content (%) | Barrel temperature (°C) | Monomul 90-35P (%) | Volume expansion | Density (g/cm ³) | 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 |

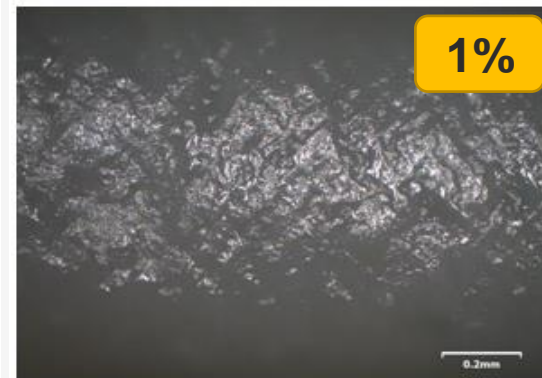
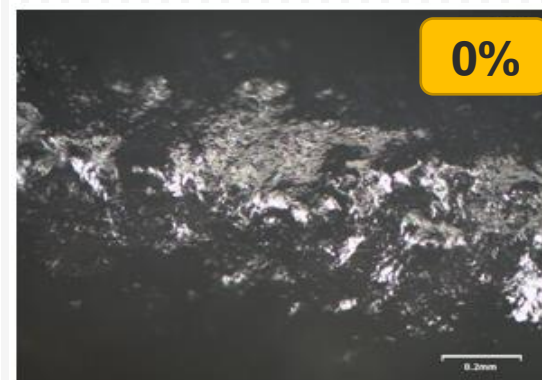
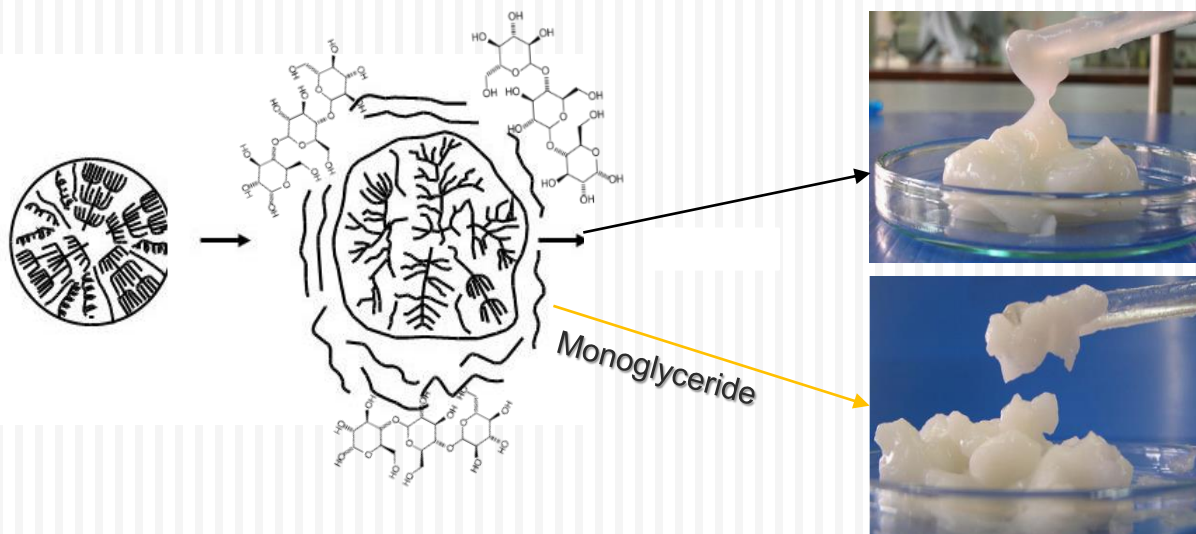
At higher moisture content : Volume expansion ↓ Density and Hardness ↑

