Beyond 2015: Harnessing New Technologies for Sustainable and Safe Food Supply for the ASEAN Community

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Beyond 2015: Harnessing New Technologies for Sustainable and Safe Food Supply for the ASEAN Community

Points to be discussed :

- ASEAN Community? Beyond 2015?
- Sustainable and Safe Food Supply?
- New Technology?

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- **Association of Southeast Asian Nations (ASEAN)**
  - Formed on August 8, 1967
    - Indonesia, Malaysia, Philippines, Singapore & Thailand

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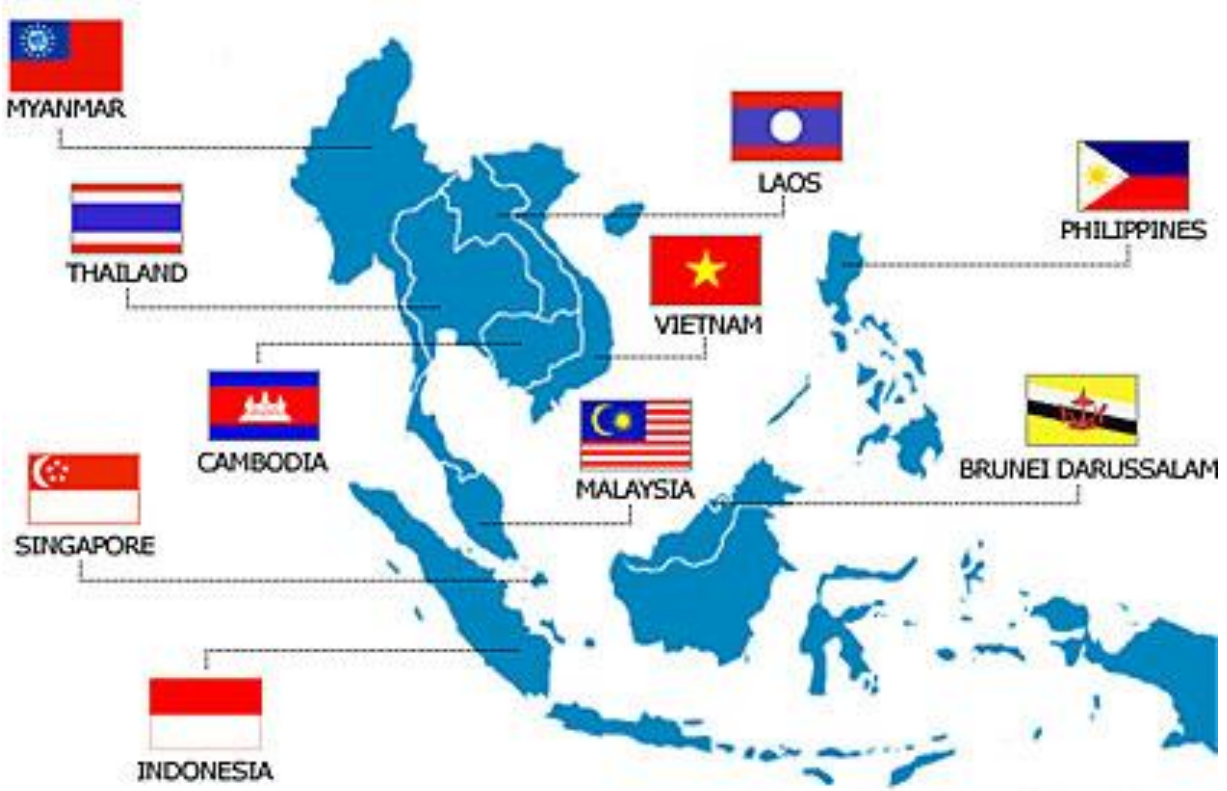
- **Association of Southeast Asian Nations (ASEAN)**
  - Now : Total of 10 Countries
    - Indonesia, Malaysia, Philippines, Singapore & Thailand
    - Brunei Darussalam, Vietnam, Laos, Myanmar & Cambodia



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- **Association of Southeast Asian Nations (ASEAN)**
  - The ASEAN Vision 2020:

    "*The ASEAN Economic Community (AEC) shall establish ASEAN as* ***single market and production base***"

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- **Association of Southeast Asian Nations (ASEAN)**
  - **ASEAN Summit, Singapore 2007:**
    Target of Economic Integration : 2015

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- Economies of its member nation is completely integrated.

→ **Single Market and Production Base**

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• Association of Southeast Asian Nations (ASEAN)

• ASEAN Summit, Singapore 2007:

Target of Economic Integration : 2015

2015

Priority sectors for Integration :

1. Agro-based goods,
2. Air transport,
3. Automotive products,
4. eASEAN (including ICT equipment),
5. Electronics goods,
6. Fisheries,
7. Health care products,
8. Rubberbased goods,
9. Textiles and clothing,
10. Tourism, and
11. Wood-based products.

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→ **Our FOCUS today :**

2015

Priority sectors for Integration :

1. **Agro-based goods,**
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11. **Wood-based products.**

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    Target of Economic Integration : 2015

→ Our FOCUS today :

Beyond 2015:

How will AEC affect sustainability & safety of food supply

?

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Food Supply is a Key Element of Food Security

The FAO definition of food security
World Food Summit of 1996:

Food security exists when all people, at all times, have physical and economic access to sufficient, ***SAFE*** and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

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Food Security and AEC?

AEC

- ASEAN Integrated Food Security (AIFS) Framework;
- Strategic Plan of Action on ASEAN Food Security (SPA-FS);
- ASEAN Multi-Sectoral Framework on Climate Change (AFCC);
- Sustainable Forest Management; Forest Law Enforcement and Governance (FLEG)

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Food Security and AEC?

ASEAN Integrated Food Security Framework:

Goal – To ensure long-term (sustainable) food security and to improve the livelihoods of farmers in the ASEAN region.

Objectives:

- To increase food production
- To reduce post-harvest losses
- To promote conducive market and trade
- To ensure food stability
- To operationalise regional food emergency relief arrangements

Harnessing new Technology to
To Meet the Objectives ?

