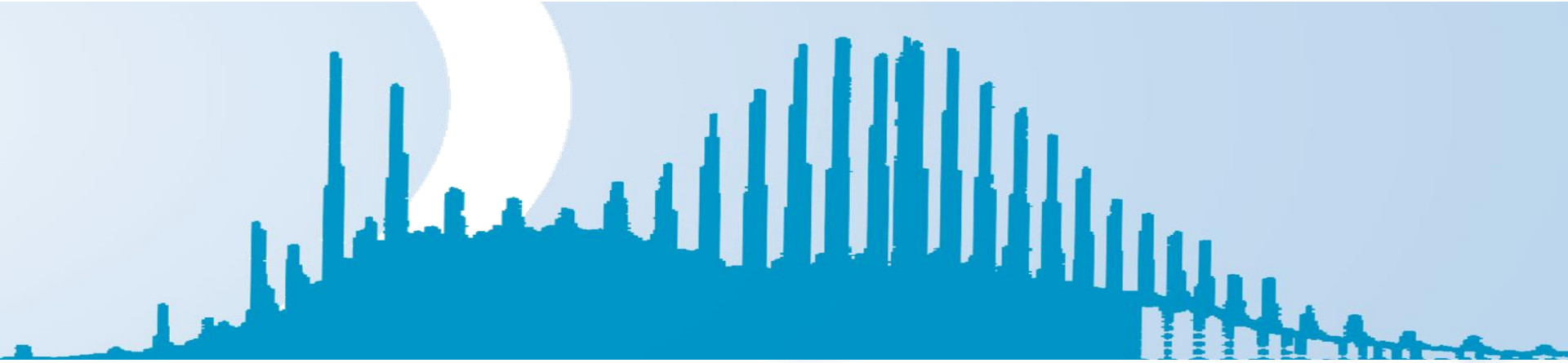
MOSH/MOAH

in Cocoa and Chocolate

» 3 Years Research «



Hamburg Cocoa Symposium

Kuehne Logistics University □ 12th May 2017 □ Hamburg/Germany

Reinhard Matissek

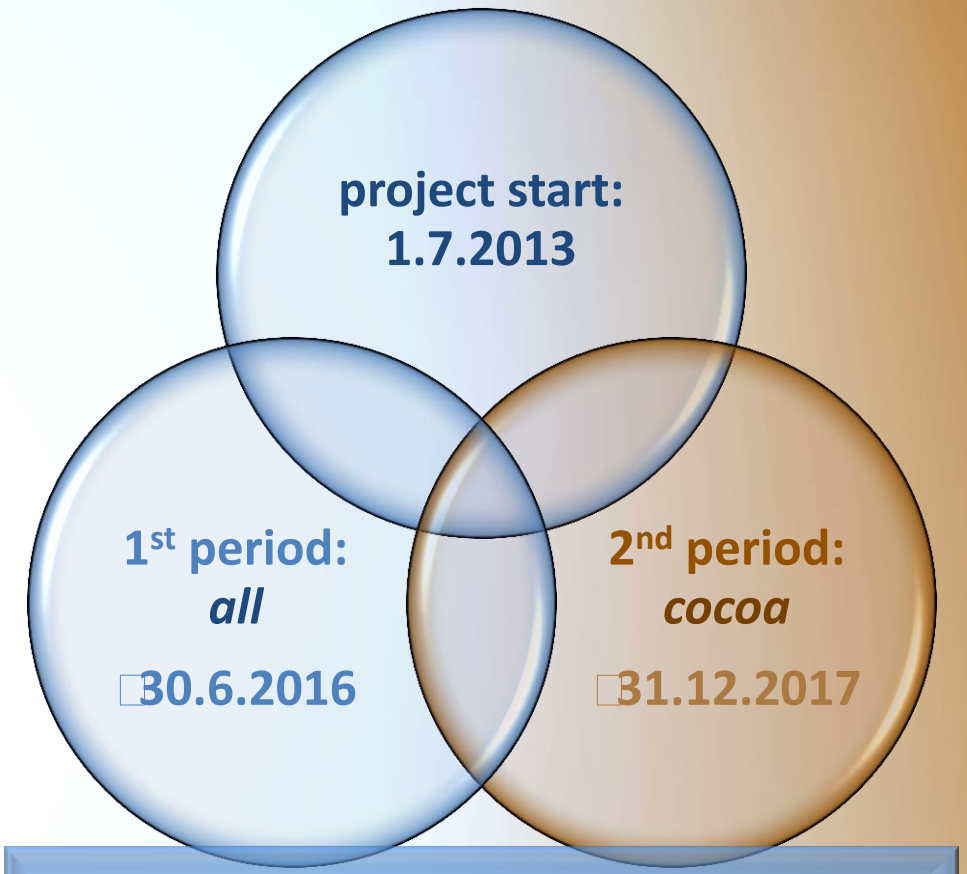
Food Chemistry Institute of the Association of the German Confectionery Industry (BDSI), Cologne/Germany

