مؤتمر عُمان الدولي السادس
لسلامـــة وجـودة الغـــذاء
Oman 6th International Conference
on Food Safety and Quality

qPCR-Based Methodologies Applied to Halal Testing

Dr. Martin Mehl • 12.06.2023 • Oman

#معاً_لغذاء_آمن
FSQC_OM

qPCR

Member of NA 057-08-02 AK (DIN CEN ISO) molecular species analytics

- ISO 20813:2019

  Molecular biomarker analysis — Methods of analysis for the detection and identification of animal species in foods and food products (nucleic acid-based methods) – General requirements and definitions

- DIN EN ISO 20813:2013

Further standards, guidelines as e.g.

Molecular biomarker analysis - General guidelines for single-laboratory validation of qualitative real-time PCR methods
in process; ISO 11781:202X(E)

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Further standards, guidelines as e.g.:

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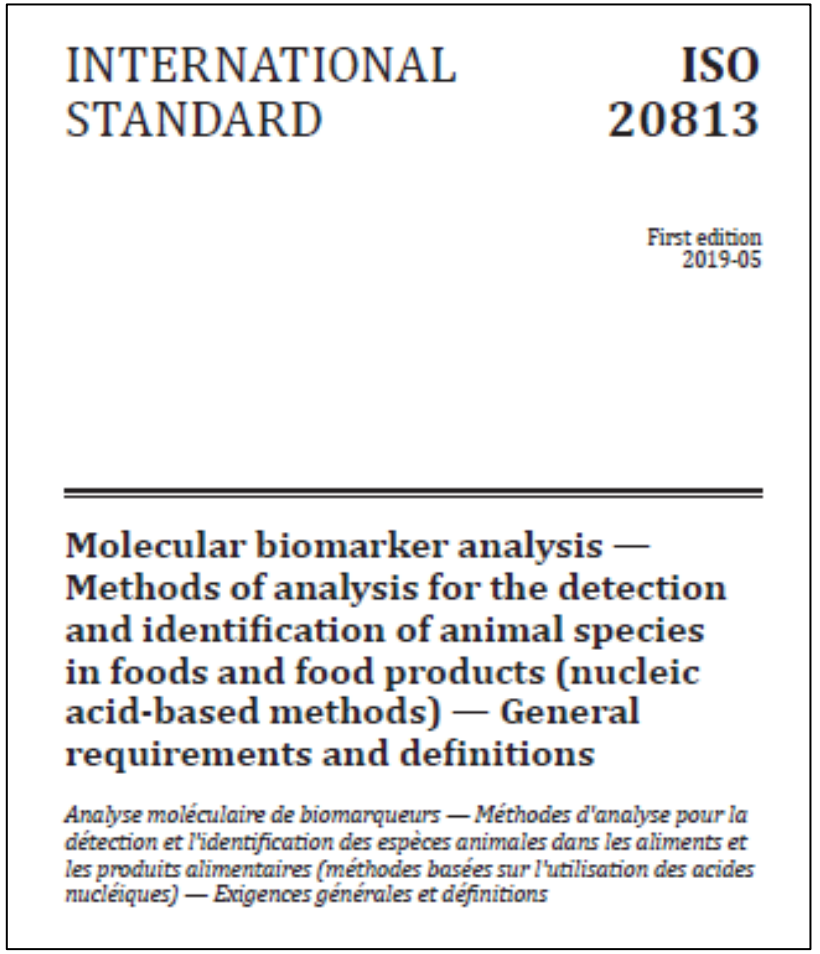

INTERNATIONAL STANDARD

ISO 20813

First edition 2019-05

Molecular biomarker analysis — Methods of analysis for the detection and identification of animal species in foods and food products (nucleic acid-based methods) — General requirements and definitions

Analyse moléculaire de biomarqueurs — Méthodes d'analyse pour la détection et l'identification des espèces animales dans les aliments et les produits alimentaires (méthodes basées sur l'utilisation des acides nucléiques) — Exigences générales et définitions

qPCR

NA 057-08-02 AK (DIN CEN ISO) molecular species analyticsreal-time PCR (qPCR) quantitative **P**olymerase **C**hain **R**eaction (PCR)

- Specific amplification and detection in real-time, additional fluorescent probe
  ISO/TS 20224 part 1-11: ISO/TS 20224 -3 **porc (sus scrofa)**

  prENxxx horse quantitative, deer…

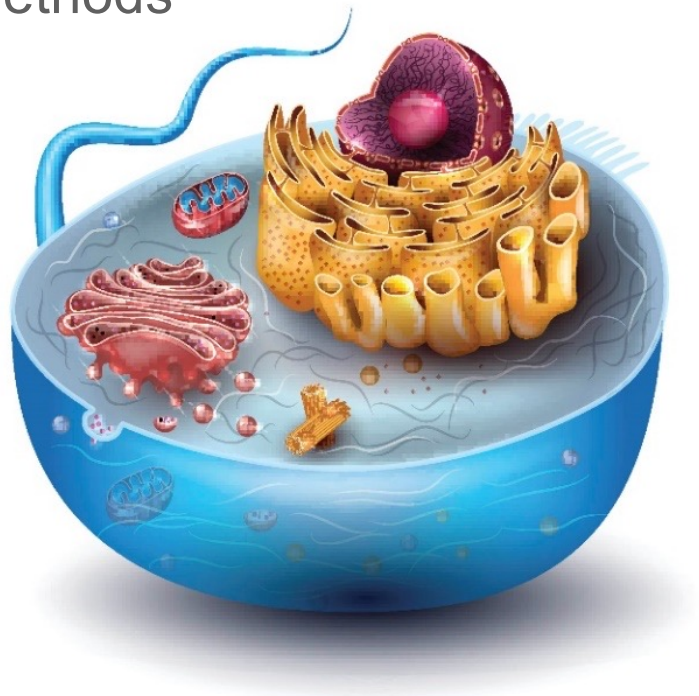
- **Barcoding**: (sequencing): Fish, muscles, meat, birds…
- **Meta-barcoding** (NGS sequencing)…
- Future projects dPCR e.g. based on § 64 projects, German food law

detection methods

Species detection

- Immunological methods

ELISA, Lateral flow
low amount for equipment
reduced sensitivity 0.1% - 1%



- Mass spec

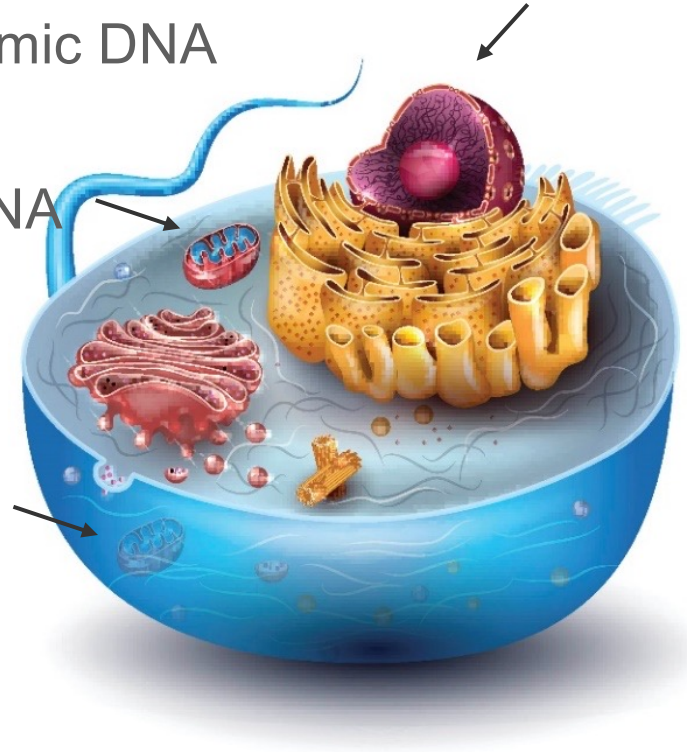
digestion, separation,
fingerprint peak detection
standardized reagents,
expensive equipment

- Molecular DNA (nucleotide) detection, “gold standard“ specific and sensitive
- Lab equipment needed. DNA amplification:
  be aware about cross contamination

qPCR

Nucleus: single copy genomic DNA — quantification (e.g. myostatin)

Mitochondria: multicopy DNA — highly conserved for species



undefined, high numbers of DNA

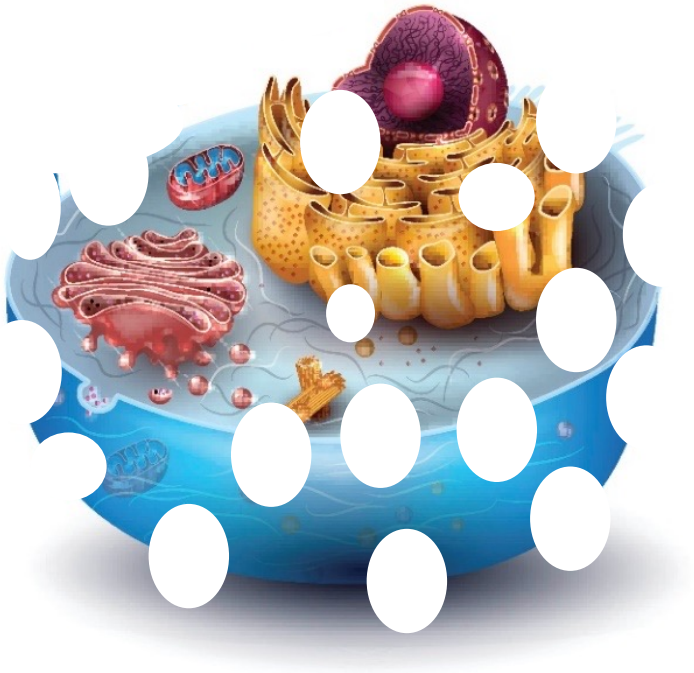
commonly Cytochrome b (*Cytb)* and Cyclooxygenase (COX) used as targets

mitochondrial assays useful for sensitive assays but not for quantification

qPCR

qPCR general procedure

1. Sampling
2. Homogenisation
3. Lysis/DNA Prep
4. qPCR
5. Data extraction



Sample matrices

sample → sample prep. → RNA/DNA prep → qPCR → data interpret.