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

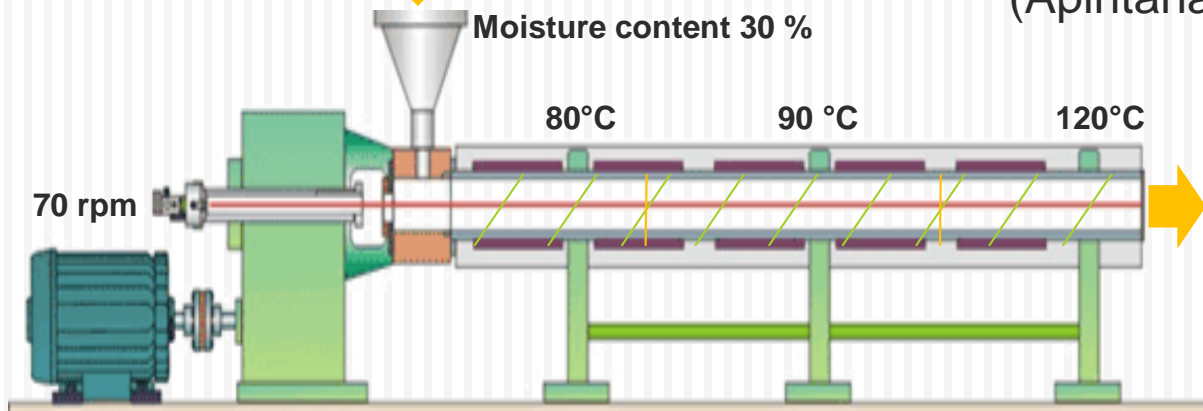
Improve the textural properties and aroma retention

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)

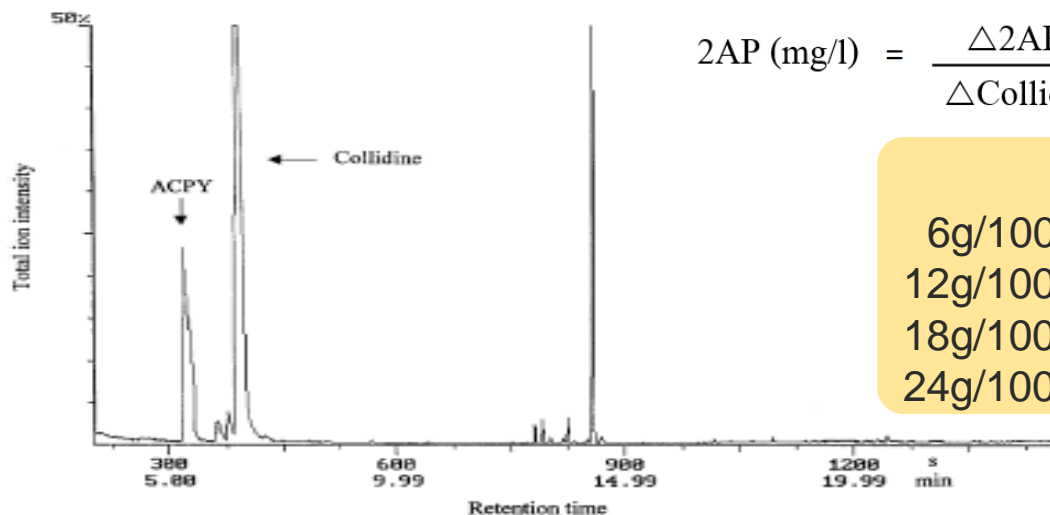


The extruded instant rice was dried by hot air dryer at 45°C for 4 h and kept in polyethylene bags until further analysis

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

1. Gas Chromatography

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

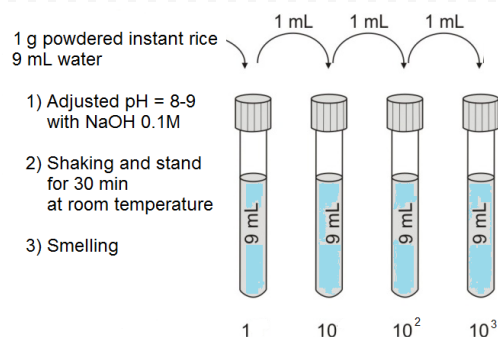


$$2AP \text{ (mg/l)} = \frac{\Delta 2AP}{\Delta \text{Collidine}} \times \frac{[\text{Collidine}]}{1000} \times \frac{1000}{100} \times 1.3$$