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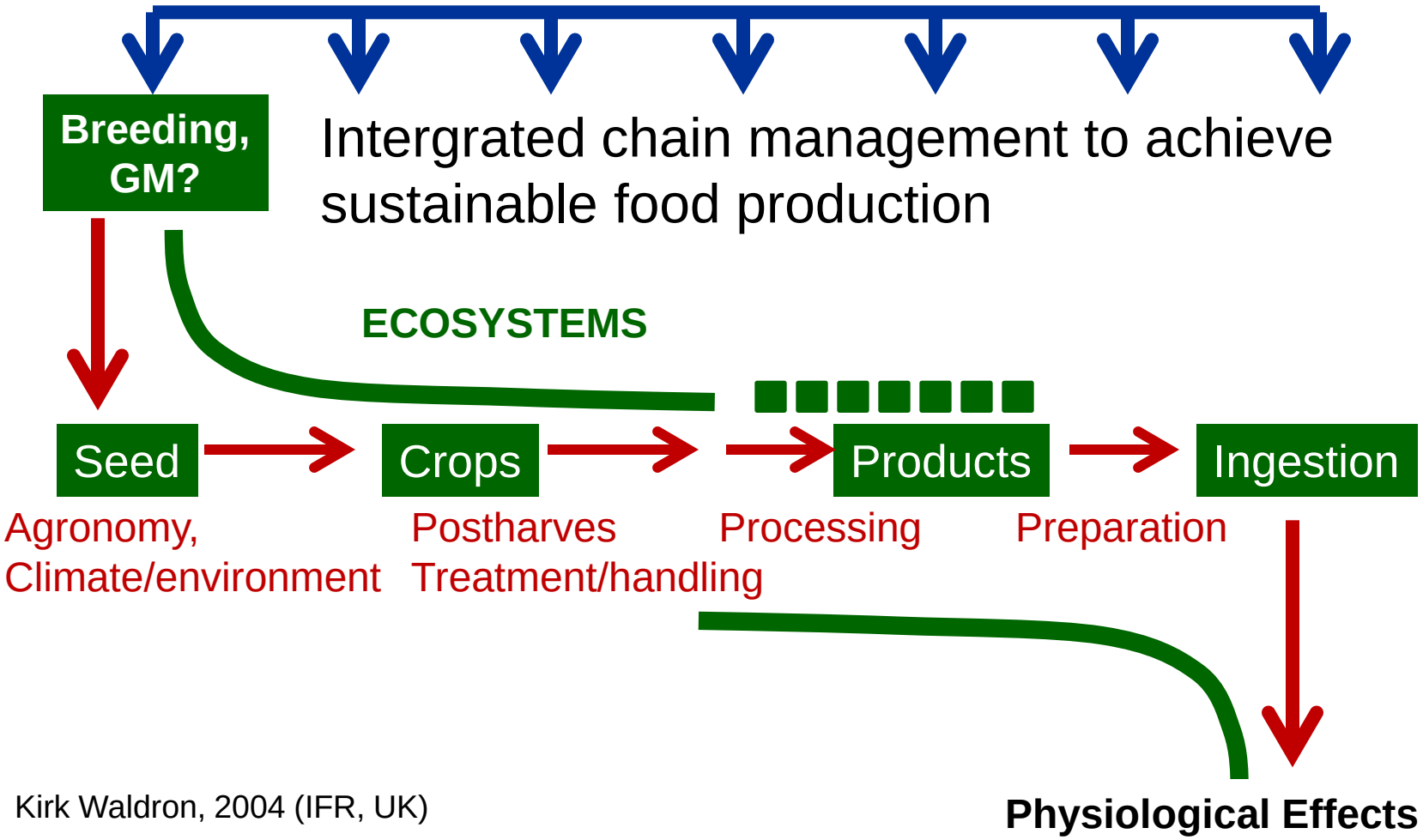
Harnessing New Technology?
Sustainable food Production



Kirk Waldron, 2004 (IFR, UK)

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Harnessing New Technology?
Sustainable food Production

"Sustainability is a path of continuous improvement, wherein the products and services required by society are delivered with progressively less negative impact upon the Earth"

Schuster, D. 2008
(Institute for Sustainability)

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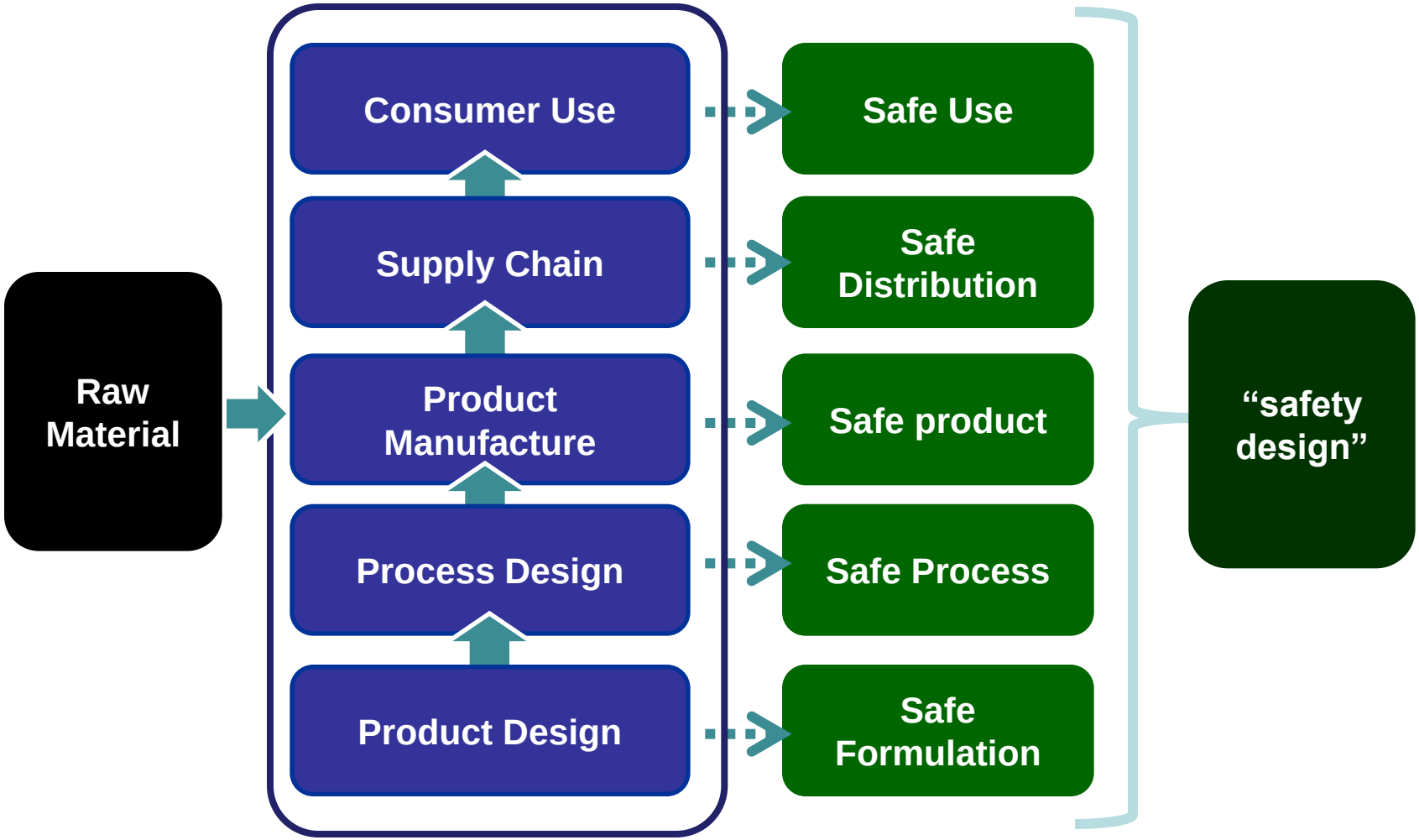
Harnessing New Technology?
Safe food Production