Lebensmittelchemisches Institut des Bundesverbandes der Deutschen Süßwarenindustrie (BDSI), Köln/Germany

MOSH/MOAH Joint Research Project – Set up

BDSI Bundesverband der Deutschen Süßwarenindustrie
Association of the German Confectionery Industry

Stiftung der Deutschen Kakao- und Schokoladenwirtschaft
Foundation of the German Cocoa and Chocolate Industry



Total Costs ≈ 1 Mio. €

Joint Research Project – Objectives

MOSH/MOAH

to minimise as far as possible

development

of a

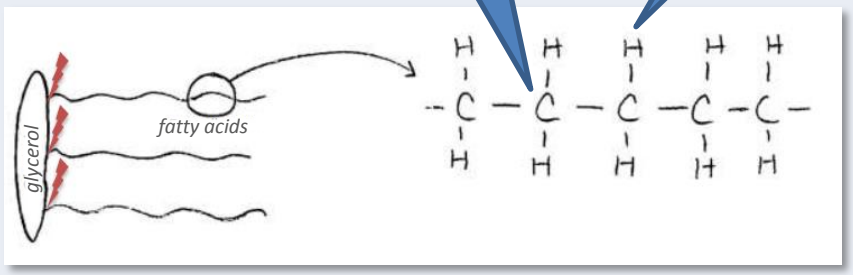
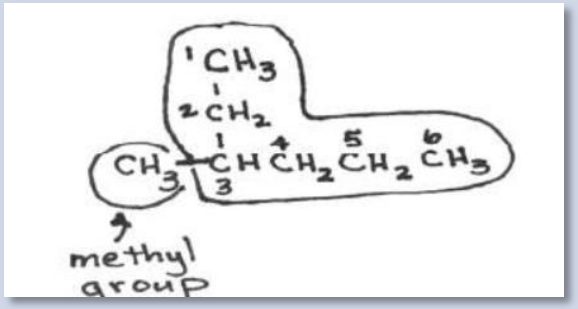
toolbox

Brief Chemistry

Mineral Oil *vs.* Edible Oil

C = Carbon

H = Hydrogen

Edible Oil		☐ obtained from plants or animals ☐ triglycerides ☐ digestible ☐ saponifiable
Mineral Oil	 carbon atom numbers: C16–C40(50)	☐ obtained from crude oil ☐ also produced synthetically from coal, natural gas or biomass ☐ indigestible ☐ unsaponifiable

The *correct* term

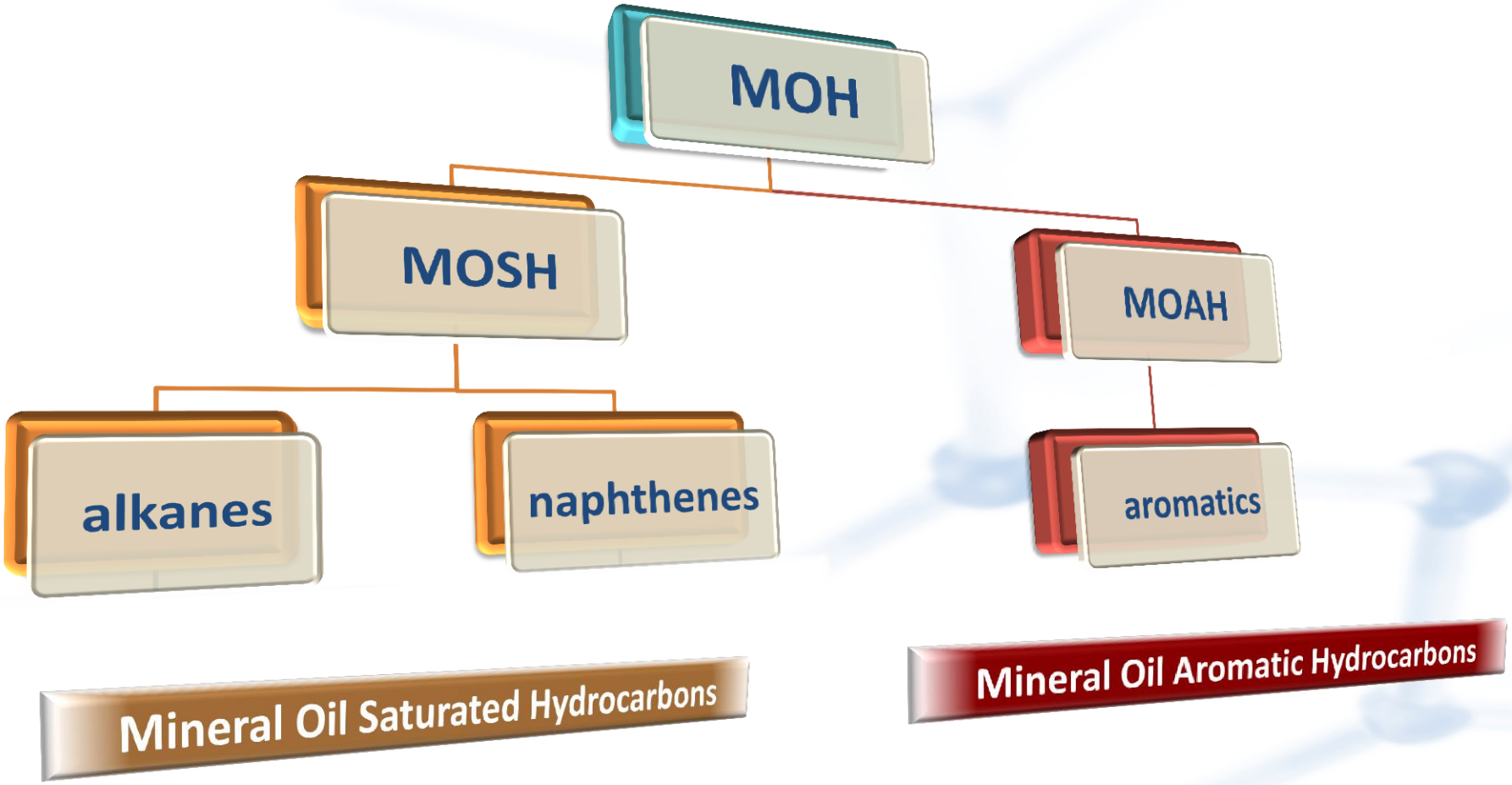
☞ **Important: It is not a question of ~~crude oil~~ itself!**