→ 100~50 µl → 5 µl DNA RNA

surface	~ 5 x 5 cm
Food	~ (kg) – gram (0.05 - 2 gram subsample)
Beverages, liquids	~ ml

Representative sampling and homogenisation most crucial for all detection methods

qPCR

sampling → DNA prep → set-up → qPCR run → data

representative (!) sampling and homogenisation

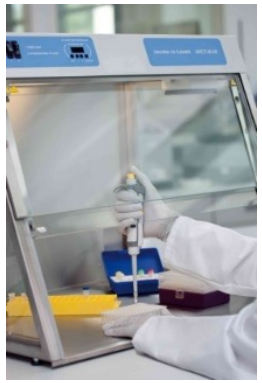
subsample e.g. 10 g

50 mg – 2 g

final sample !

- manually (spin-filter)
- automation (magnetic beads)

~ 1-2 hrs

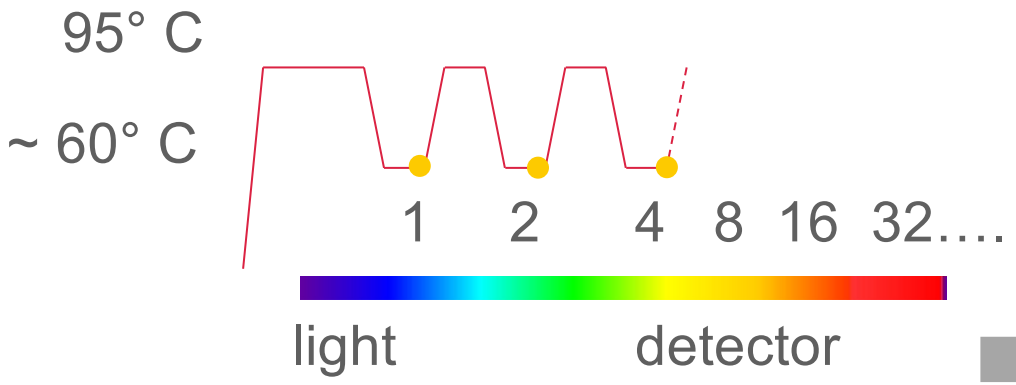


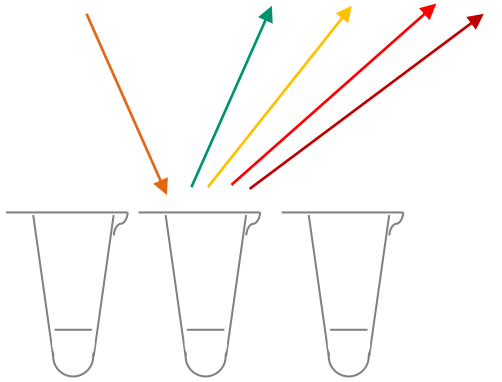
qPCR setup: mastermix + DNA (controls)

qPCR run and data extraction

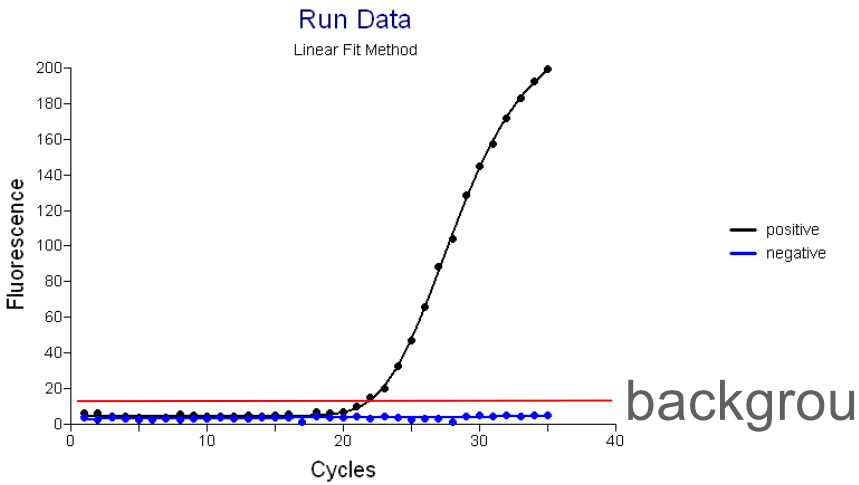
data handling

qPCR





heat/cool



background signal

computer/software

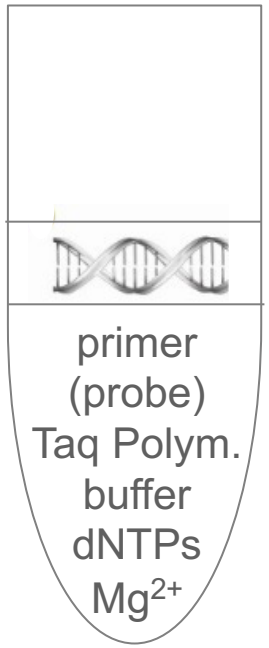
FAM

HEX

ROX

Cy5

procedure of DNA amplification and detection:



sample DNA (5µl)

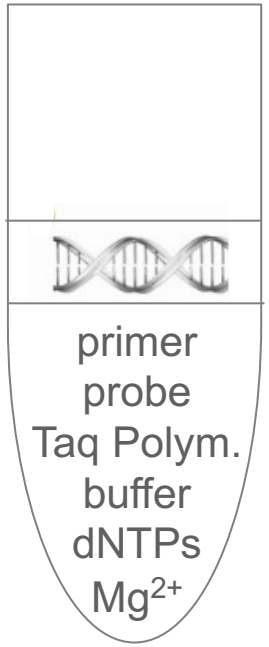
Master Mix (20 µl)

nucleotides

Guanine
Adenine

Cytosine
Thymine

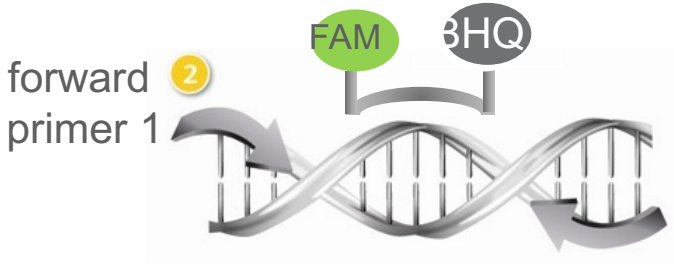
procedure of DNA amplification and detection:



sample DNA (5µl)

Master Mix (20 µl)

