METHODS OF ANALYSIS SUPPORTING HALAL FOOD CERTIFICATION – Introduction

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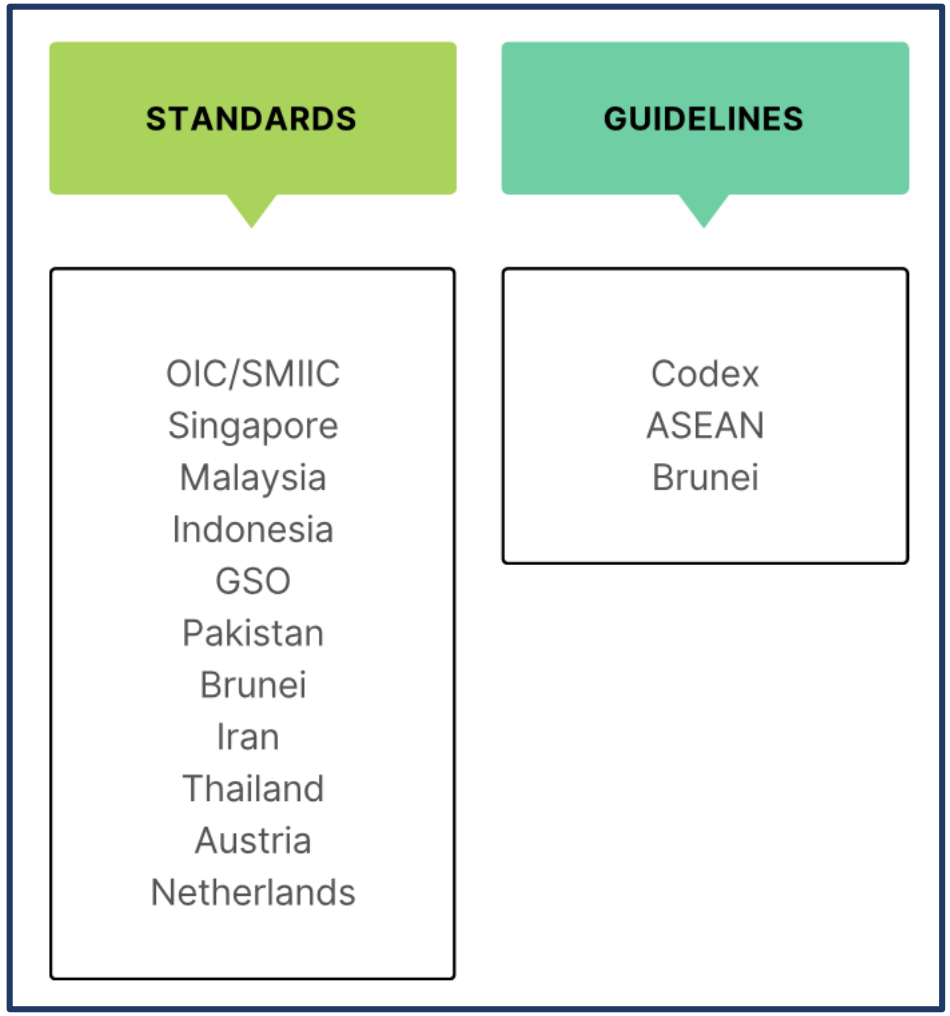
Dr. Silvia Dominguez, PhD • Université Laval, QC, Canada; GFoRSS

Halal Food

- Muslim population; consumers looking for ethical foods
- Halal = “permissible”
- Produced according to Islamic law, but no standard definition
- In general, must not:
  - Contain ingredients not allowed
    - E.g., pork, alcohol, blood, meat of animals not slaughtered according to Islamic law
  - Have been in contact with those substances
  - Be stored in facilities or transported in vehicles that are not allowed
- Different Islamic groups may have different criteria

Standards

- ❑ No unified halal food standard
- ❑ Topics covered:
  - General requirements
  - Quality / supply chain management system
  - Requirements for certification bodies
  - Requirements for testing laboratories
  - Proficiency testing
  - Packaging
  - Site-specific (slaughterhouses, meat-processing facilities, hotels…)
  - Product-specific (gelatin)
  - …



van der Speigel et al. (2012); Akbar et al. (2023)

Differences in Halal Standards

- Slaughter, stunning, seafood, insects, filthiness, labeling…
- Ex. Slaughter

Slaughterer	Pakistan	SMIIC	GSO	Singapore	Indonesia	ASEAN	Malaysia	Thailand	Iran
The slaughter must be a Muslim	√	√	×	√	√	√	√	√	√
The slaughterer may be from the Semitic religion.	×	×	√	×	×	×	×	×	×
The slaughterer must be 18 years old.	-	-	-	-	√	-	√	-	-

(√: allowed, ×: not allowed, -: no specific item is mentioned). *Akbar et al. (2023)*

- Codex (CAC/GL 24-1997): minor differences in opinion in the interpretation of lawful and unlawful animals and in the slaughter act

Differences in Halal Standards (cont.)