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Harnessing New Technology?

Alternative-Emerging Food Processing Technologies
(FDA/IFT 2000)
http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm

- Microwave and Radio Frequency
- Ohmic and Inductive Heating
- High Pressure Processing
- Pulsed Electric Field
- High Voltage Arc Discharge
- Pulsed Light
- Ultraviolet Light
- Ultrasound
- X-Rays

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- X-Rays

Food Packaging
Food Irradiation
Biotechnology
Omic-Technologies: Nutrigenomic
Nano-Technology
Ingredient Technology
...

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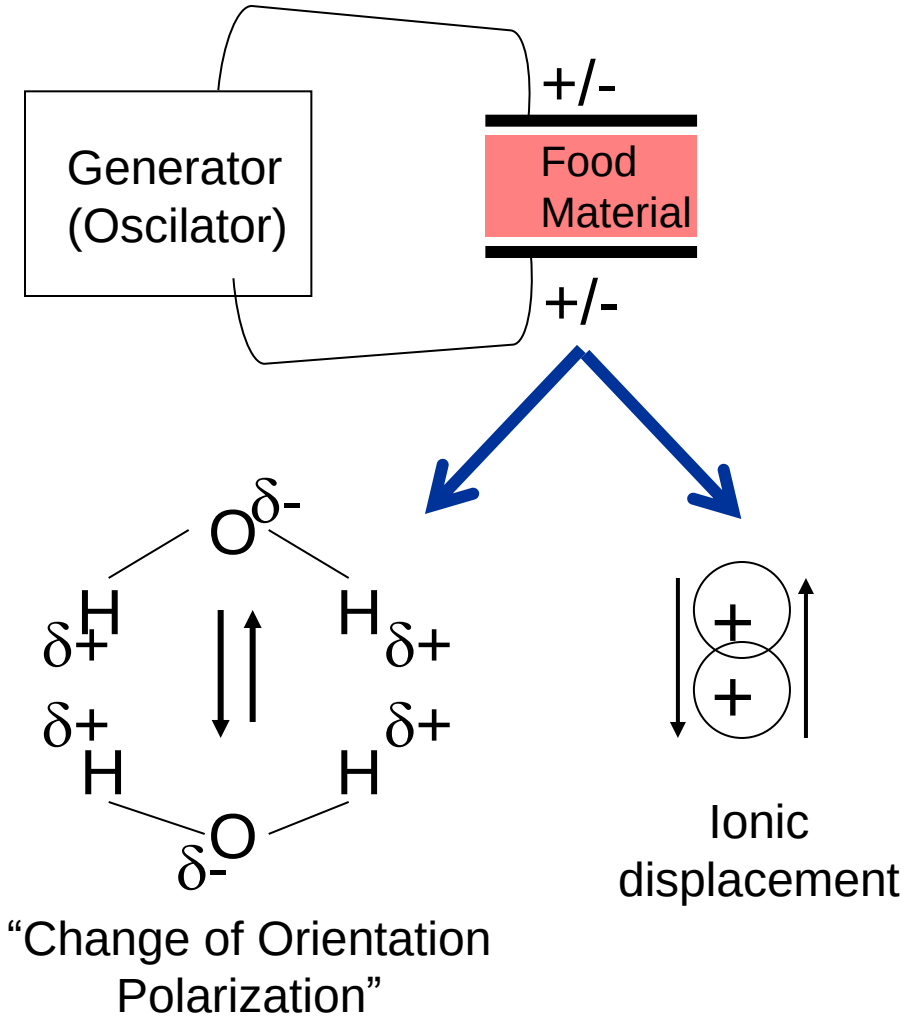
Harnessing New Technology?

Equivalence of alternative technologies

Questions of Interest
Process Description?
Mechanism of Activation?
Critical Factors and Quantification?
Process deviations?
Organizms of concern?
Indicator organizms ?
Main reseacrh need ?



