

# EFFECT OF STERILITY ( $F_0$ ) VALUE AT DIFFERENT CANNING TEMPERATURES ON THE PHYSICAL PROPERTIES OF CANNED *GUDEG*

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**Bogor Agricultural University (Institut Pertanian Bogor)**  
**INDONESIA**

Track 12

Date: Monday, 9 September 2013

Time: 16:00 – 17:30

Venue: Topaz 220

Food Engineering (II)

Session Co-Chairs: Prof Bhesh Bhandari & Dr Yang Hongshun

FEN-O 2.1: 16:00 – 16:15

Effect of Sterility ( $F_0$ ) Value at Different Canning Temperatures on the Physical Properties of Canned Gudeg  
Prof Purwiyatno Hariyadi, Bogor Agricultural University, Indonesia

FEN-O 2.2: 16:15 – 16:30

Recovery Rate and Radical Scavenging Activity of Oleoresin from Ginger (*Zingiber officinale* Roscoe) Extracted with Supercritical CO<sub>2</sub>  
Dr Dang Quoc Tuan, Vietnam National University, Vietnam

FEN-O 2.3: 16:30 – 16:45

Ethylene Powder: Promising Alternative to Fruit Ripening and Food Safety  
Prof Bhesh Bhandari, University of Queensland, Australia

FEN-O 2.4: 16:45 – 17:00

Crystallisation Properties of Crude Palm Oil in Static and Dynamic Condition  
Dr Nur Wulandari, Bogor Agricultural University, Indonesia



## Abstracts

*Gudeg* is a traditional food from Yogyakarta and Central Jawa, Indonesia. The meal is made of young jackfruits (*Artocarpus heterophyllus*) cooked in a mixture of spices, palm sugar and coconut milk. Traditionally, *gudeg* is cooked for a long time and we have studied canning process for *gudeg* to shorten the cooking time, extent its shelflife and improve the overall convenience. This study specifically aims to evaluate the effect of sterility value ( $F_0$ ) with different time-temperature combination on the physical properties (hardness and color) and the preference score of the canned *gudeg*. *Gudeg* was prepared according to the traditional recipe with modification. Prepared young jackfruit cuts were canned and retorted at predetermined sterility ( $F_0$ ) values of 4, 12, 20, and 28 minutes at different retort temperatures of 111, 116, and 121°C. The hardness of the resulting canned *gudeg* was measured with a texture analyzer, whereas its color with a Minolta Chromameter. A sensory analysis was also conducted on the canned *gudeg*. Our study shows that increasing the  $F_0$ -values during processing causes softening of the *gudeg* as indicated by increased penetration depth from the penetrometer test. Increase in  $F_0$ -values is also associated with increase in the redness and decrease in the yellowness as well as the brightness of the canned *gudeg*. Processing at different retort temperatures of 111, 116 and 121°C with the same  $F_0$ -values, however, did not show any significant difference in color and texture. An  $F_0$ -value of 20 minutes obtained from a processing temperature of 121°C for 57.1 minutes provides the best canned *gudeg* as assessed by panel preference, texture and color. At the temperature range studied (111-121°C), the physical properties of canned *gudeg* are determined by the  $F_0$  values; regardless of retort temperatures.


## GUDEG ?

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- **Gudeg** : a traditional food from Yogyakarta and Central Jawa, Indonesia.
- The meal is made of **young jackfruits** (*Artocarpus heterophyllus*).
  - *Local name: Gori*
- Cooked in a mixture of spices, palm sugar and coconut milk.

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- **Gudeg** : Need a very long cooking time  
→ up to 12 hours
- Smooth texture of young jackfruits and unique flavor and color of cooked gudeg
- BUT ... It will not last long

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- **Gudeg** : Studies of canning technology for Gudeg have been done

↓

**To obtain specific objectives :**

- shorten the cooking time,
- extent its shelflife, and
- improve the overall convenience.