probe: specific sequence, labelled with fluorescent dye and quencher



- second sequence:higher security
- detection in real-time

nucleotides

Guanine
Adenine

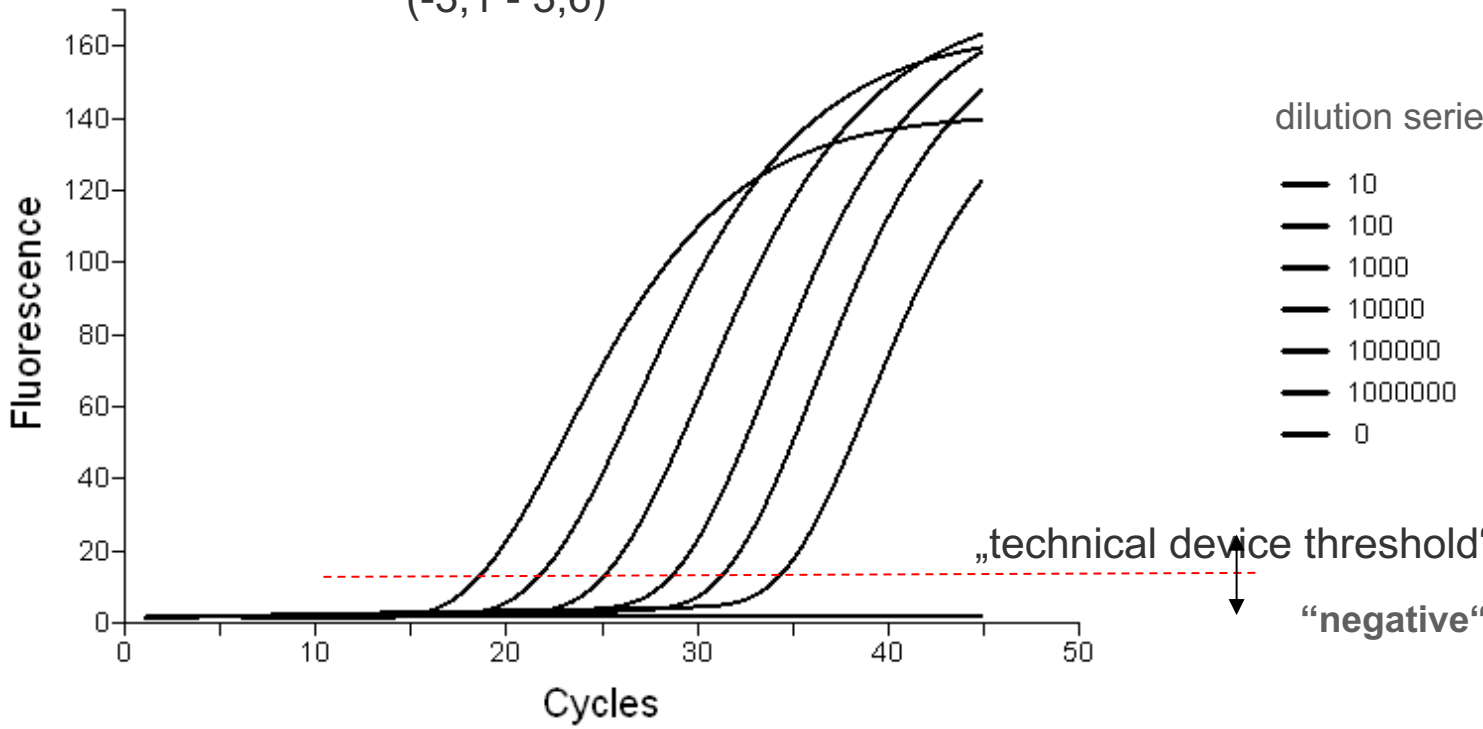
Cytosine
Thymine

qPCR – qualitative or relative quantification

Ct values

high DNA amount **low DNA amount**

3,322 at Δ 10 x
(-3,1 - 3,6)

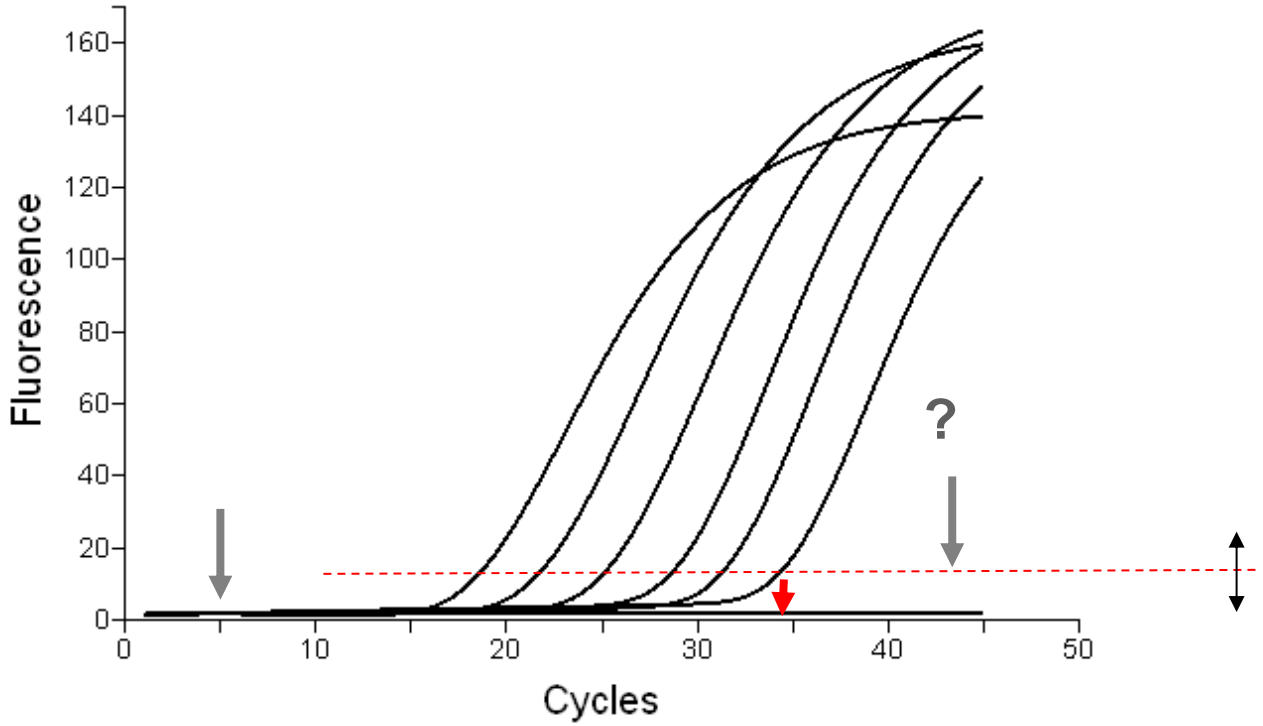


“negative“ < LOD (e.g. 0.01% to < ppm)

qPCR – qualitative, or relative quantification

Ct values

high DNA amount **low DNA amount**



Algorithms as e.g.

LinRegPCR

Ct cycle treshhold
Cp crossing point
Cq cycle quantitative

value

< LOD (e.g. 0.01% to < ppm)

qPCR

Amount	dilution	percentage	ppm
1	10^0	100 %	1.000.000 ppm

qPCR

Amount	dilution	percentage	ppm
1	10^{0}	100 %	1.000.000 ppm
0.1	10^{-1}	10 %	100.000 ppm

qPCR

Amount	dilution	percentage	ppm
1	10^{0}	100 %	1.000.000 ppm
0.1	10^{-1}	10 %	100.000 ppm
0.01	10^{-2}	1 %	10.000 ppm

qPCR

Amount	dilution	percentage	ppm
1	10^0	100 %	1.000.000 ppm
0.1	10^{-1}	10 %	100.000 ppm
0.01	10^{-2}	1 %	10.000 ppm
0.001	10^{-3}	0.1 %	1.000 ppm

e.g. GMO
EU: 0.9%
legal treshhold

e.g. horse meat scandal 2013: informal, non – legal thresholds in EU:

> 1 % ingredient or severe incompetence

0.1 - 1 % internal controls in factory recommended

< 0.1 % contamination, “technical unavoidable” contamination? trace

qPCR

Amount	dilution	percentage	ppm
1	10^{0}	100 %	1.000.000 ppm
0.1	10^{-1}	10 %	100.000 ppm
0.01	10^{-2}	1 %	10.000 ppm
0.001	10^{-3}	0.1 %	1.000 ppm
0.0001	10^{-4}	0.01 %	100 ppm

qPCR

Amount	dilution	percentage	ppm
1	10^{0}	100 %	1.000.000 ppm
0.1	10^{-1}	10 %	100.000 ppm
0.01	10^{-2}	1 %	10.000 ppm
0.001	10^{-3}	0.1 %	1.000 ppm
0.0001	10^{-4}	0.01 %	100 ppm
0.00001	10^{-5}	0.001 %	10 ppm

qPCR

Amount	dilution	percentage		ppm	
1	10^{0}	100	%	1.000.000 ppm	
0.1	10^{-1}	10	%	100.000 ppm	
0.01	10^{-2}	1	%	10.000 ppm	“ingredient”
0.001	10^{-3}	0.1	%	1.000 ppm	
0.0001	10^{-4}	0.01	%	100 ppm	
0.00001	10^{-5}	0.001	%	10 ppm	
0.000001	10^{-6}	0.0001	%	1 ppm	
0.0000001	10^{-7}	0.00001	%	0.1 ppm	

0.0000000… (not zero)

Sensitivity of qPCR in muscle meat ≤ 1 ppm …contamination in production?

difficult interpretation (y/n)...

standardisation

Sensitivity	Limit of detection (LOD)	**all target** DNA to be detected
	absolute LOD_{abs} usually 95%	dilution series in relevant range
	relative LOD LOD_{rel}	dilution in relevant material (A)
	assymetric LOD	multiplex qPCR
	Limit of Quantification (LOQ)	
Specificity	1. *in sillico*, 2. in practice	**only target** DNA has to be detected
	inclusivity, excluvity	no “false positives“
Robustness	othogonal variation	same results, even by variation

standardisation

Sensitivity	Limit of detection (LOD)	**all target** DNA to be detected
	absolute LOD_{abs} usually 95%	dilution series in relevant range
	relative LOD LOD_{rel}	dilution in relevant material (A)

Dilution series, e.g. 19 of 20 samples positive: LOD_{95}

Low amount of DNA: statistical aspects: **Poisson Distribution**

e.g. 2 DNA/10 µl → 5µl / assay …

standardisation

Orthogonal robustness study, e.g. according to **TS 17329-1: 2021**

multifactorial test with 3 x LOD_{95} DNA
Cq values should not have high variation

Factor	1	0
PCR equipment	A	B
PCR mastermix	X	Y
Primer concentration	protocol	-30%
Probe concentration	protocol	-30%
Volume mastermix	19 µl (-5%)	21 µl (+5%)
Annealing temperature	+ 1 °C	- 1 °C

Interlaboratory study (ring trials) and proficiency tests as internal, DRRR, FAPAS

ISO 20224-3 2019E

Molecular biomarker analysis — Detection of animal derived materials in foodstuffs and feedstuffs by real-time PCR — Part 3: Porcine DNA detection method