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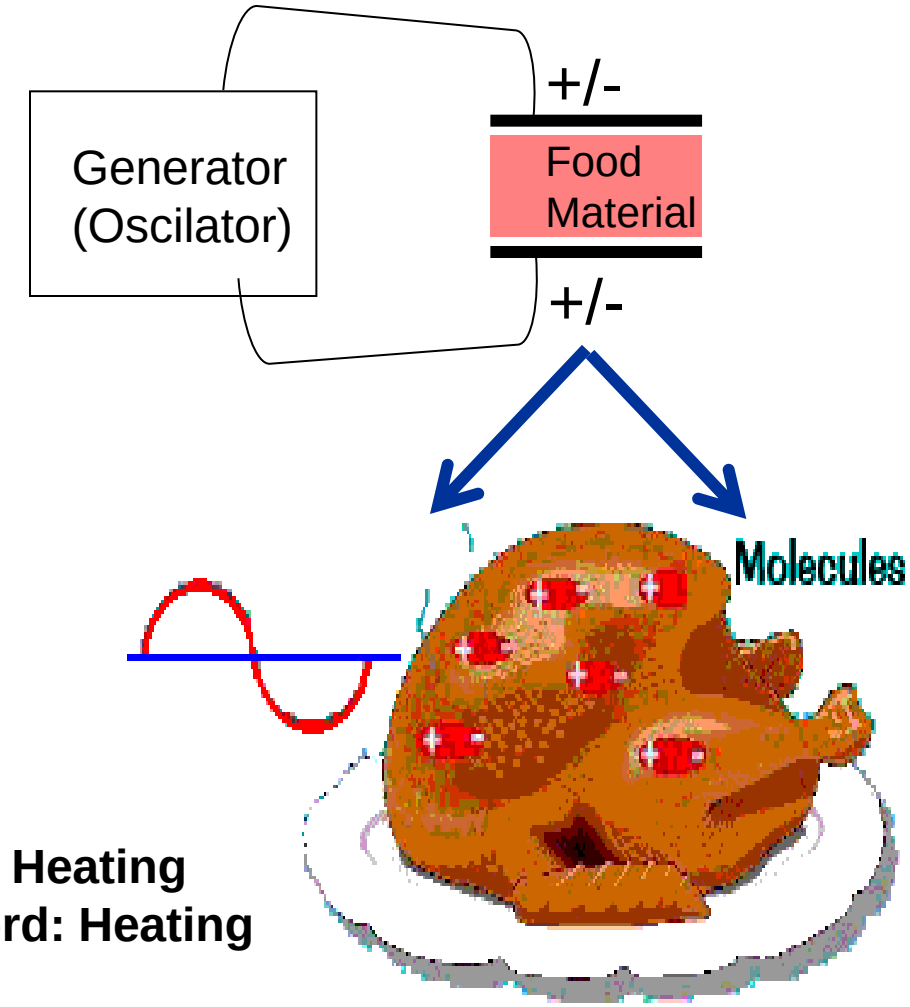

Internal Heating
- keyword: Heating

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Harnessing New Technology?

Equivalence of alternative technologies

Questions of Interest	Technology	
	Microwave	
Process Description?	Well described	
Mechanism of Activation?	Well described	
Critical Factors and Quantification?	Well described Hard to predict cold zone	
Process deviations?	As in conventional thermal processing	
Organizms of concern?	As in conventional thermal processing	
Indicator organizms ?	As in conventional thermal processing	
Main reseacrh need ?	Prediction of cold zone and Uniformity of heating	

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Harnessing New Technology?

Equivalence of alternative technologies

Questions of Interest	Technology	
	Microwave	Ohmic Heating
Process Description?	Well described	Well described
Mechanism of Activation?	Well described	Well described
Critical Factors and Quantification?	Well described Hard to predict cold zone	Well described Hard to predict cold zone
Process deviations?	As in conventional thermal processing	As in conventional thermal processing
Organizms of concern?	As in conventional thermal processing	As in conventional thermal processing
Indicator organizms ?	As in conventional thermal processing	As in conventional thermal processing
Main reseacrh need ?	Prediction of cold zone and Uniformity of heating	Prediction of cold zone

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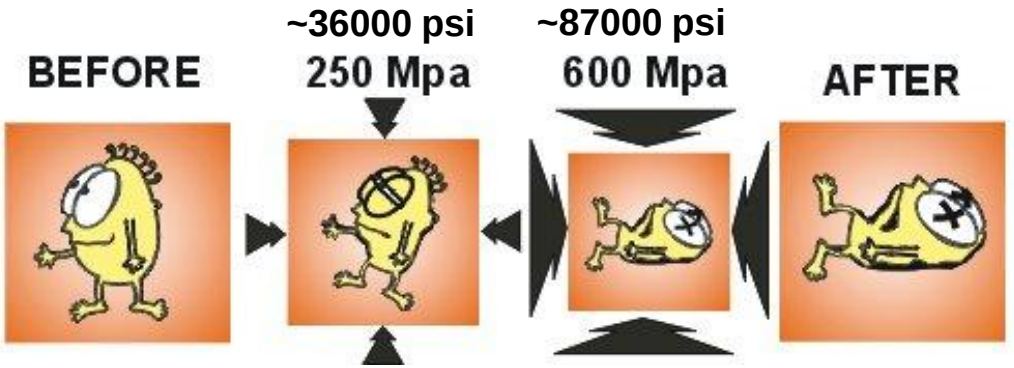
Harnessing New Technology?

Equivalence of alternative technologies

Questions of Interest
Process Description?
Mechanism of Activation?
Critical Factors and Quantification?
Process deviations?
Organizms of concern?
Indicator organizms ?
Main reseacrh need ?

Technology of High Hydrostatic Pressure



- High Pressure can kill microorganisms by interrupting with their cellular function without the use of heat that can damage the taste, texture, and nutritional value of the food.

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Harnessing New Technology?

Equivalence of alternative technologies

Questions of Interest	Technology of High Hydrostatic Pressure
Process Description?	Well described
Mechanism of Activation?	Well described
Critical Factors and Quantification?	Well described Proposed Models
Process deviations?	Well described
Organizms of concern?	Identified
Indicator organizms ?	Suggested
Main reseacrh need ?	Validation kinetics Influence of synergistic processing conditions

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Harnessing New Technology?

Equivalence of alternative technologies

Technology of High Hydrostatic Pressure

Fruit Juice treated by HHP

- Incativate food pathogens (*salmonella* and *E.coli* 0157:H7)
- Preserve the fruit juice's fresh, natural characteristics.
- HHP of 80,000 psi for 30 seconds → a 3-5 log reduction of all of the pathogens of concern in fresh juice

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Harnessing New Technology?

Equivalence of alternative technologies

Technology of High Hydrostatic Pressure

Oyster treated by HHP

- Another example of food safety is the destruction of *Vibrio* bacteria in raw oysters without destroying the raw feel and taste of the oyster.
- A pressure of 200 to 300 MPa for 5 to 15 minutes at 25C inactivated :
  - *Vibrio parahaemolyticus* ATCC 17803,
  - *Vibrio vulnificus* ATCC 27562,
  - *Vibrio choleare* ATCC 14035,
  - *Vibrio choleare* non-O:1 ATCC 14547,
  - *Vibrio hollisae* ATCC 33564
  - *Vibrio mimicus* ATCC 33653

("D. Berlin, D. Herson, D. Hicks, and D. Hoover; Applied and Environmental Microbiology, June 1999“)

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Harnessing New Technology?