## GUDEG ?

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- **Canned Gudeg** : has been introduced to market

- Supported by works of the *Technical Implementation Unit for Development of Chemical Engineering Processes, Indonesian Institute of Sciences (UPT. BPPTK LIPI)*

## OBJECTIVES ?

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- To Study the effect of  $F_0$ -value on the quality (color, texture and other organoleptic properties) of Gudeg
- To study the effect of different combination of time-temperature (at the same  $F_0$ -value) on the quality (color, texture and other organoleptic properties) of Gudeg

## MATERIALS & METHOD ?

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### Materials for Gudeg Preparation:

Young Jack fruits, meat/beaf, mixed of spices, coconut milk, and salt

### Material for analysis

Aquadest, HCl,  $K_2SO_4$ , HgO,  $Na_2S_2O_3$ ,  $H_2SO_4$ ,  $H_3BO_3$ , HCl, NaOH, Etc

### Equipments for Analysis

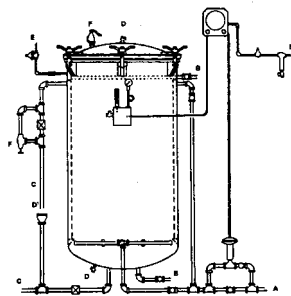
Penetrometer, analytical balance, *Chromameters*, glassware, etc

## MATERIALS & METHOD ?

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### Equipments for Processing :

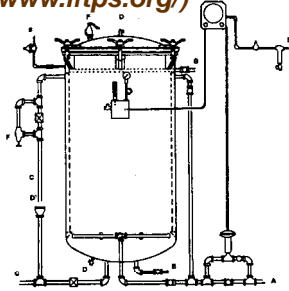
Vertical Retort, thermocouples, thermorecorder, thermometer, *blender*, etc



## MATERIALS & METHOD ?

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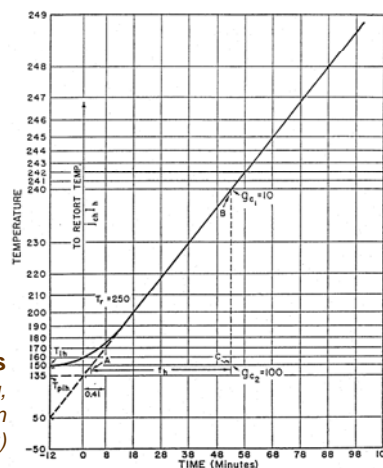
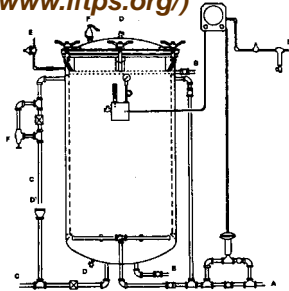
Retort operational procedure, retort heat distribution and determination of heat penetration curve were done according to standardized protocol (*Institute For Thermal Processing Specialists - IFTPS; www.iftps.org/*)



## MATERIALS & METHOD ?

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Retort operational procedure, retort heat distribution and determination of heat penetration curve were done according to standardized protocol (*Institute For Thermal Processing Specialists - IFTPS; www.iftps.org/*)



**Determination of  $f_h$  and  $J_h$  - values**  
(Lopez, A. 1981. *A Complete Course of Canning*, 11<sup>th</sup> editions, Book 1-Basic Information on Canning)

## MATERIALS & METHOD ?

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### Time (t)-Temperature (T) Combination?

T <sub>r</sub> (°C)	Target F <sub>0</sub> (min)	Calculated*) t <sub>b</sub> (minutes)	Calculated**) t <sub>p</sub> (minutes)
111	4	88.5	81.3
	12	174.7	167.5
	20	253.9	246.8
	28	332.3	325.2
116	4	62.5	54.9
	12	91.5	84.0
	20	117.7	110.1
	28	144.9	137.4
121	4	38.0	30.0
	12	52.6	44.7
	20	65.1	57.1
	28	73.6	65.6

\*) Ball processing time; determined by Ball's formula (Lopez, A. 1981. *A Complete Course of Canning, 11<sup>th</sup> editions, Book 1-Basic Information on Canning*)

\*\*) Operator processing time, (Tb – 0,6 CUT)

## RESULTS & DISCUSSIONS?

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### Preparation of Canned Gudeg

```

    graph TD
      A[Preparation: Jackfruits, meat, spices] --> B[Can filling]
      B --> C[Exhausting 85°C, 10 min]
      C --> D[Can closing]
      D --> E[Sterilization (T, t)]
      E --> F[Cooling]
      F --> G([Canned Gudeg])
    
```

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## RESULTS & DISCUSSIONS?

### Preparation of Canned Gudeg

Preparation:  
Jackfruits, meat, spices

- We have established canning process for gudeg to produced canned gudeg **similar/comparable** to that of traditionally prepared/cooked gudeg
- pH=5.68 and  $a_w = 0.934$   
 → *potentially hazardous food (PHF)*.