Table 1 — Oligonucleotides

Name	DNA sequence of the oligonucleotide	Final concentration in PCR
Porcine beta actin gene as the target sequence (GeneBank accession number: DQ452569.1)[a]		
Porcine-97bp-F	5′-CGTAGGTGCACAGTAGGTCTGAC-3′	400 nmol/l
Porcine-97bp-R	5′-GGCCAGACTGGGGACATG-3′	400 nmol/l
Porcine-97bp-P	5′-[FAM]-CCAGGTCGGGGAGTC-[NFQ-MGB[b]]-3′	200 nmol/l

a PCR Product = 335 - cgtagg tgcacagtag gtctgacgtg actccccgac ctggggtccc cagcacactt agccgtgttc cttgcactct ctgcatgtcc ccagtctggc c - 431 - DQ452569.1

b FAM: 6-Carboxyfluorescein, MGB: Minor Groove Binder (non-fluorescent chromophore)

10 min	95 °C initial denaturation
15 s	95 °C denaturation
60 s	60 °C annealing/elongation
45	cycles

The absolute limit of detection ($LOD_{95\%}$) for the method is ≤ 5 DNA copies. The collaborative trial of the ovine detection method was carried out at the same time as collaborative trials for the bovine, porcine and chicken detection methods. Bovine, ovine, porcine and chicken target DNA sequences were synthesized and cloned into the pUC57 vector (2710 bp in length, GenBank/EMBL accession number Y14837). This constructed plasmid pUC57-bopc (3127 bp in length) was sequenced to ensure that only one copy of the ovine, bovine, porcine and chicken target DNA sequence was inserted (Fig. 1). No deletion or insertion mutations were found in the inserted sequences (Fig. 2). The target sequences of corresponding PCR methods are indicated in bold capital letters.

standardisation 2

GSO 2649:2021

Gulf Standard ● ACTIVE

Detection Of Porcine DNA- Test Method- Food And Food Products

Scope

This standard describes the adapted and modified methods for the qualitative detection of porcine deoxyribonucleic acid (DNA) in food and food products. It is applicable to raw materials, processed and highly processed food and food product. The Polymerase Chain Reaction (PCR) technique is used for the identification and confirmation of porcine DNA presence.
The method described has been optimized for different food matrices (homogenous or heterogeneous). However, due to the type of food analyzed, some of the processes may have to be modified in the laboratory. In such cases, the laboratory may proceed with the modifications, provided validation studies had been carried out.

Type	Prepare
Edition	1
Approved on	01 July 2021
Sector	Food And Agriculture Sector
ICS - 67.050	general methods of tests and analysis for food products

مواصفة قياسية خليجية ● **الإصدار الحالي**

الطبعة : 1 *اعتمدت بتاريخ* ***01 يوليو 2021***

الكشف عن الحمض النووي الديؤكسى ريبوزى للخنزير –

القطاع	قطاع الغذاء والزراعة
ICS - 67.050	الطرق العامة لاختبار المنتجات الغذائية وتحليلها * ميكروبيولوجيا الأغذية، انظر 07.100.30 * التحليل الحسي للأغذية، انظر 67.240

standardisation 2

GSO 2649:2021 adapted from MS 2627:2017

CTAB, Phenol extraction; DNA

classical PCR with post-PCR gel electrophoresis detection or qPCR

primers e.g. 5'- GAC CTC CCA GCT CCA TCA AAC ATC TCA TCT TGA TGA AA-3'
5'- GCT GAT AGT AGA TTT GTG ATG ACC GTA-3‘

3-step PCR 94°C, 30s / 54°C, 30s / 72°C, 40s, 2 min extinction
35 cycles
positive results should be in in the range of Ct 32-34
LOD: 0.01% (w/w)

standardisation 3 commercial / other systems

Commercial kits as Pork Sens Plus

No “halal test” !

sensitive test for detection of pork (sus scrofa),

highly specific (as other sus scrofa tests)

very sensitive: ~ 0.4 ppm in muscle meat

validated, suitable for food, not validated for other products as cosmetics, environmental samples etc.

Example: Pork sens detection

DNA preparation using PREP Basic/Advanced (simple spin filter system) or automation

Qualitative real-time PCR with internal amplification control (IAC), commercial Pork sens assay

5 min	95 °C	initial denaturation
45 cycles:		
15 s	95 °C	denaturation
30 s	60 °C	annealing / elongation

Detection FAM: *sus scrofa* HEX: IAC inclusivity/exclusivity: *sus scrofa (domestica)*

Example: Pork sens detection

Highly sensitive

Do not change settings (thermoprofile), be aware of contamination

Validated for food and ingredients,
but not for cosmetics, pharmaceuticals, environmental material

If result is positive, it may have an impact, careful handling of data interpretation mandatory

Laboratory staff	procedure, controls, contamination?
Lab management	controls, replicates, samples, contamination, sampling out of laboratory?
Management	how to classify and handle this (decision)
Communication	how to communicate

Example: Pork sens detection

Management how to classify and handle this (decision)

Communication how to communicate

Guidelines e.g.

سيياقملا و تافصاوملل تاراملا فئيه

Emirates Authority for Standards & Metrology

(ESMA)