☞ it is a matter of purified fractions of mineral oil (destillates) for specific purposes

☞ hydrocarbons derived from mineral oil
„mineral oil hydrocarbons“

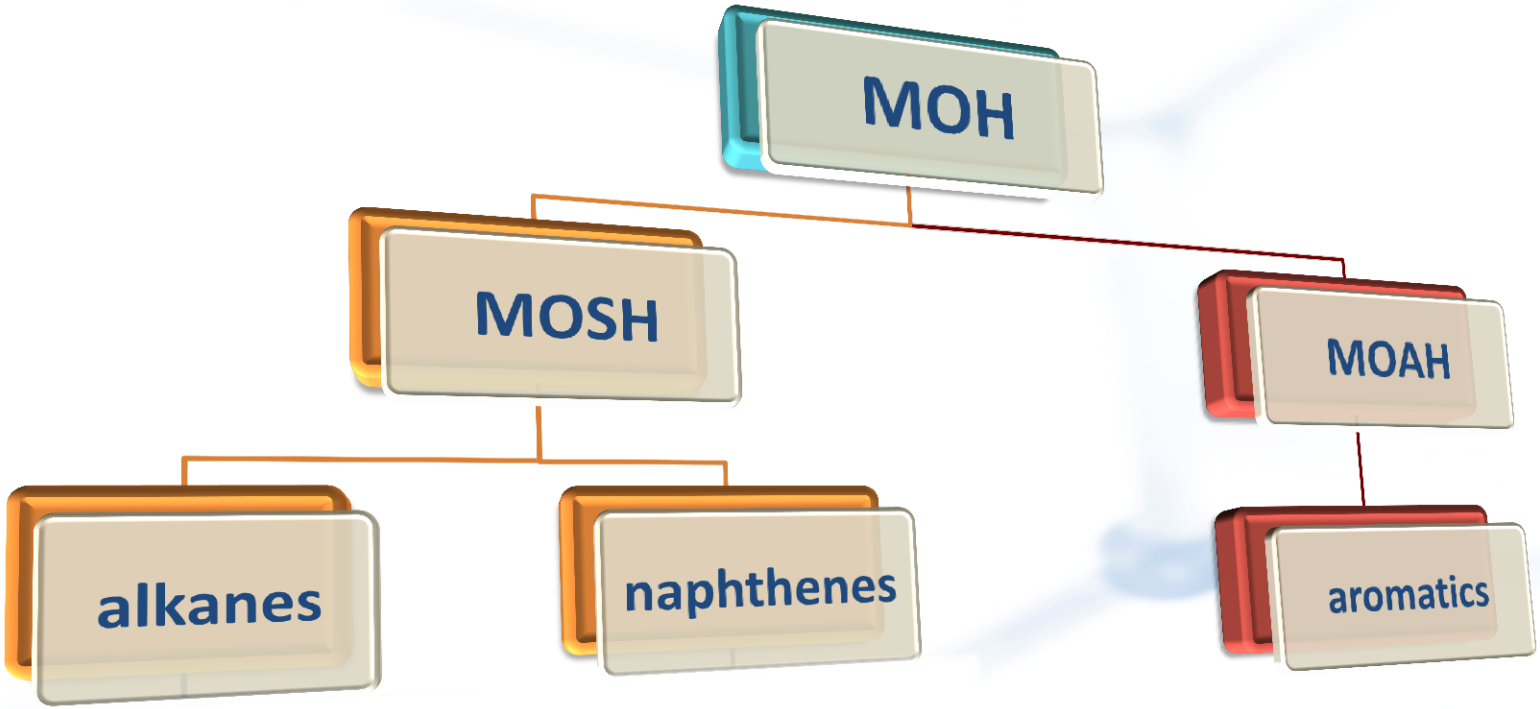
☞ **highly complex mixture of substances**:
e.g. printing inks (newspapers)