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## RESULTS & DISCUSSIONS?

Organoleptic Properties	GUDEG	
	Traditionally Prepared/Cooked	Canned
Taste/flavor	<ul style="list-style-type: none"> <li>• Sweet, having characteristic unique of gudeg taste</li> </ul>	<ul style="list-style-type: none"> <li>• Sweet, having characteristic unique of gudeg taste</li> </ul>
Color	<ul style="list-style-type: none"> <li>• Dark brown</li> </ul>	<ul style="list-style-type: none"> <li>• Lighter dark brown</li> </ul>
Texture	<ul style="list-style-type: none"> <li>• Mussy, tender, easy to cut</li> </ul>	<ul style="list-style-type: none"> <li>• Solid, tender, easy to cut</li> </ul>




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Appearance	GUDEG	
	Traditionally Prepared/Cooked	Canned
		

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**APPEARANCE**




$F_0$ -value  
= 4 min



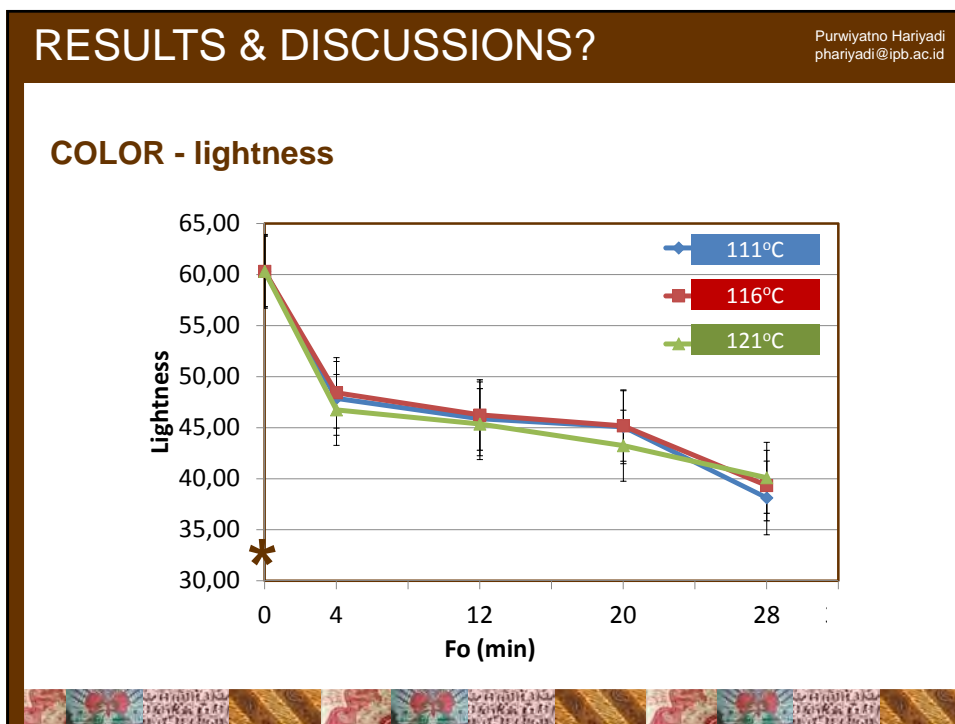
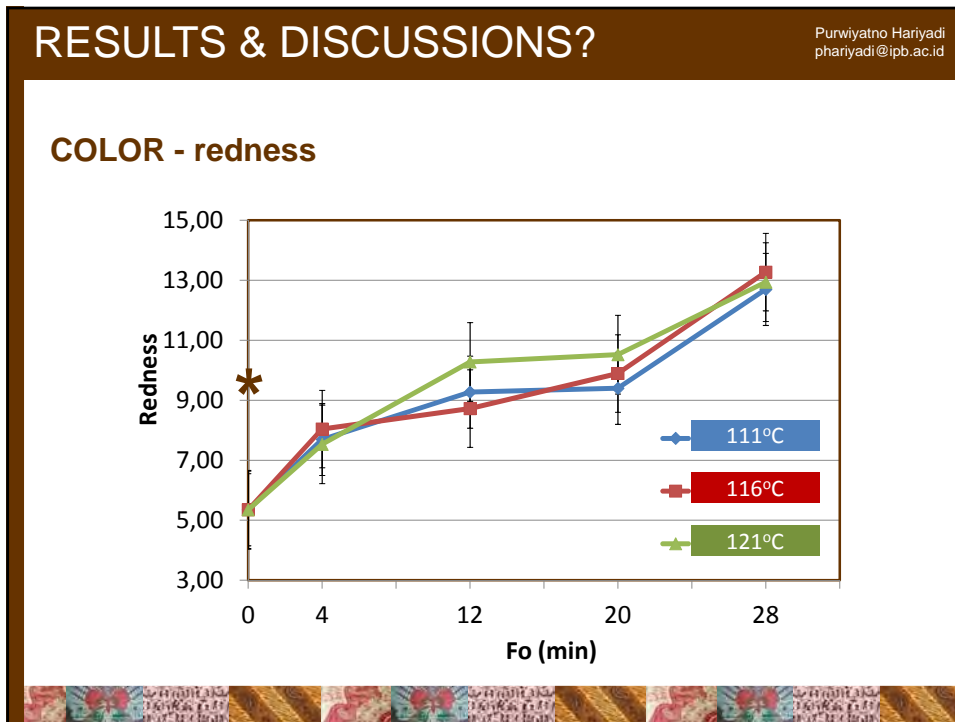
$F_0$ -value  
= 12 min