Equivalence of alternative technologies

Technology of High Hydrostatic Pressure

Oyster treated by HHP

Destroys the vibrio in shellfish

Detaches the meat from the shell

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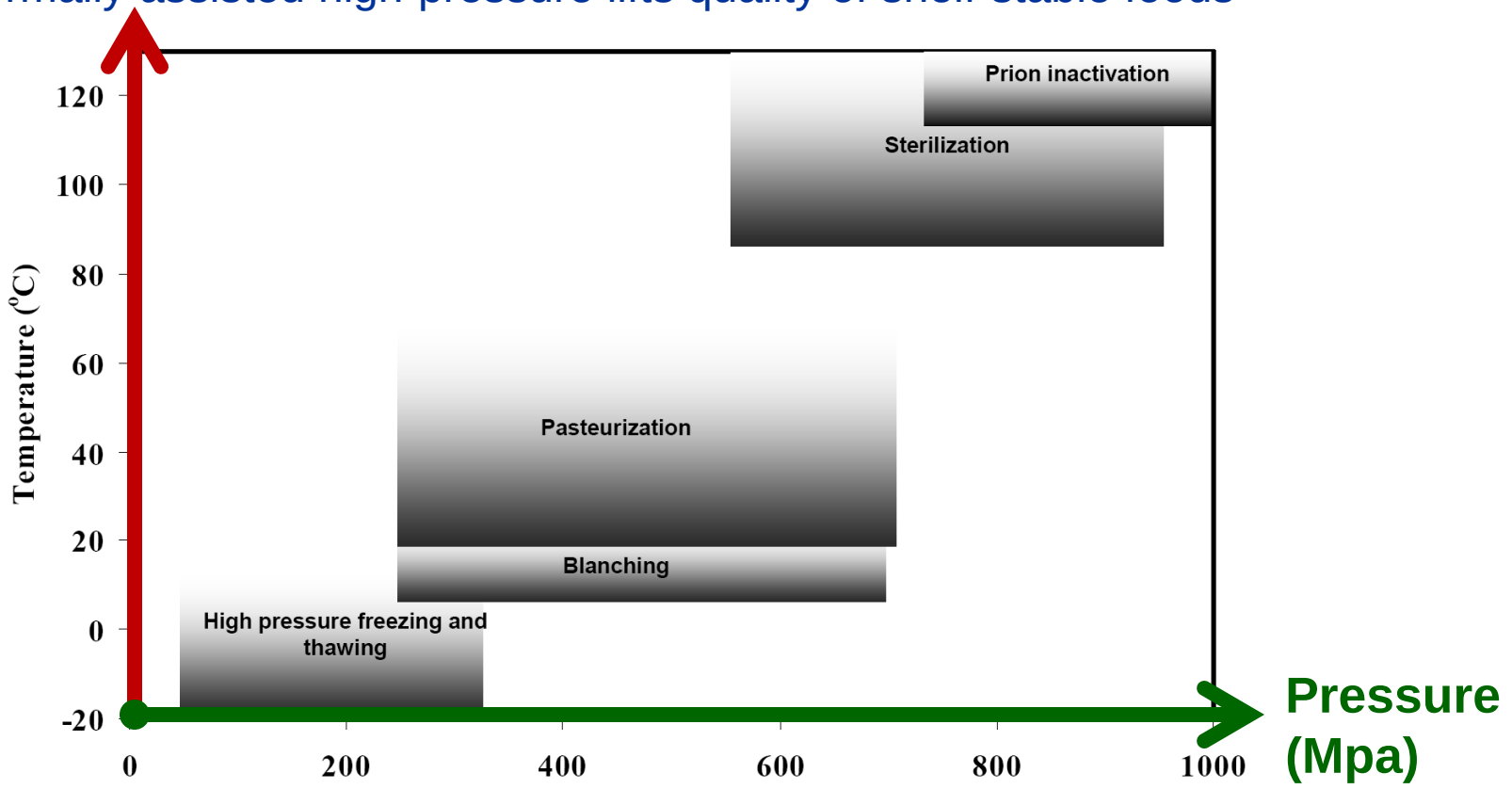
Harnessing New Technology?

Equivalence of alternative technologies

Technology of High Hydrostatic Pressure

Thermally-assisted high-pressure lifts quality of shelf-stable foods



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Harnessing New Technology?

Equivalence of alternative technologies

Technology of High Hydrostatic Pressure

Ultra-high-pressure inactivation of prion infectivity in processed meat: A practical method to prevent human infection

Paul Brown*†, Richard Meyer‡, Franco Cardone§, and Maurizio Pocchiari§

*National Institutes of Health, Bethesda, MD 20892; ‡Washington Farms, Tacoma, WA 98443; and §Istituto Superiore di Sanità, 00161 Rome, Italy

Communicated by Ralph M. Garruto, State University of New York, Binghamton, NY, March 28, 2003 (received for review March 1, 2003)

Bovine spongiform encephalopathy contamination of the human food chain most likely resulted from nervous system tissue in mechanically recovered meat used in the manufacture of processed meats. We spiked hot dogs with 263K hamster-adapted scrapie brain (10% wt/wt) to produce an infectivity level of ≈9 $\log_{10}$ mean lethal doses (LD_{50}) per g of paste homogenate. Aliquots were subjected to short pressure pulses of 690, 1,000, and 1,200 MPa at running temperatures of 121–137°C. Western blots of PrPres were found to be useful indicators of infectivity levels, which at all tested pressures were significantly reduced as compared with untreated controls: from ≈10^3 LD_{50} per g at 690 MPa to ≈10^6 LD_{50} per g at 1,200 MPa. The application of commercially practical conditions of temperature and pressure could ensure the safety of processed meats from bovine spongiform encephalopathy contamination, and could also be used to study phase transitions of the prion protein from its normal to misfolded state.

food processing | scrapie | bovine spongiform encephalopathy | new variant Creutzfeldt-Jakob disease | prion disease

Substrate Tissue. Oscar Mayer brand hot dogs were purchased at a U.S. food store chain and brought to Europe at ambient temperature, where sample preparation was performed. Analysis showed 0.98 water activity (Aw), pH of 6.8, fat content of 30%, and salt level of 2.2%. Three hot dogs were mechanically homogenized for 3 min.