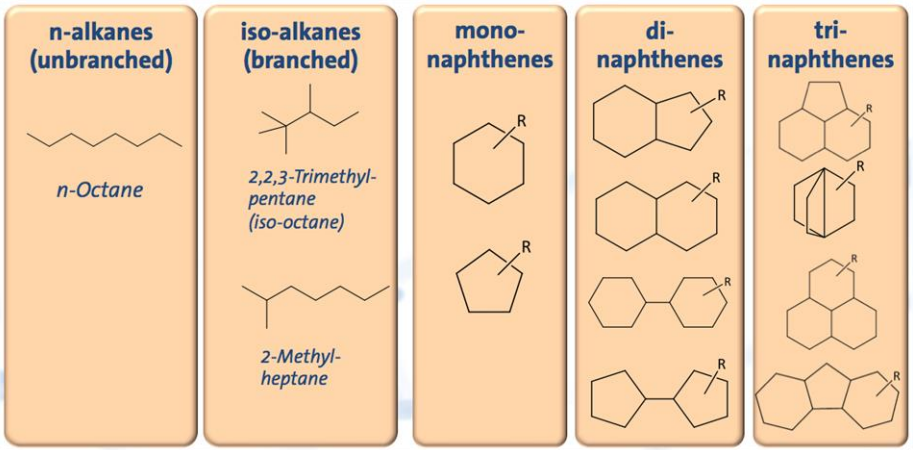
Mineral Oil Hydrocarbons (MOH) – Classification