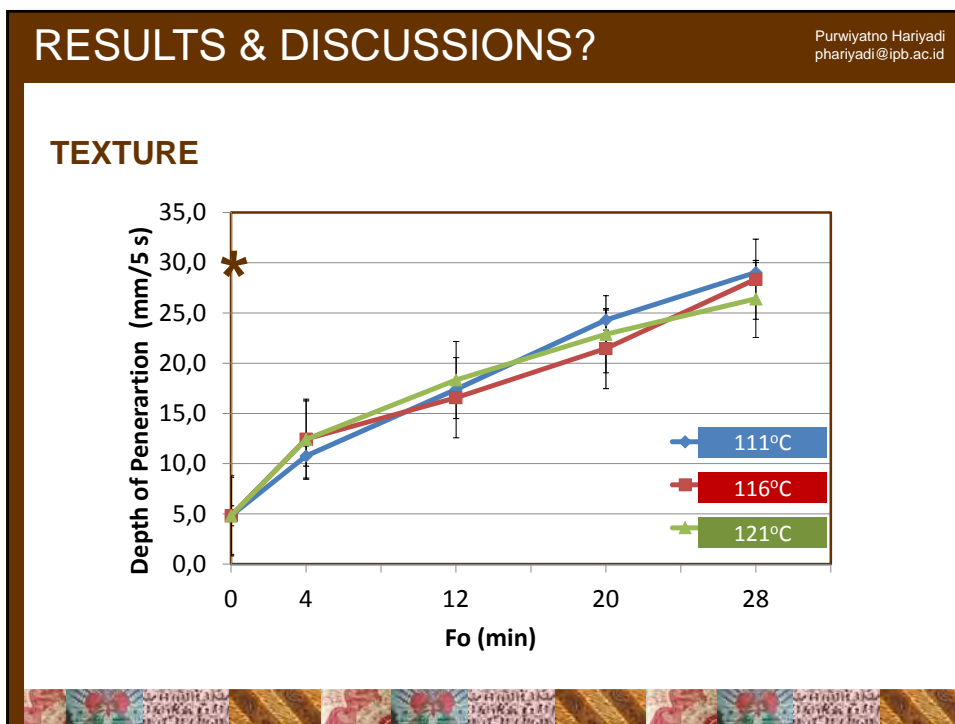
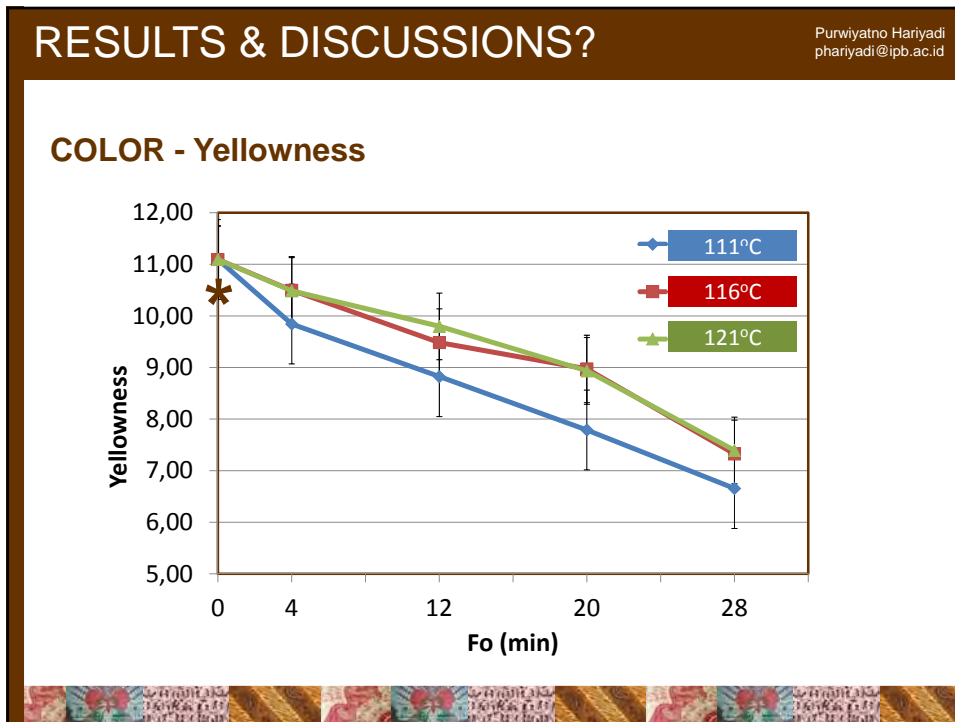