- Ex. Insects

Insects	Pakistan	GSO	ASEAN	Thailand	Malaysia	Brunei	Singapore	OIC/SMIIC	Iran
Locust	√	√	√	√	√	√	√	√	√
Crab (non-toxic)	×	×	√	√	√	×	√	×	×
Dabb Lizard (spiny-tailed)	×	×	√	√	√	×	√	×	×
Non-Ugly insects	×	×	√	√	√	×	×	×	×
Ugly insects	×	×	×	×	×	×	×	×	×

(√: allowed, ×: not allowed).

Akbar et al. (2023)

- Ex. Alcohol

Nation	Percentage of Ethanol	Type of Ethanol
Malaysia	1%	Naturally Formed
	0.5% in final product	Industrial Ethanol
Singapore	Not Stated	Naturally Formed
	Less than 0.5% additives, 0.1% remains in the final product	Industrial Ethanol
Indonesia	1%	Naturally Formed
	1% for additives, but in the final product must have 0.0% presence of ethanol	Industrial Ethanol
Brunei	2%	Naturally Formed
	Haram and Prohibited	Industrial Ethanol

Pauzi et al. (2019)

Certifications

No unified halal certification

Multiple halal certification bodies

Ex. 85 HCBs from 47 countries accredited by JAKIM (Malaysia)

Follow country-specific standards or their own quality assurance systems

Verification

- Audits
  - Ex. halal slaughter, including potential cross-contamination
- Certificates, verified by audits
- Laboratory tests (conformity of suspected samples)
  - Most targeted analytes: pork & alcohol

FOOD	ANALYTE
MEAT PRODUCTS	PORK
CONFECTIONERY PRODUCTS	PORK GELATIN
BEVERAGES	ALCOHOL
FERMENTED SAUCES	ALCOHOL

Laboratory Methods for Haram Ingredients

Used in scientific literature:

Haram ingredient	Identification	Examples of laboratory analysis methods
Animal species[a]	Pork meat or pork derivates, or meat from other animal species	DNA hybridization, DNA sequencing, PCR
Animal fat	Fat composition: vegetable or animal fat	FTIR, NIRS, DSC, NMR, HPLC, LC-MS(/MS), GC, PTR-MS, electronic nose technology
Proteins, peptides or amino acids from pork origin	Protein composition: collagen or gelatine from pork or other animals	SDS-PAGE, CE, FTIR, colorimetry, chromatography (e.g. HPLC), immunoassays and immunoblotting (e.g. ELISA), biosensors, NIRS, MS, 2D-PAGE coupled to mass spectrometric techniques (MALDI-TOF)
Animal origin of ingredients	Natural or synthetic origin, chemical or microbial conversion, bone or wooden origin	SNIF-NMR, IRMS & SNIF-NMR, Isotope ratio-based finger prints, chiral GC analysis, C/N-ratio by CHN-analyser
Alcohol	Alcohol	GC, electronic nose technology, PTR-MS

[a] Species may also be identified by compositional characteristics, e.g. fat and protein composition.

van der Speigel et al. (2012)

Commercial Methods

Pork

- ❑ **Protein-based (ELISA); DNA-based (PCR)**
  - **Detection (+); quantification (-)**
  - **Challenge: highly-processed matrices (protein, DNA denaturation)**
  - **Time, cost differences**

Alcohol (ethanol, propanol, methanol…)

- ❑ **Enzymatic reactions + colorimetric / fluorometric indicators**

thank you
danke
謝謝
рахмат
ngiyabonga
teşekkür ederim
gracias
Баярлалаа
спасибо
mersi
kia ora
barka
welalin
tack
spas
faafetai lava
vinaka
спасібі
blagodaram
dank je
misaotra
matondo
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grazzi
mahalo
tapadh leat
хвала
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shukriya
mercé
мерси
شكرًا لك
তোমাকে ধন্যবাদ
감사합니다
xièxie
merci