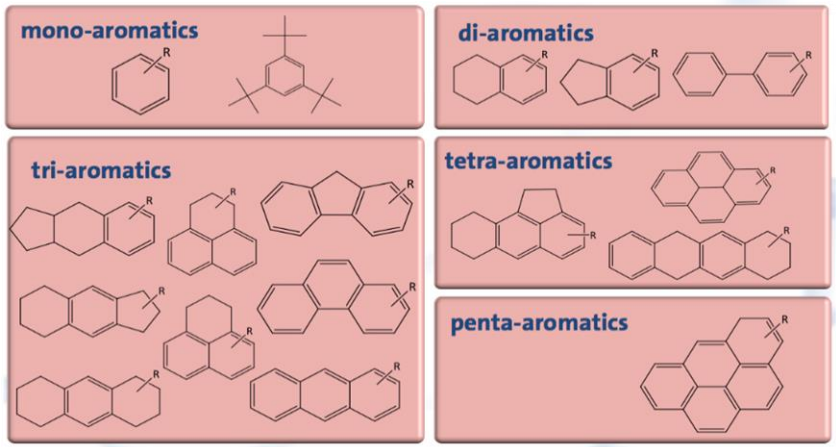


Source: EFSA Journal 2012 / BfR 2009

Myriads of Single Substances

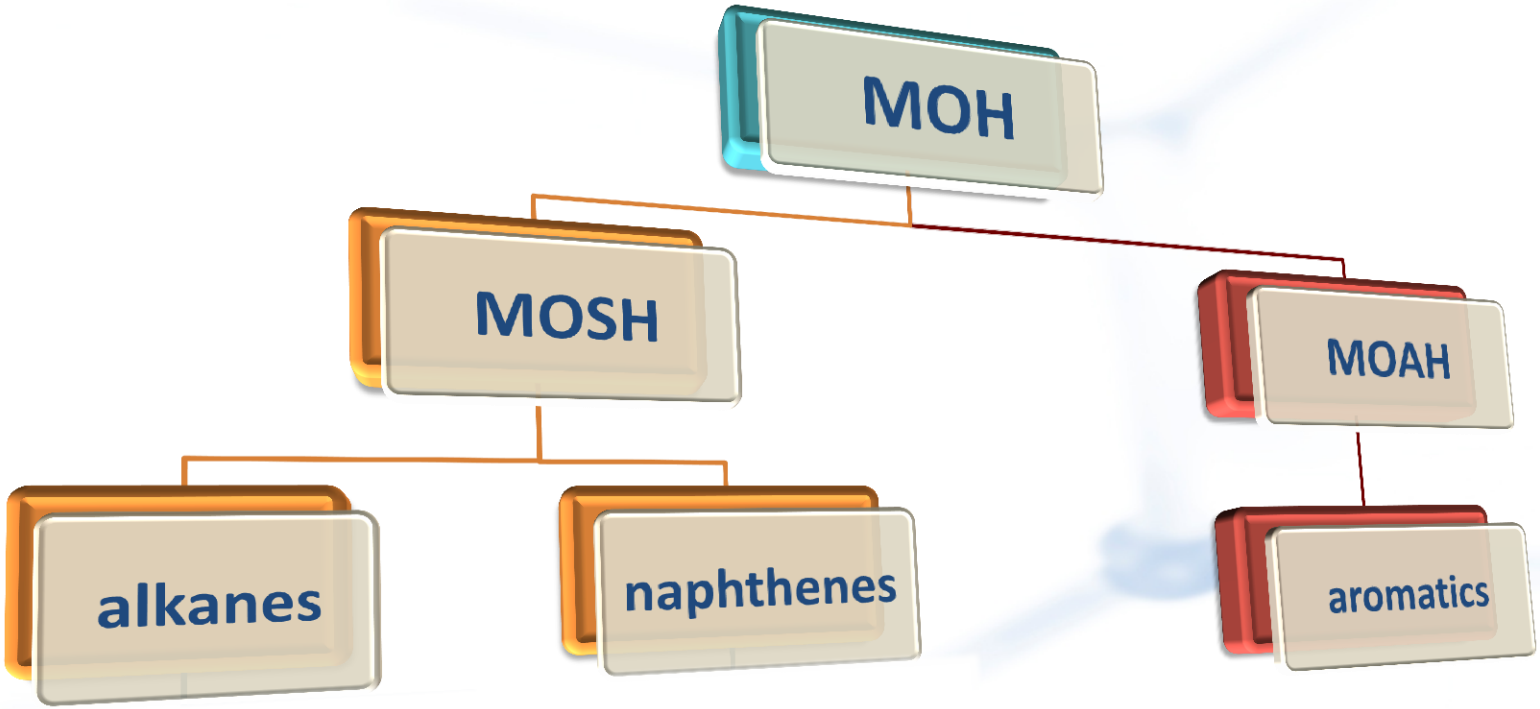


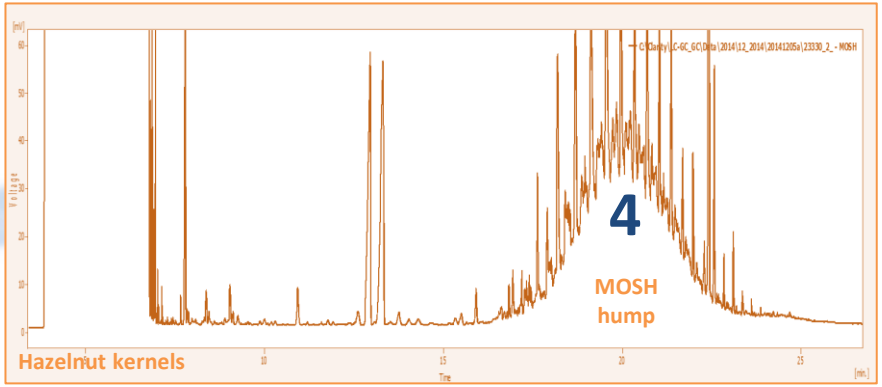




Source: EFSA Journal 2012 / BfR 2009

Composition classically found in Foods





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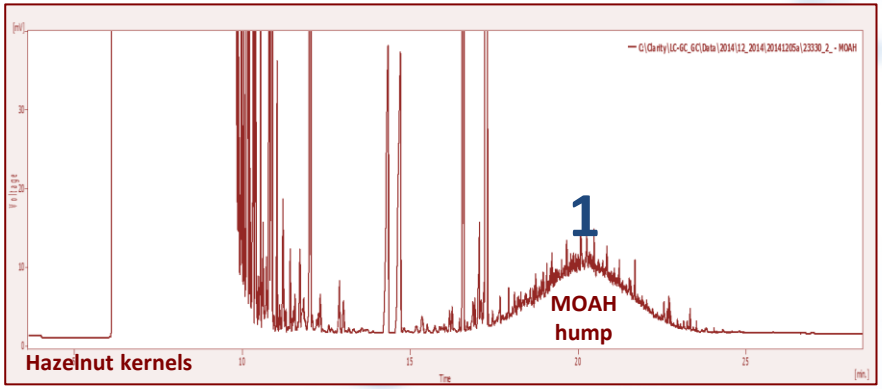
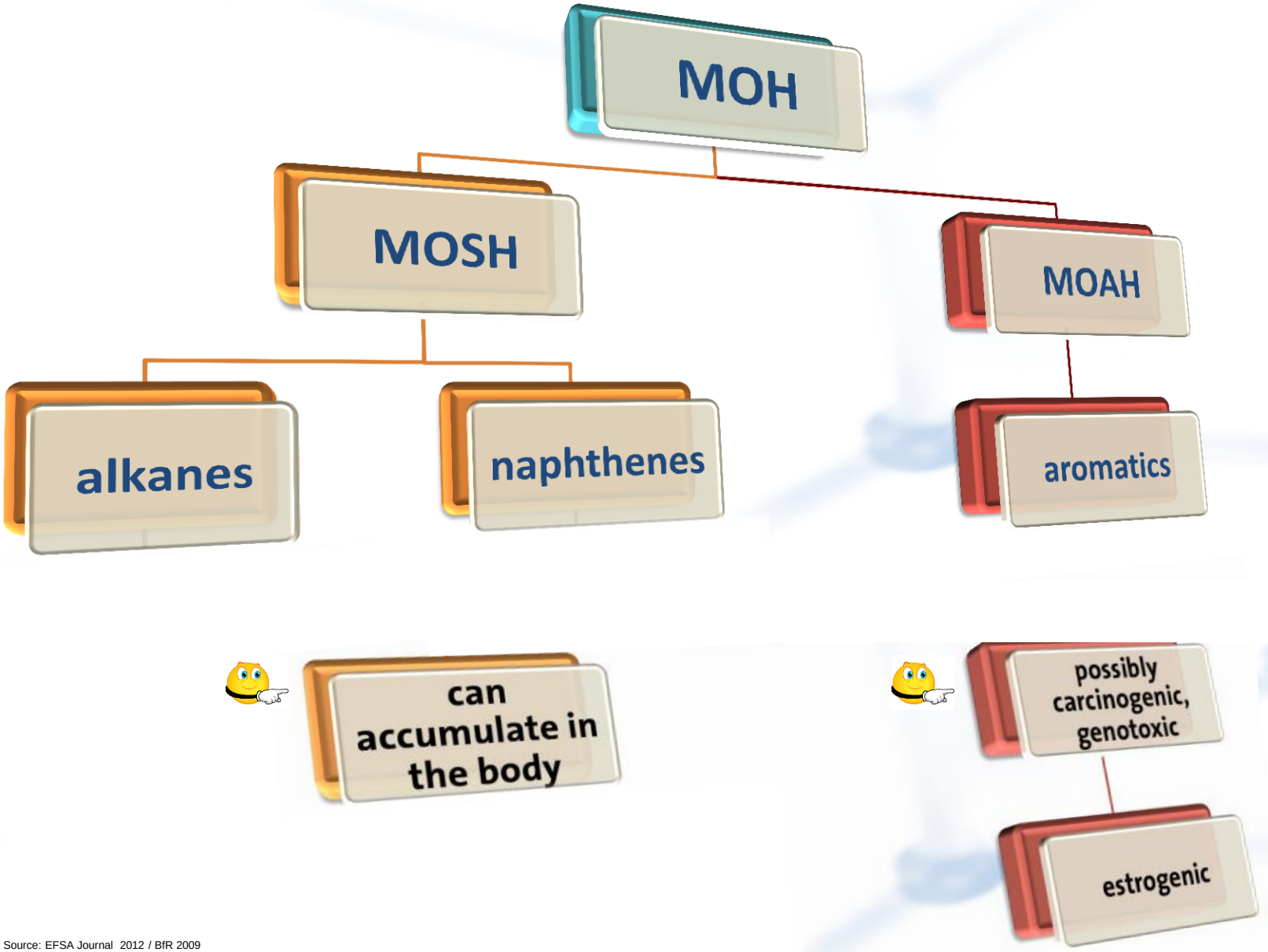


Impact on Health



Source: EFSA Journal 2012 / BfR 2009

European Food Safety Authority

EFSA Journal 2012;10(6):2704

SCIENTIFIC OPINION

Scientific Opinion on Mineral Oil Hydrocarbons in Food[1]

EFSA Panel on Contaminants in the Food Chain (CONTAM)[2, 3]

European Food Safety Authority (EFSA), Parma, Italy

Mineral Oil Ordinance 4th Draft of 24.2.2017

New! Only valid in Germany!