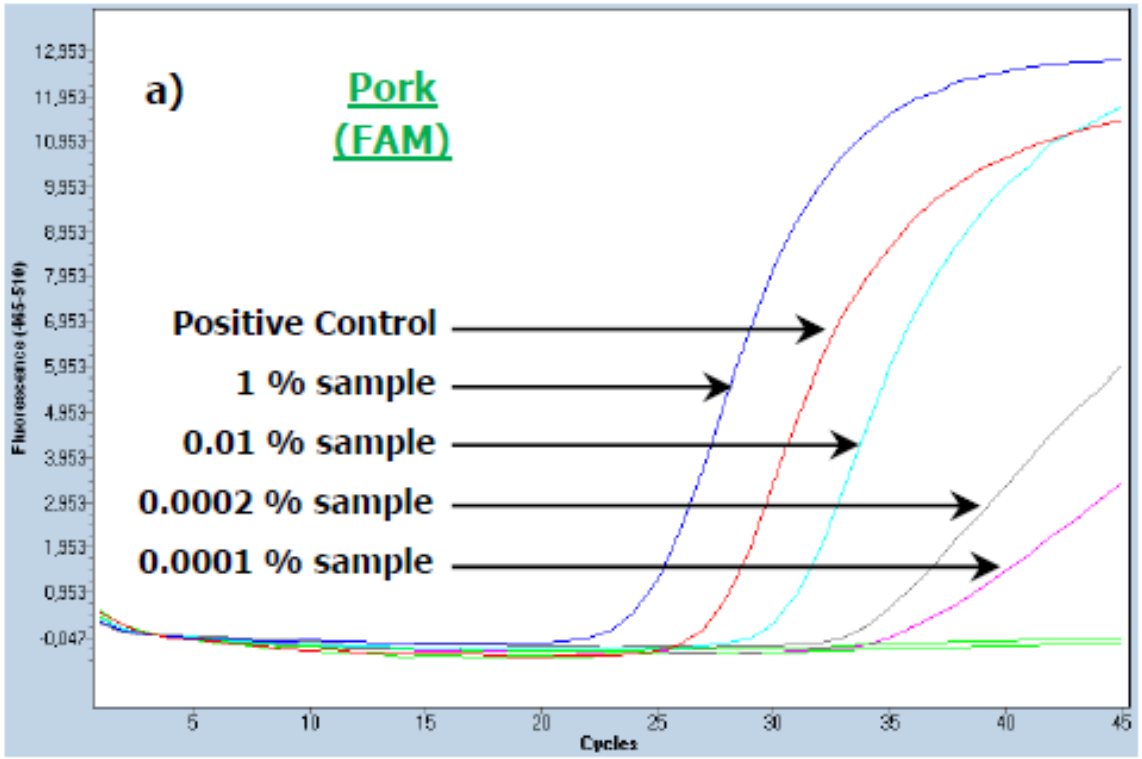
قيتاراملا نيسايلا تافصاوملا

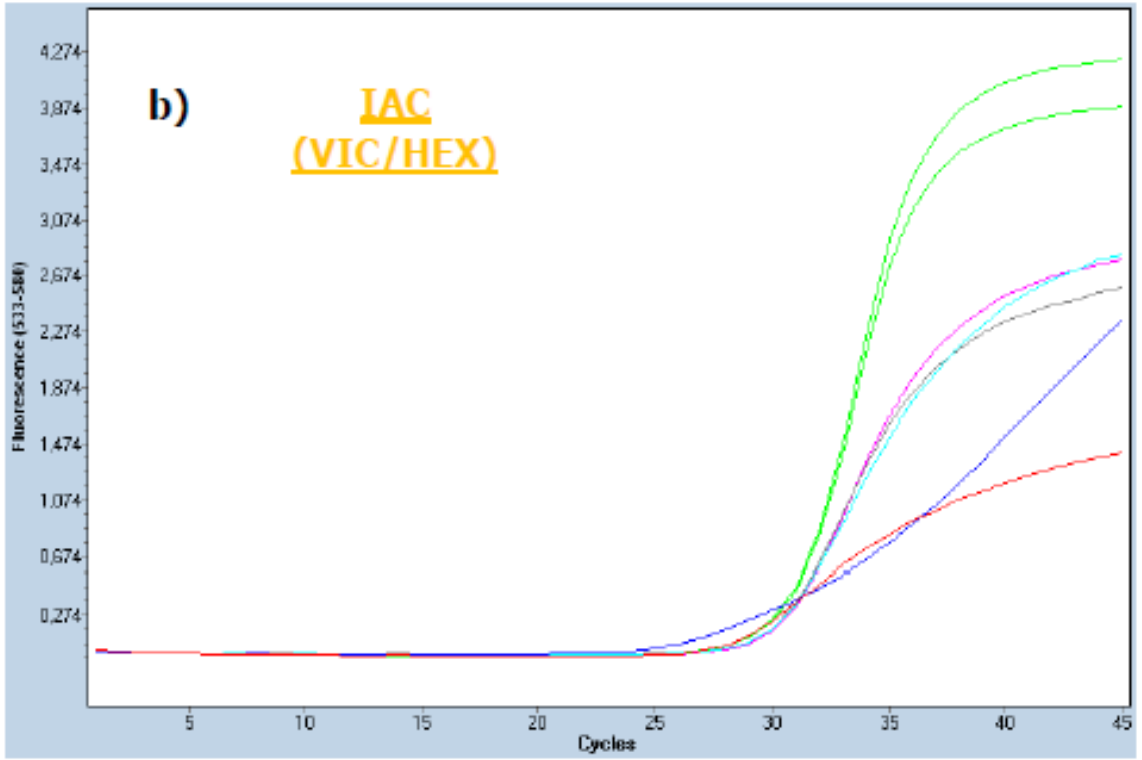
UAE.S 2055 -1:2015

للحلا ميدعلل ماعلا داطارشلا :لولا ءزجلا - للحلا تاجتنملا

Halal products - Part one: General Requirements for Halal Food

Example: Pork sens detection: results





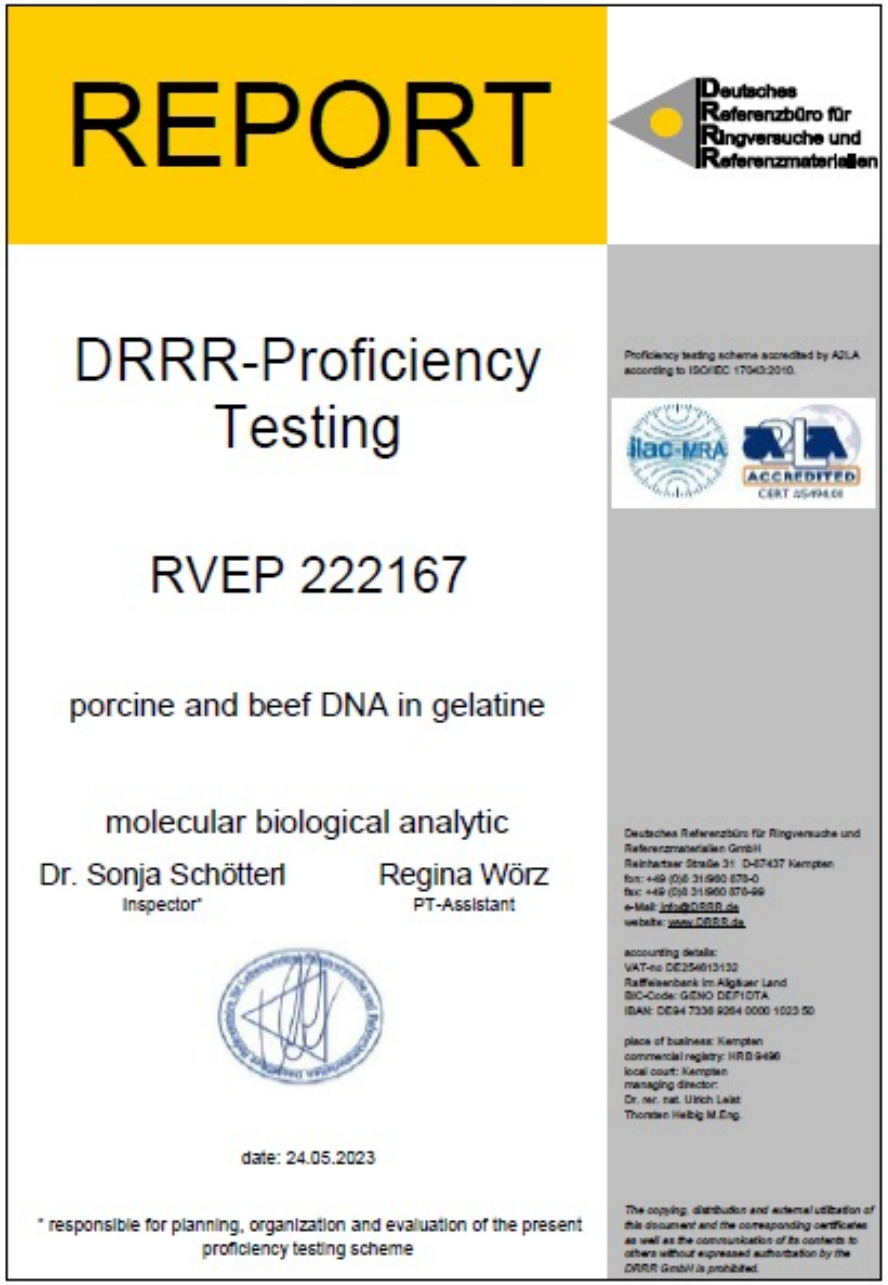
Example: Pork sens detection

Can be used for gelatin and products (with reduced sensitivity)

Profiency tests: FAPAS (lyophilized meat)

DRRR:

Gelatine		pork
Sweets (gummi drops)	pork	
meat	different species	
milk	different species	



REPORT

Deutsches Referenzbüro für Ringversuche und Referenzmaterialien

DRRR-Proficiency Testing

RVEP 222167

porcine and beef DNA in gelatine

molecular biological analytic

Dr. Sonja Schötterl
Inspector*

Regina Wörz
PT-Assistant

date: 24.05.2023

* responsible for planning, organization and evaluation of the present proficiency testing scheme

Proficiency testing scheme accredited by AZLA according to ISO/IEC 17043:2010.

ilac-MRA AZLA ACCREDITED CERT D/PT-94.01

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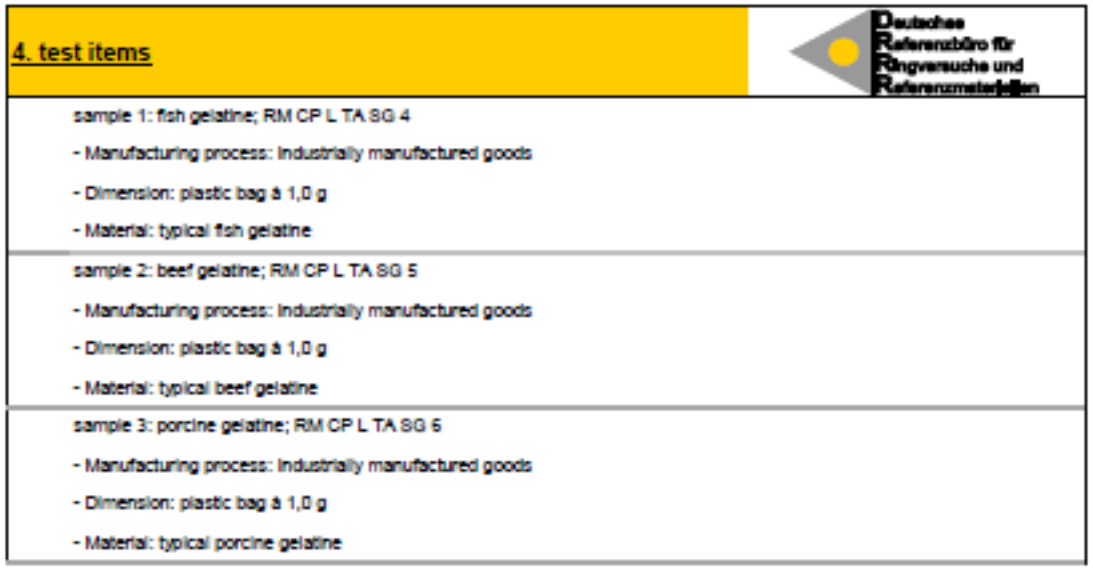
Raiffeisenbank im Allgäuer Land
BIC-Code: GENO DEF1OTA
IBAN: DE94 7336 9264 0000 1023 50

place of business: Kempten
commercial registry: HRB 9496
local court: Kempten
managing director:
Dr. rer. nat. Ulrich Leist
Thorsten Helbig M.Eng.



4. test items

Deutsches Referenzbüro für Ringversuche und Referenzmaterialien

sample 1: fish gelatine; RM CP L TA SG 4
- Manufacturing process: industrially manufactured goods
- Dimension: plastic bag à 1,0 g
- Material: typical fish gelatine

sample 2: beef gelatine; RM CP L TA SG 5
- Manufacturing process: industrially manufactured goods
- Dimension: plastic bag à 1,0 g
- Material: typical beef gelatine

sample 3: porcine gelatine; RM CP L TA SG 6
- Manufacturing process: industrially manufactured goods
- Dimension: plastic bag à 1,0 g
- Material: typical porcine gelatine

3 samples, 12,5% chance by guess

results (qualitative)
Identification of the animal species pork

Deutsches Referenzbüro für Ringversuche und Referenzmaterialien

customer data					performance	
lab code no.	method description	sample set			number of correct findings	performance
		sample 1 *negative*	sample 2 *negative*	sample 3 *positive*		
1	CTAB TaqMan	negativ	negativ	positiv	3	successful
2	SureFood® PREP Advanced TaqMan, Kim et. al.	negativ	negativ	positiv	3	successful
3	CTAB+magnetic Beads Maxwell Promega Taqman	negativ	negativ	positiv	3	successful
4	DNeasy® mericon® Food as manufacture description with some modification and prep basic extraction (r-biopharm) protocol 1 mericon Pig Ki (qaigen) and SureFood® ANIMAL ID Pork SENS (R-biopharm)	negativ	negativ	positiv	3	successful
5	Magnetic Beads RT PCR	negativ	negativ	positiv	3	successful

2023 PT with grinded meat samples

REPORT

Deutsches Referenzbüro für Ringversuche und Referenzmaterialien

DRRR-Proficiency Testing

RVEP 222166

beef, pork, horse

molecular biological and immunological analytic

Dr. Sonja Schötterl
Inspector*

Yeliz Elüstü
PT-Assistant

date: 28.04.2023

* responsible for planning, organization and evaluation of the present proficiency testing scheme

Proficiency testing scheme accredited by ACLA according to ISO/IEC 17043:2010.