Sample Preparation. Six grams of brain tissue were blended into 54 g of the hot dog paste with a further 3 min of mechanical homogenization to achieve a final 10% (wt/wt) concentration of brain in the hot dog substrate. Approximately 2-g quantities of the "spiked" hot dog homogenate were distributed into 0.75 mil nylon/2.25 mil (1 mil = 25.4 μm) polyethylene pouches, heat-sealed, repacked in 100 mm × 125 mm pouches (12-μm polyester outer layer; 15 μm of nylon, 12.5 μm of aluminum foil, 102 μm of polypropylene-inner layer), and heat sealed again. An undiluted aliquot of brain macerate used for the spikes was similarly packaged for testing.

Pressure Testing. The sealed samples were immersed in poly-

MEDICAL SCIENCES

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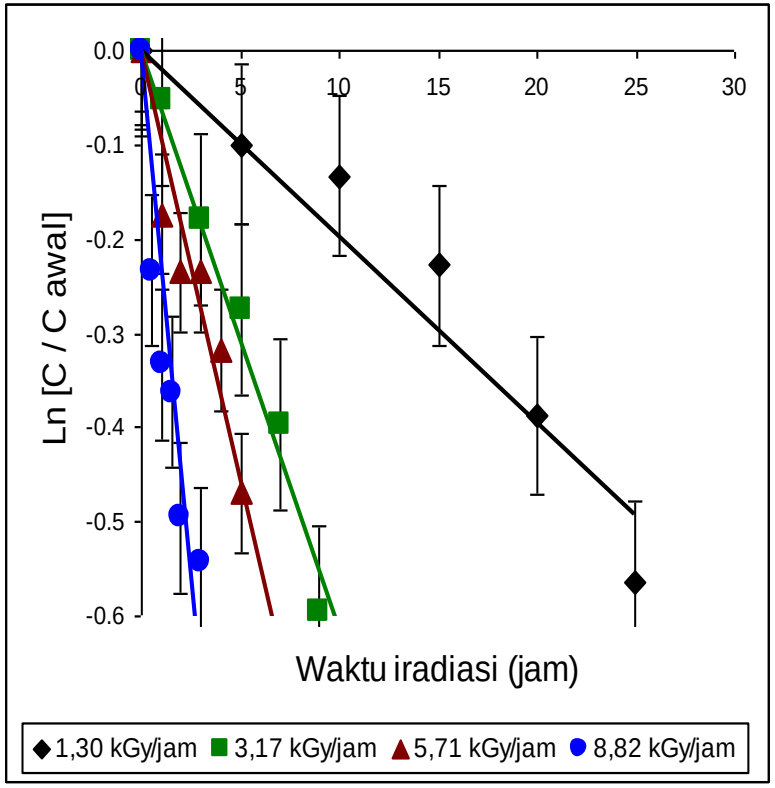
Harnessing New Technology?

Change of anti-nutrition compound in soybean during Irradiation at certain dose-rate



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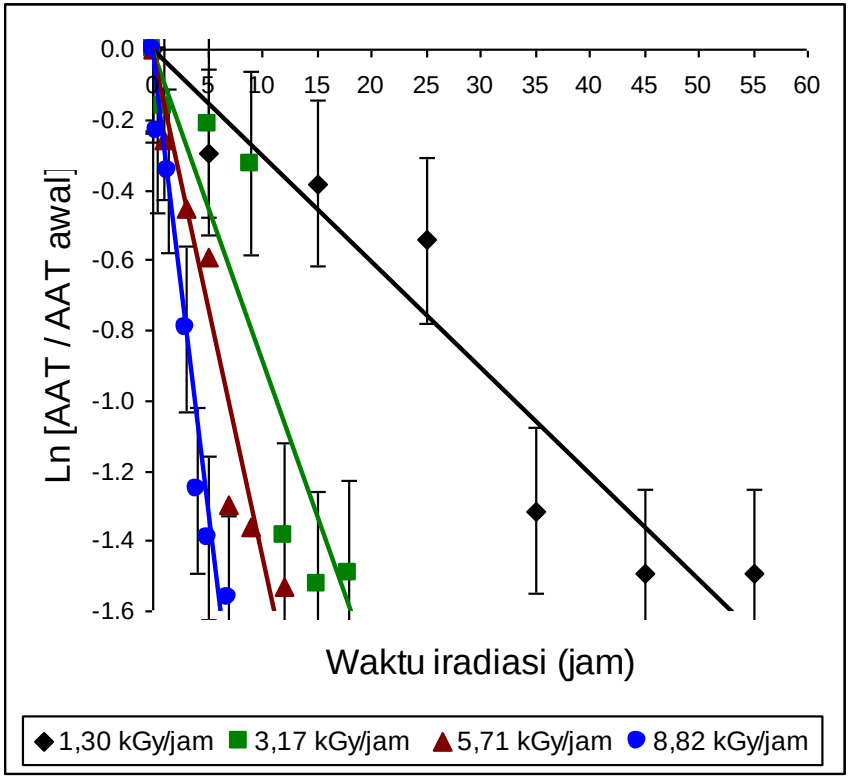

(b)

(a) Phytic Acid (b) Antitripsin activity

Tanhindarto, R.P, Hariyadi[P], Purnomo, E.H, and Irawati, Z. 2013. *Effect of gamma irradiation at different dose-rate on the anti-nutritional compounds (phytic acid and anti-trypsin) and color of soybean (Glycine max L.))*

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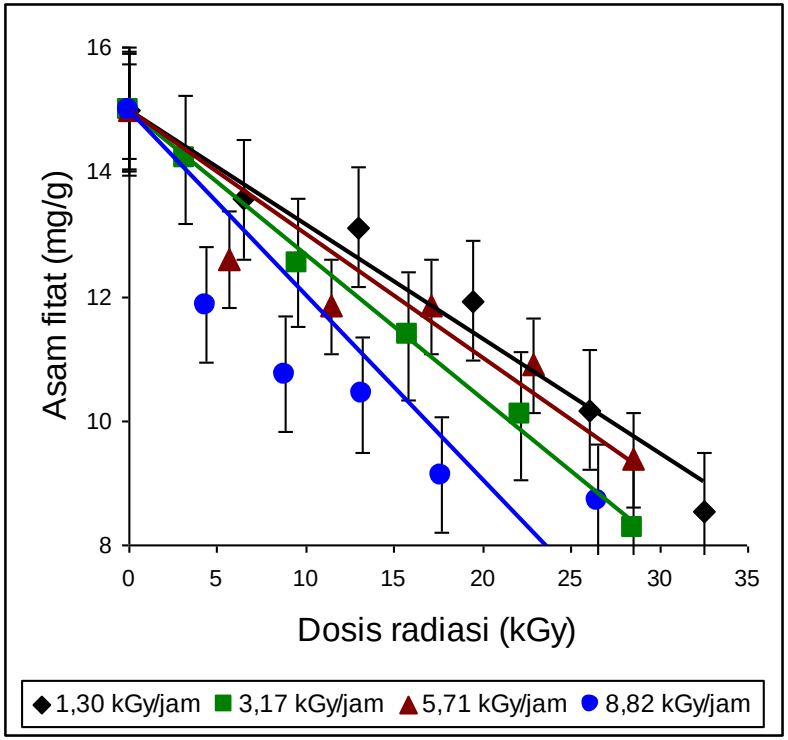
Harnessing New Technology?