- **Regulation of the Migration of MOAH***
  - Migration limit is valid only for Food Contact Materials (FCM) made from waste paper material
  - A general limit in foods, which applies for all contamination sources, is not provided
- **Mandatory of Barrier**
  - Obligation to use a functional barrier
  - If barrier, then migration of MOAH = not detectable (LOQ: 0.5 mg/kg food / food simulant)
  - Exeptions from barrier engagement
- **MOSH-Regulation is not longer included**
  - problems of definitional and analytical differentiation
- **Entry into Force**
  - open

*MOAH: high alkylated aromatic hydrocarbons C16–C35; one or more rings
LOQ: Limit of Quantitation

EU Monitoring MOSH/MOAH

Commission Recommendation (EU) 2017/84 of 16 January 2017

- Based on the Scientific Opinion on Mineral Oil Hydrocarbons in Food
  [EFSA Journal 2012;10(6):2704]
- Adressing Member States – „with the active involvement of the food business operators“
- Collection of Data: Including **chocolate** and **cocoa**
  (as well as food contact materials for these products)
- Where MOSH/MOAH are detected in food, Members States should carry out investigations to determine possible sources
- Analytical method (CEN) is only related to fats and oils
  - EU-wide coordination of analytics by JRC

Systematic Approach

From raw material to ...

- Cocoa
- Oilseed
- Fats/Oils
- Grain
- Sugar
- Others

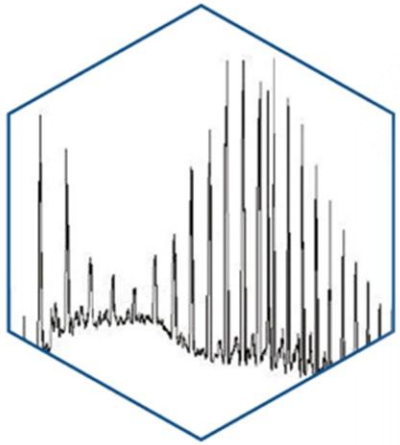
Commodity-based

Process-based

Processed Foods

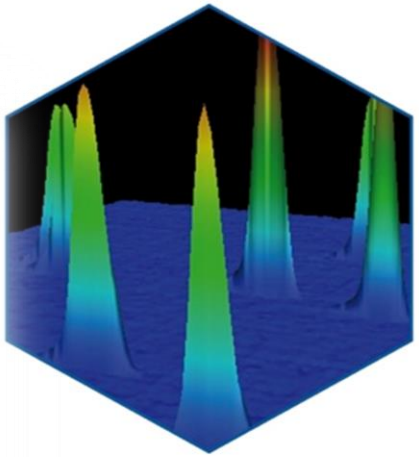
Scientific Approach

The State-of-the-Art Methodology



Surveying the humps [Quantitation]

Creating a database



Surveying the finger prints [Characterisation]

Detection, Characterisation and Tracking of Entry Sources

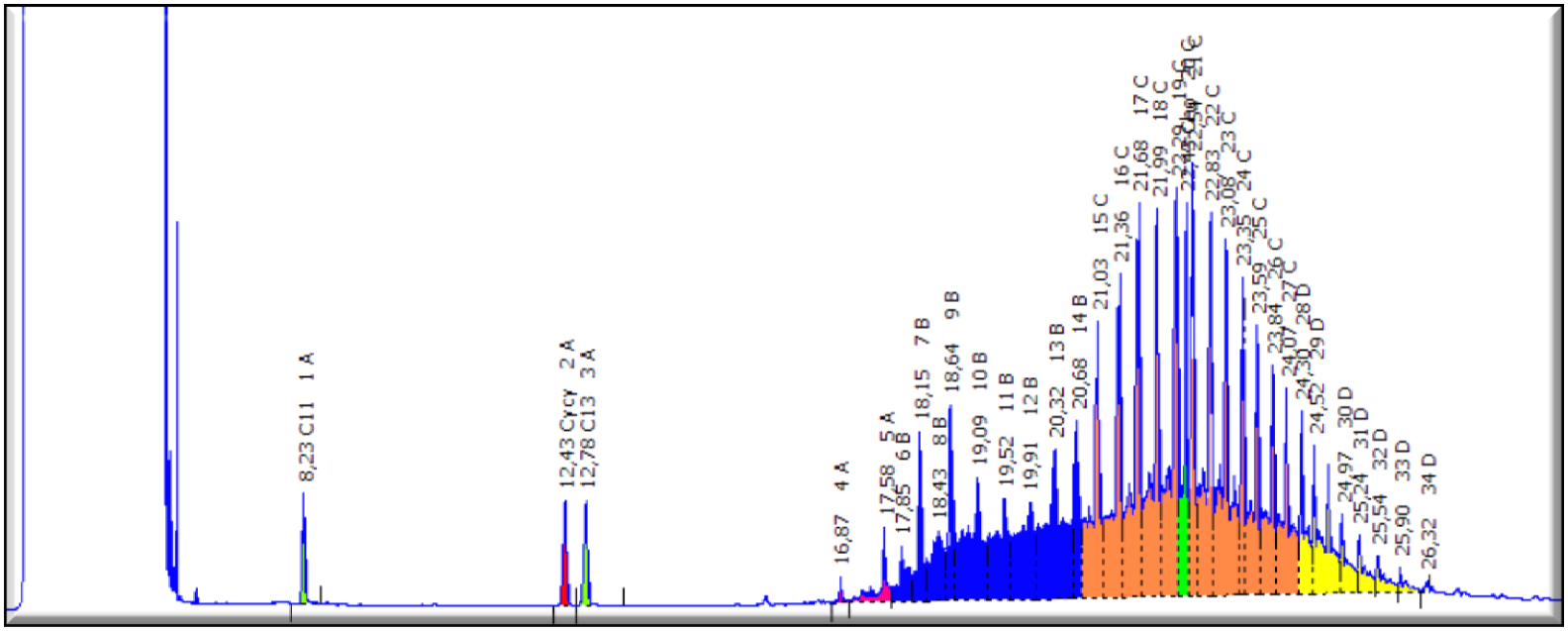
LC Liquid Chromatography; GC Gas Chromatography, FID: Flame Ionisation Detector; TOF: Time-of-Flight; MS: Mass Spectrometry