ACCREDITED
CERT #5494.01

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Thorsten Helbig M.Eng.

RVEP 222166 / Art.-No.: 2010263

Deutsches Referenzbüro für Ringversuche und Referenzmaterialien

results (qualitative)
Identification of species, sample 1

customer data					performance	
		sample 1				
lab code no.	method description	beef *positive*	pork *positive*	horse *positive*	number of correct findings	performance
1	ISO 20	positiv	positiv	n/a	2	
2,1	§ 64 LFGB, L 08.00-62, 2019-03	positiv	positiv	positiv	3	successful
2,2	16S rDNA-Metabarcoding (NGS) nach Dobrovolny et al. (2019) Food Chemistry, 272, 354-361.	positiv	positiv	positiv	3	successful
3	Extraktion: NukleoSpin Food mit Einwaage 200mg, qPCR LFGB L08.00-62 50 Zyklen	positiv	positiv	positiv	3	successful
4	PCR-RFLP (Wolf et al., 1999), real-time PCR (Laube at al., 2007 and Köppel at al., 2009), EURL	positiv	positiv	positiv	3	successful
5,1	In-house method based on ISO 20224-3 ; 2020 combination with International Journal of Food Science and Technology 38; 2003: 111-8. Real-Time PCR	positiv	positiv	n/a	2	
5,2	In-house method based on ISO 20224-3 ; 2020 combination with International Journal of Food Science and Technology 38; 2003: 111-8. Real-Time PCR	positiv	positiv	n/a	2	
5,3	In-house method based on ISO 20224-3 ; 2020 combination with International Journal of Food Science and Technology 38; 2003: 111-8. Real-Time PCR	positiv	positiv	n/a	2	
6	GEN-IAL GmbH GEN-IAL® First-Beef PCR Kit, GEN-IAL GmbH GEN-IAL® First- Pig PCR Kit , GEN-IAL GmbH GEN-IAL® First-Horse PCR Kit	positiv	negativ	positiv	2	
7	RT-PCR -	positiv	negativ	positiv	2	

Deutsches Referenzbüro für Ringversuche und Referenzmaterialien

results (qualitative)
Identification of species, sample 1

customer data					performance	
		sample 1				
lab code no.	method description	beef *positive*	pork *positive*	horse *positive*	number of correct findings	performance
8	relativ quantitative real-time PCR -	positiv	positiv	n/a	2	
9	real-time PCR LOD 0,01%	n/a	positiv	positiv	2	
10	Real-time PCR	positiv	n/a	n/a	1	
11	CTAB-Chloroform RT-PCR 45 Zyklen	positiv	positiv	positiv	3	successful

further PTs in autumn:

- animal species
- insects in cereals / in feed

www.DRRR.de

Insects

- EU: novel food, ongoing approvals for increasing number of insects (protein)

Tenebrio molitor
Hermetia illucens
Locusta migratoria
Alphitorius diaperionus
…

Besondere Edition

Ritter Sport preist Schokolade der Sorte "Ganze Grille" an - Kunden reagieren extrem sauer

Von **Eva Orttenburger** 17.2.2023, 09:17 Uhr

Mit diesem Bild sorgte Ritter Sport auf Instagram für einen Scherz - doch dieser ging nach hinten los. © Ritter Sport

marketing joke

mostly Burgers,

powder

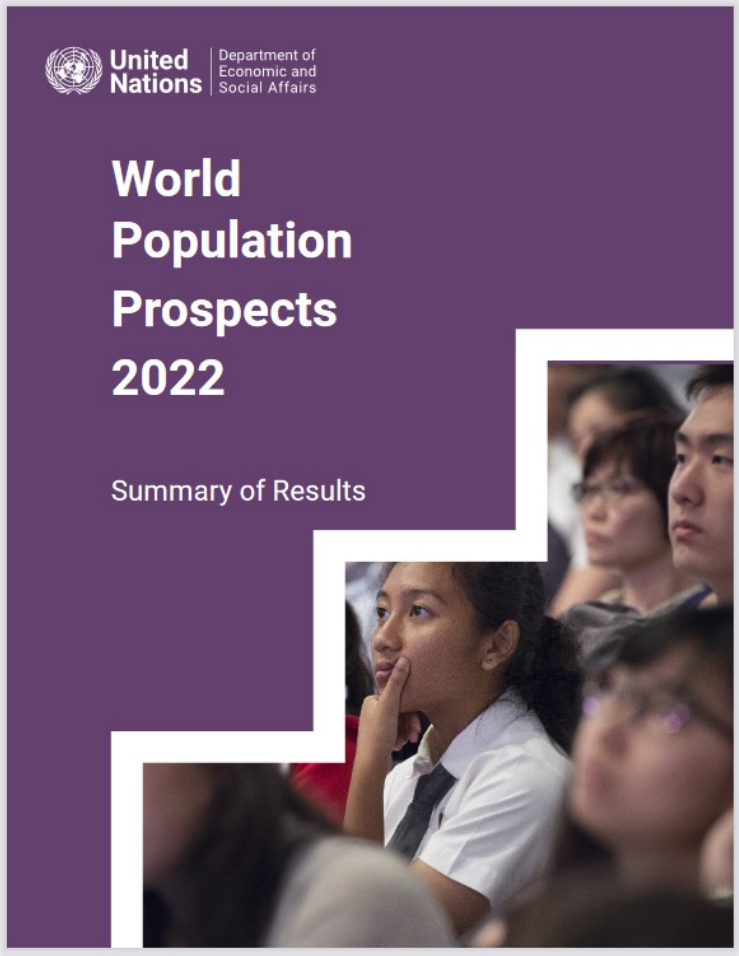
so far not commercial successful in Europe

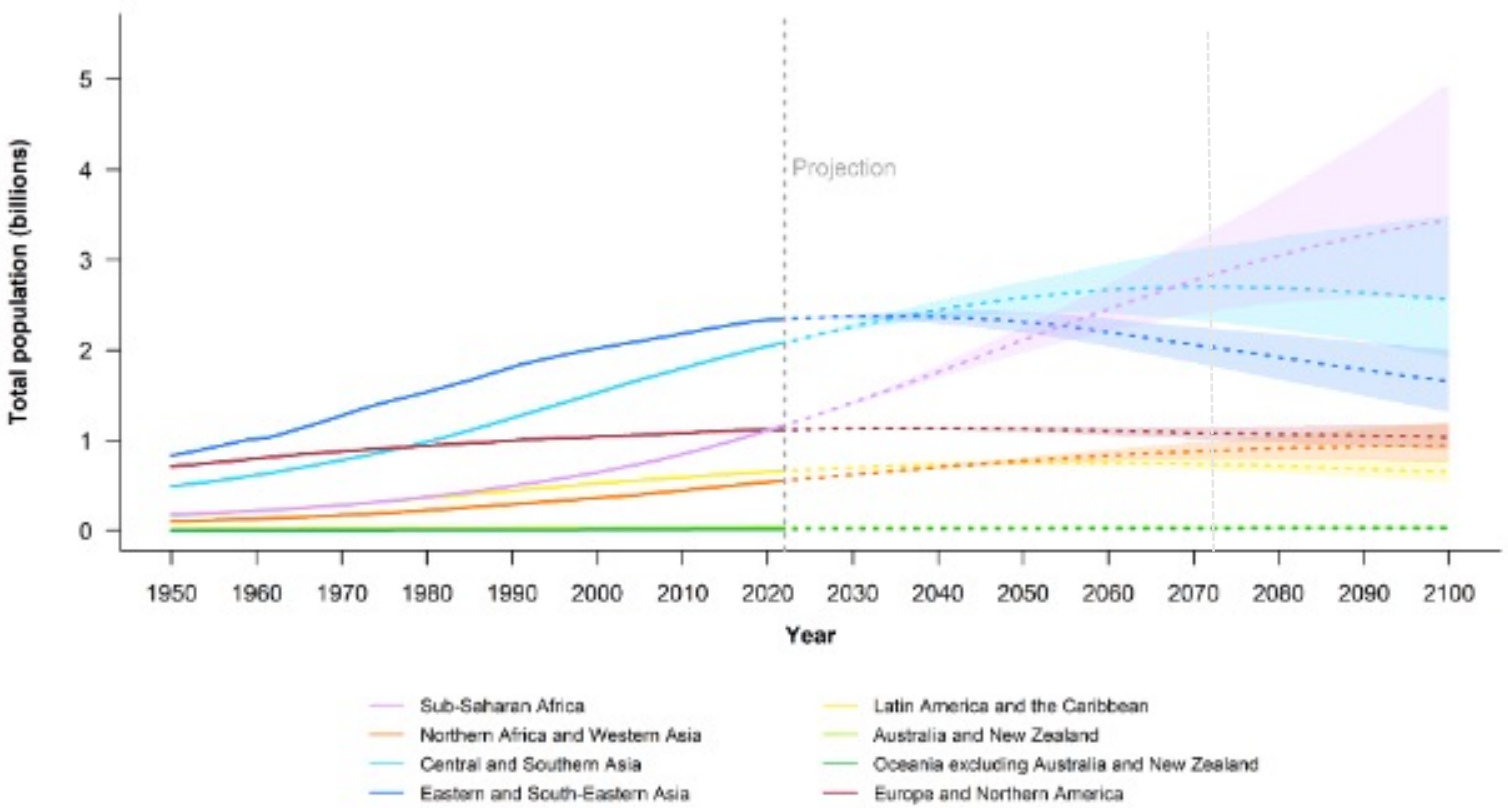
must be labelled

Allergen Risk

“crustaceans mites”

50 years from now…





various scenarios: ~ 2070 -2100 population > 10 Billion

Sale of insect-based food products not allowed in Oman

OBSERVER WEB TEAM
PUBLISHED: 11:04 AM, FEB 08, 2023

The Food Safety & Quality Center (FSQC) has issued a clarification on the consumption of insect-based food products in some countries of the world.