$F_0$ -value  
= 20 min



$F_0$ -value  
= 28 min





## RESULTS & DISCUSSIONS?

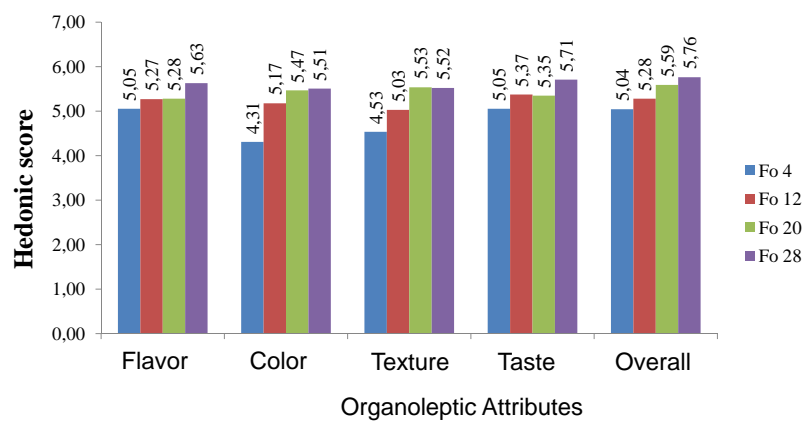
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- A sensory analysis was also conducted on the canned *gudeg*, processed at 121°C, with F<sub>0</sub>-value of 4, 12, 20, 28 minutes
- Conducted by 75 intrained panelists

## RESULTS & DISCUSSIONS?

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Panelis Score (Hedonic score)



## RESULTS & DISCUSSIONS?

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### Duncan Test

Quality atributes	F <sub>0</sub> =4	F <sub>0</sub> =12	F <sub>0</sub> =20	F <sub>0</sub> =28
Color		√	√	√
Flavor	√	√	√	√
Texture			√	√
Taste	√	√	√	√
Overall	√	√	√	√
“Selected products”			√	

## CONCLUSIONS?

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1. We have established canning procedure for gudeg
2. At the temperature range studied (111-121°C), the physical properties of canned gudeg are determined by the F<sub>0</sub> values; regardless of retort temperatures.
3. A canned gudeg with F<sub>0</sub>-value of 20 minutes (obtained from a procesing temperature of 121°C for 57.1 minutes) provides the best canned gudeg as assessed by panel preference, texture and color.

## CONCLUSIONS?

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### 4. Nutritional composition of the selected Canned Gudeg (per 100 g)

Nutrients	Amount
Water (g)	75.40 ± 0.27
Ash (g)	1.55 ± 0.01
Fat (g)	5.68 ± 0.00
Protein (g)	0.83 ± 0.01
Carbohydrate (g)	16.54 ± 0.28
Fiber (g)	1.97 ± 0.01

## THANK YOU

**THANK YOU ... TERIMA KASIH**  
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