Change of anti-nutrition compound in soybean as affacted irradition dose at different dose-rate



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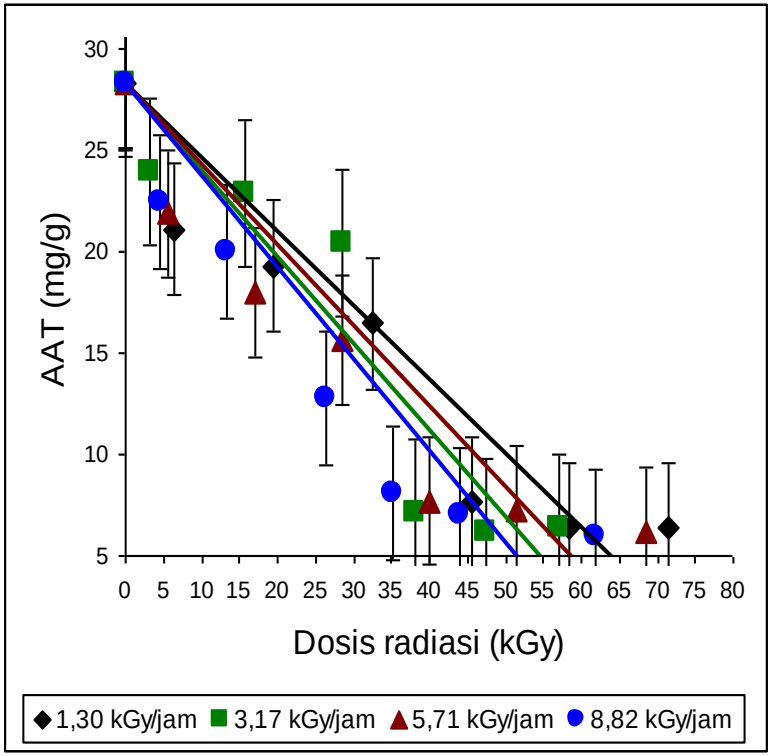

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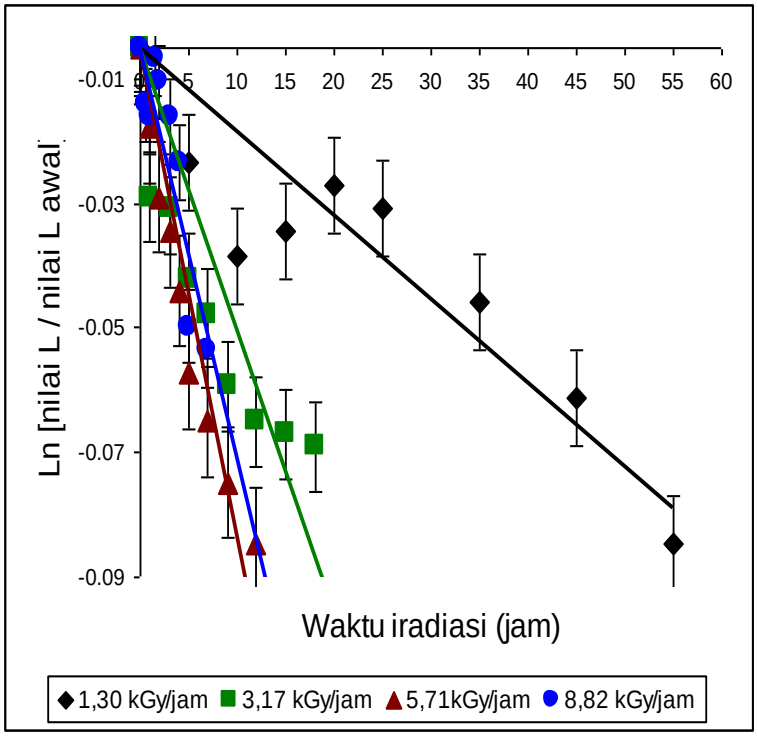
Harnessing New Technology?

Change of color (brightness) of soybean and soybean flour during Irradiation at different dose-rate



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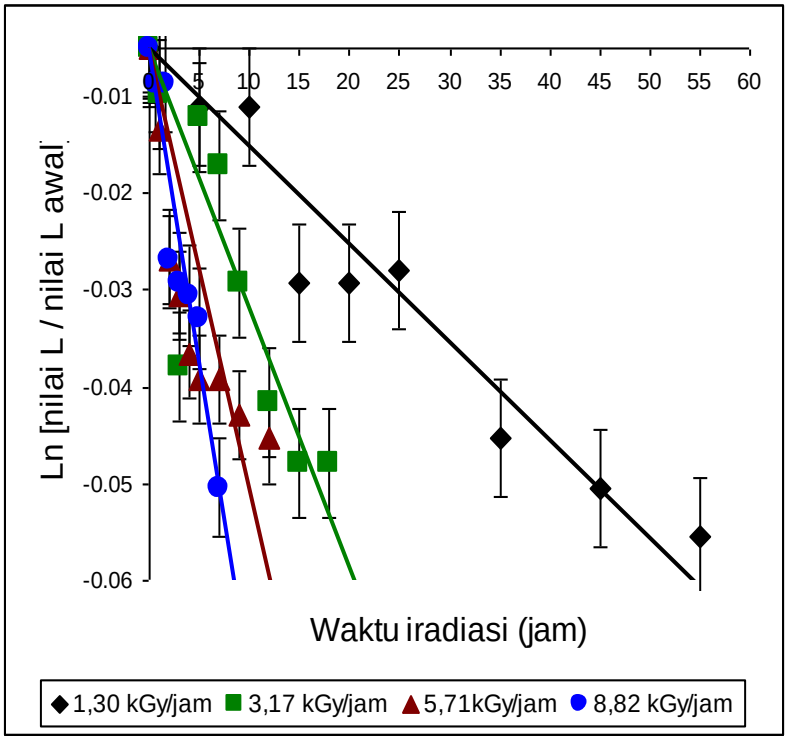