FSQC said that such food products do not comply with the regulations and standard specifications and are not allowed to be traded in the local markets.

Consignments of all imported food products go through inspection and laboratory analysis to ensure their safety and compliance with the regulations and standard specifications.

Some of the GCC countries, including Qatar, recently announced that they will not allow the entry of insect-based food products into their markets.

The Ministry of Health in Doha said that insect products do not meet “the requirements of the technical regulations for halal food.”

“The regulations of the Gulf Cooperation Council (GCC) countries prohibit eating insects or proteins and supplements extracted from them,” it added.

The European Union Commission recently approved the use of small mealworm larvae and domestic crickets in food.

qPCR

Validation report DNA / matrix DNA dilution inclusivity, exclusivity

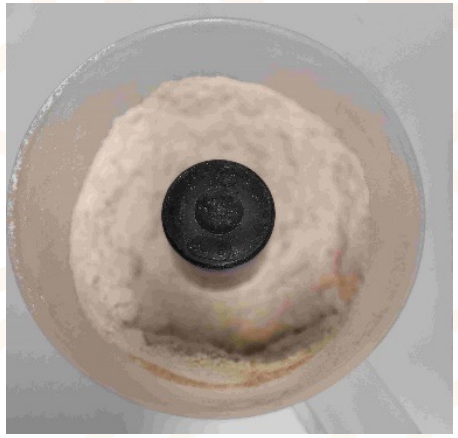
Table 1: Overview of specificity tests using SureFood® ALLERGEN Insects

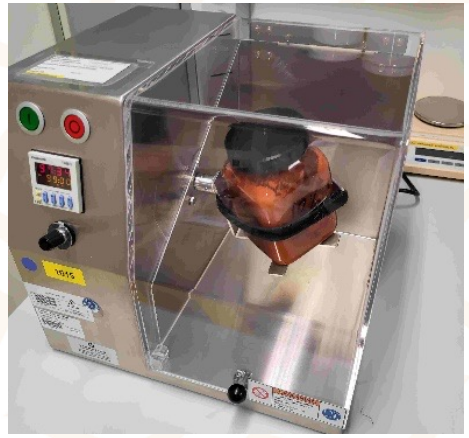
sample		class / order / suborder	FAM
Achatinidae	Achatinidae	Gastropoda / Stylommatophora / Achatinia	negative
Ant	***(Formicidae)***	**Insecta /Hymenoptera**	**positive**
Atlantic salmon	*(Salmo salar)*	Actinopterygii / Salmoniformes	negative
Beef	*(Bos taurus)*	Mammalia / Artiodactyla / Ruminantia	negative
Beetle larva	***(Pachnoda butana)***	**Insecta / Coleoptera / Polyphaga**	**positive**
Black bean aphid	***(Aphis fabae)***	**Insecta / Hemiptera / Sternorrhyncha**	**positive**
Blue mussel	*(Mytilus edulis)*	Bivalvia / Mytilida	negative
Blue shark	*(Prionace glauca)*	Chondrichthyes / Carcharhiniformes	negative
Buffalo worm	***(Alphitobius diaperinus)***	**Insecta / Coleoptera**	**positive**
Bumblebee	***(Bombus)***	**Insecta / Hymenoptera**	**positive**
Butterfly	***(Lepidoptera)***	**Insecta / Lepidoptera**	**positive**
Canola	*(Brassica napus)*	Plantae / Brassicales	negative
Charlock mustard	*(Sinapis arvensis)*	Plantae / Brassicales	negative
Chicken	*(Gallus gallus)*	Aves / Galliformes	negative
Colorado potato beetle	***(Leptinotarsa decemlineata)***	**Insecta / Coleoptera**	**positive**
Common rough woodlouse	*(Porcellio scaber)*	Malacostraca / Isopoda / Oniscidea	negative
Common squid	*(Loligo spp.)*	Cephalopoda / Myopsida	negative
Crocodile	*(Crocodilia)*	Reptilia / Crocodylomorpha / Crocodilia	negative
Cuttlefish	*(Sepia officialis)*	Cephalopoda / Decapodiformes / Sepiida	negative
Dragonfly	***(Odonata)***	**Insecta / Palaeoptera**	**positive**

epending on sample matrix,
de, DNA preparation and

/ was observed with DNA
rachnids with 100 %

Insects, seriell 1:10 (w/w) dilution experiment: 45 gram matrix plus 5 gram sample