| | 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

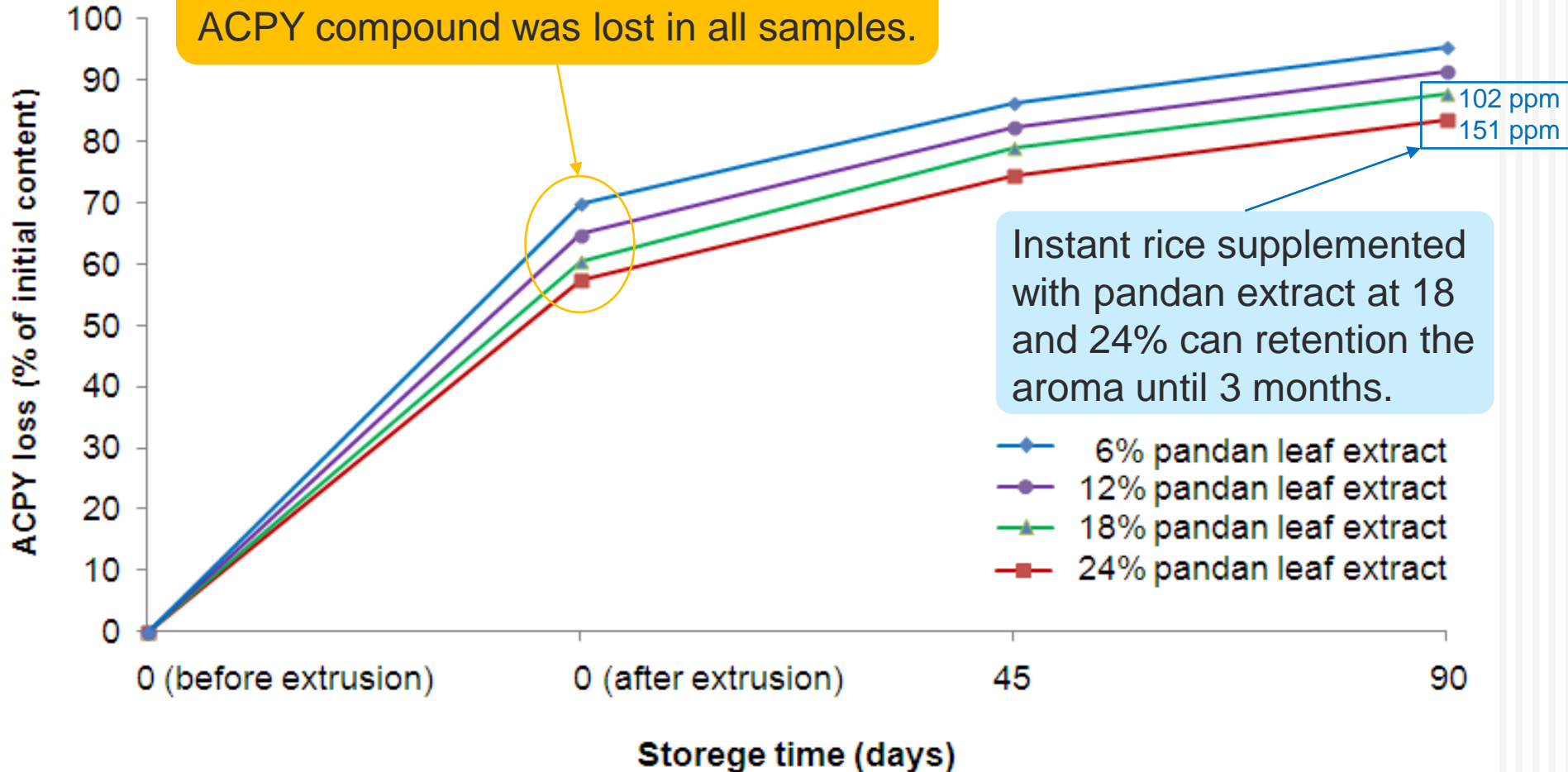
2. Aroma Sensory Measurement



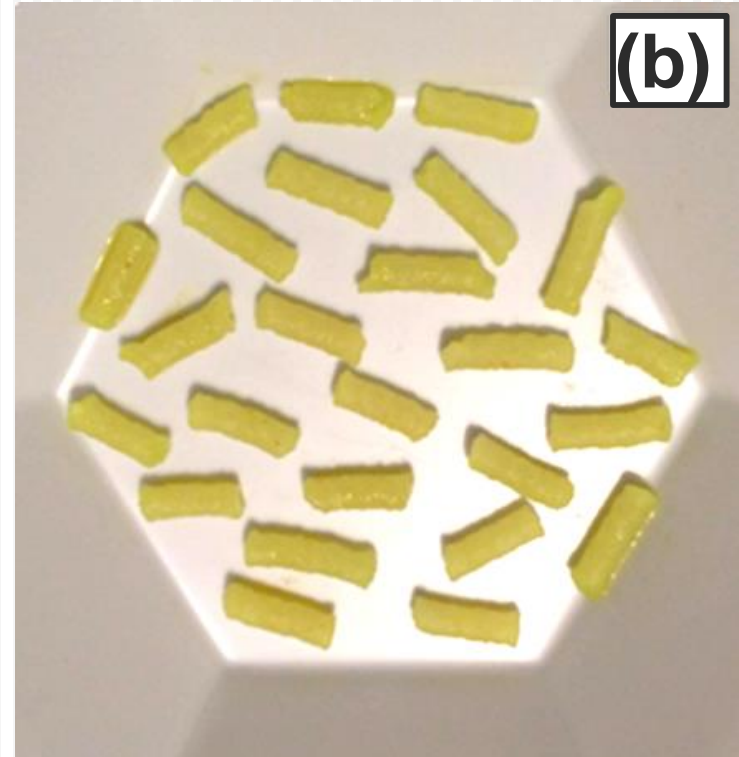
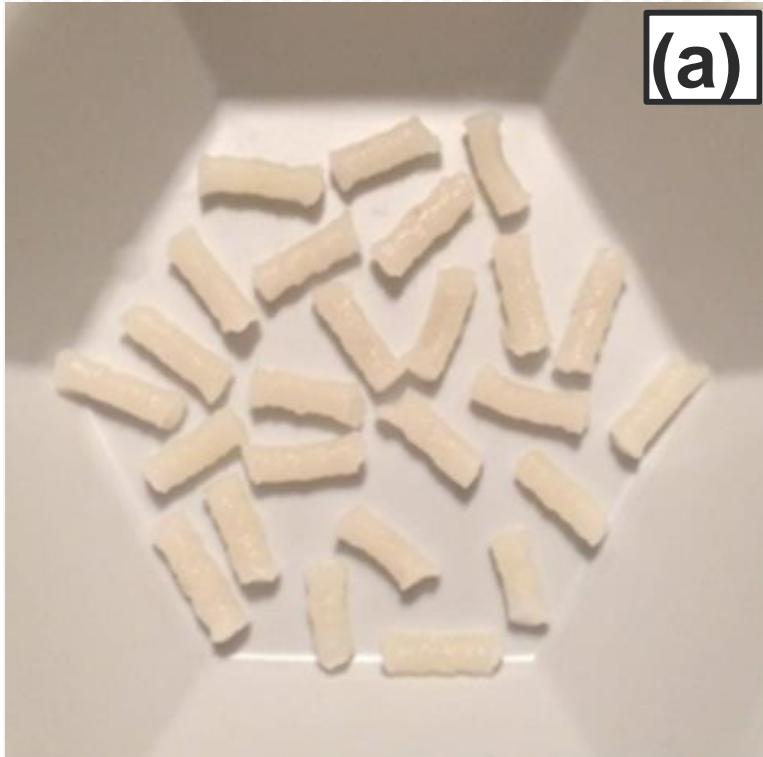
| Pandani (%) | 0 day | | | | 45 days | | | 90 days |
|-------------|-------|----|-----------------|-----------------|---------|----|-----------------|---------|
| | 1 | 10 | 10 ² | 10 ³ | 1 | 10 | 10 ² | 1 |
| 6 | ✓ | | | | | | | |
| 12 | ✓ | ✓ | | | ✓ | | | |
| 18 | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| 24 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

THE ACPY LOSS DURING STORAGE OF EXTRUDED INSTANT RICE

After the extrusion, more than 50% of ACPY compound was lost in all samples.



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

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Thank You for Your Attention