(b)

(a) Soybean grain (b) Soybean flour

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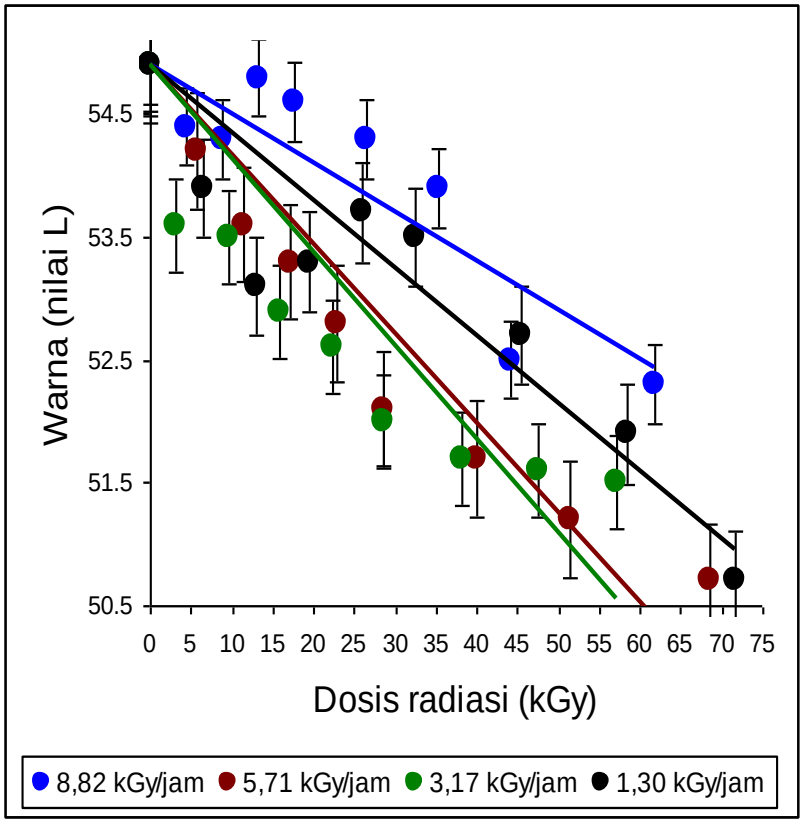

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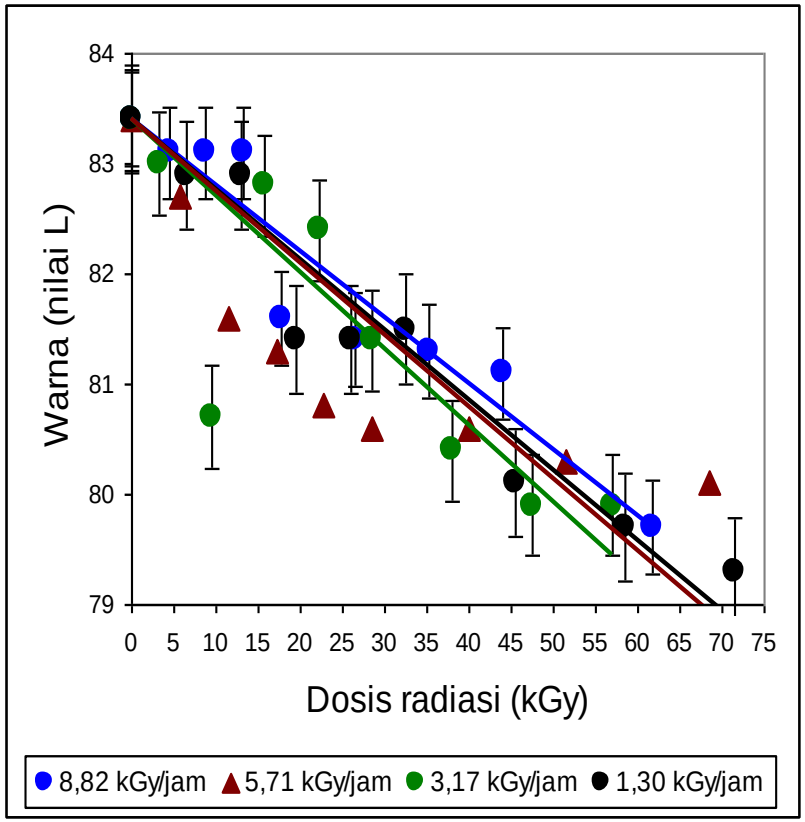

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Harnessing New Technology?

The Challenges Beyond 2015:

How to assure supply of value-added food products,

- To comply with food safety and sustainability practices?
  - To meet consumer need for product quality, convenience, availability and affordability?

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Harnessing New Technology?

The Challenges Beyond 2015:

ASEAN need to :

- Improved innovation system
- Improved assessment system for new (food and feed) technologies
  - Improved network for facilitating application new technology
- Improved education system
  - Food technology curriculum

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Harnessing New Technology?

The Challenges Beyond 2015:

ASEAN need to :

- **Improved food regulatory system**
  - Scientific approaches and parameters for the assesment of the new technologies, and
  - Develop the equivalence of many alternative technologies in term of its sustainability and safety is a must.

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Harnessing New Technology?

The Challenges Beyond 2015:

ASEAN need to :

- **Improved food regulatory system**
  - Scientific approaches and parameters for the assesment of the new technologies, and
  - Develop the equivalence of many alternative technologies in term of its sustainability and safety is a must.
  - **and ...**
  - **Harmonized/alligned food safety/sustainability standards**

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Harnessing New Technology?

The Challenges Beyond 2015:

Ensuring safer & more sustainable foods has positive implications for **food security**:

- Safe food is in itself an element of food security.
- Sustainable food supply is a must.
- **Need mechanism to harness new technology available**
    - to improve GAP, GMP and GHP→ **essential** for safer and more sustainable foods → reduces food losses → increases food availability.
    - To improve eficiency of production and distribution system → physical and economical access of foods

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Thank you

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