3 x 5 s 10.000 rpm

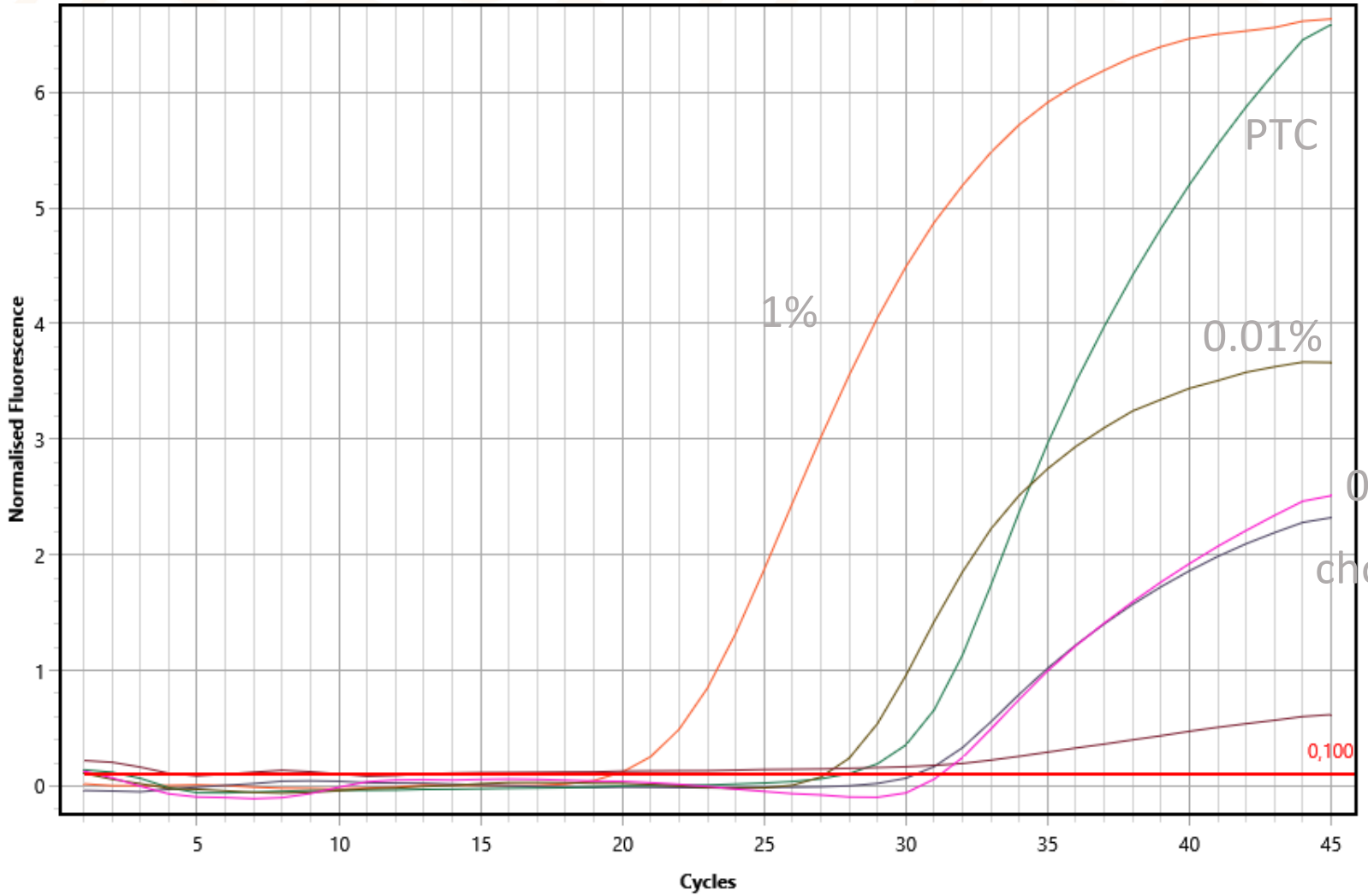
100% to 1 ppm

not a reference material

Laboratory material

…

Raw data



chocolate bar/cereals

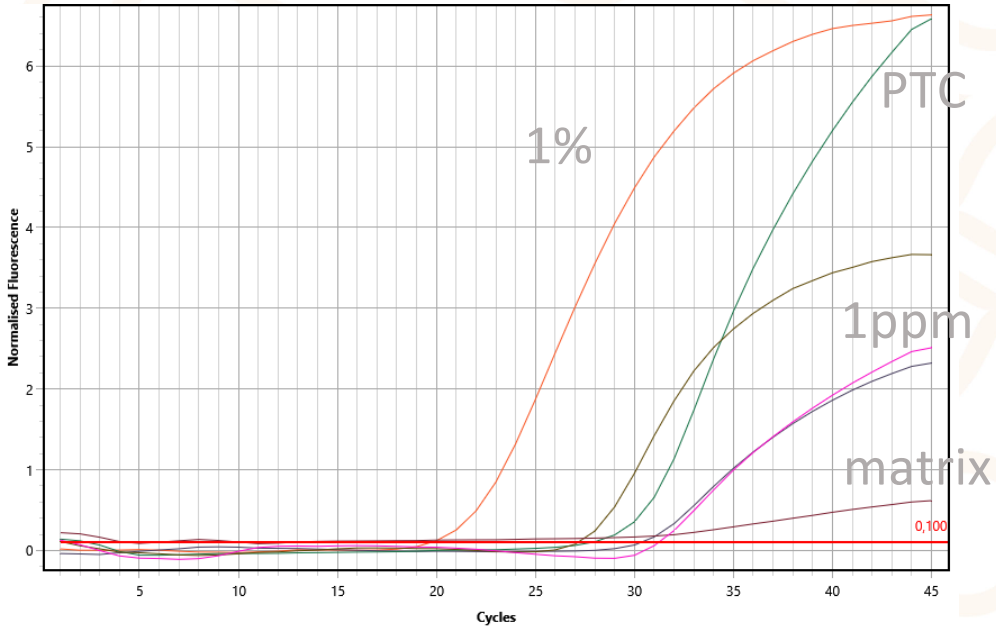
matrix oats

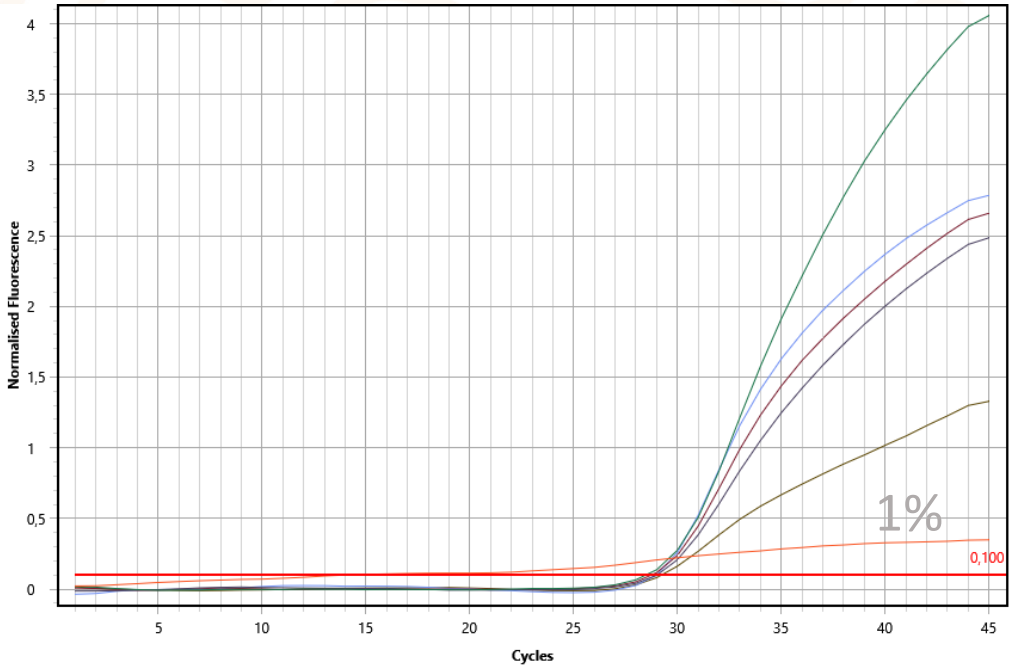
Automatic data extraction

insects

IAC

Ingredient contamination trace





matrix not calulated as positive, no curve, √

high protein concentration, dilute the DNA (e.g. 1:10) chocolate bar in ppm/sub-ppm range positve

check lab conditions

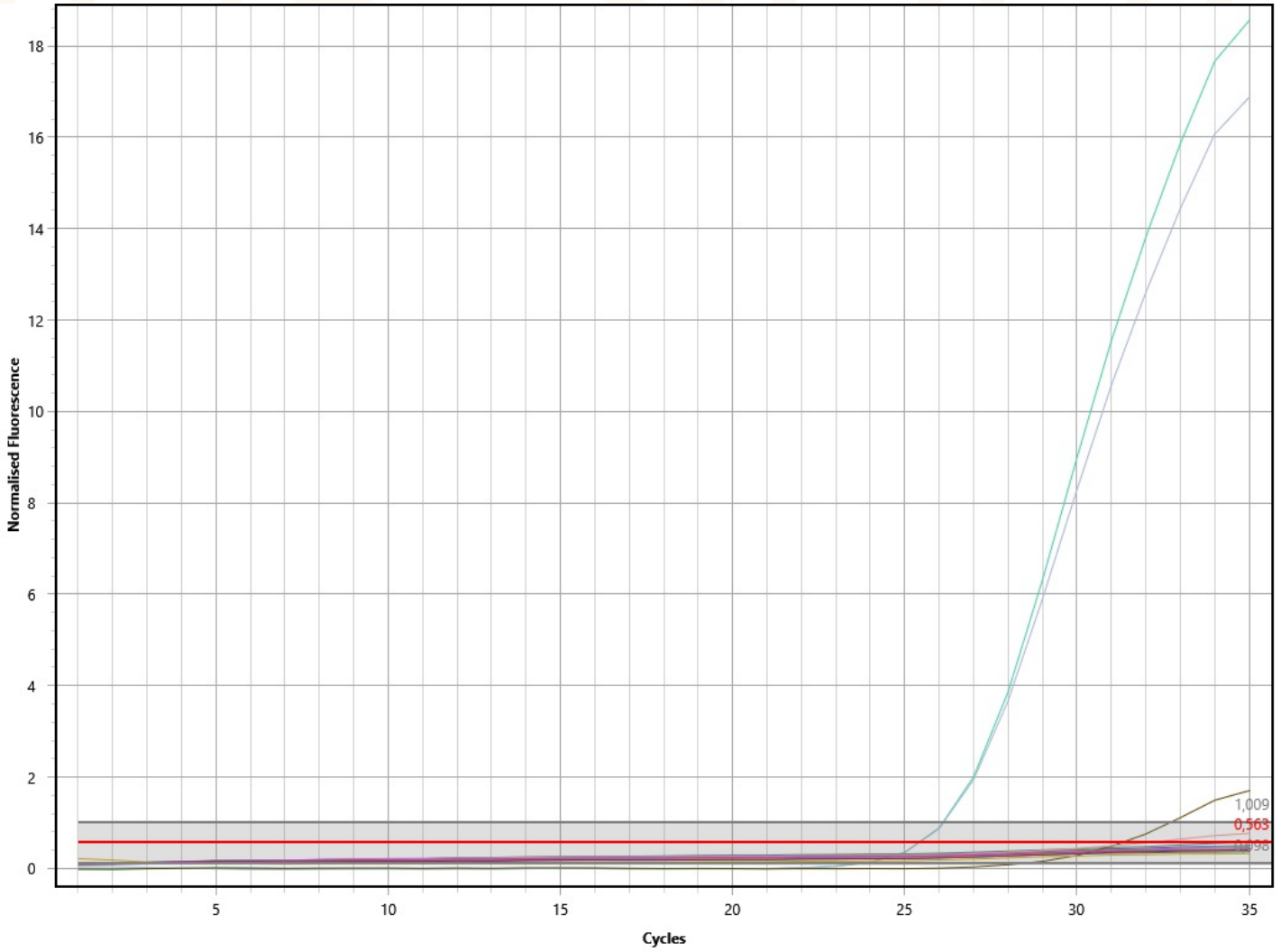
Sample matrices

Example:
Gelatine

DRRR
Profiency test

Pork sens

“problem“



1 of 2 results
(duplicate), presumptive; to be confirmed: if positive: porcine DNA detectable 2/3

مؤتمر عُمان الدولي السادس
لسلامـــة وجـودة الغـــذاء
Oman 6th International Conference
on Food Safety and Quality
12 - 14 يونيو 2023م - مسقط

Summary

modern highly processed, multi-component food can be of analytical challenge

qPCR (DNA methods) serves as sensitive technical tools - trace analytic is however difficult for correct interpretation

- Use proper controls: NTC, PTC, negative extraction (blank) controls, positive extraction controls
- Avoid contamination sources
- duplicates, confirmation
- Check not only Ct values, curves, software settings
- Standardisation, but not just SOP
- Profiency tests, education
- Information about product, production if available

Thank you for your attention

…what about Lab (pure cell culture) meat ?

technical, regulatory treshhold for insects? locusts? bee? differentiation?

مؤتمر عُمان الدولي السادس لسلامـــة وجـودة الغـــذاء

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#معاً_لغذاء_آمن

FSQC_OM