Online LC-GC-FID Method

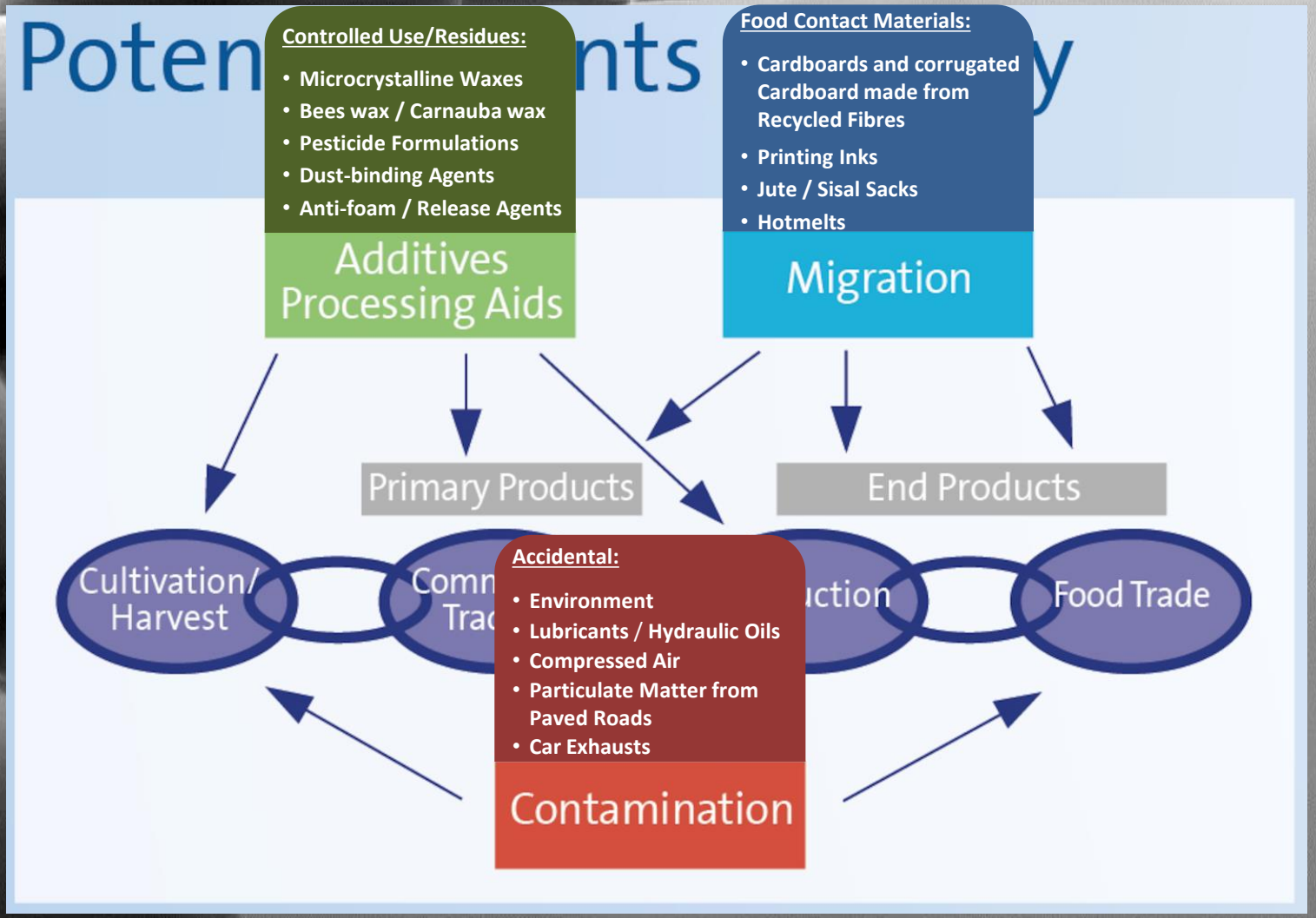
CEN Standardisation

DIN EN 16995:2016 draft

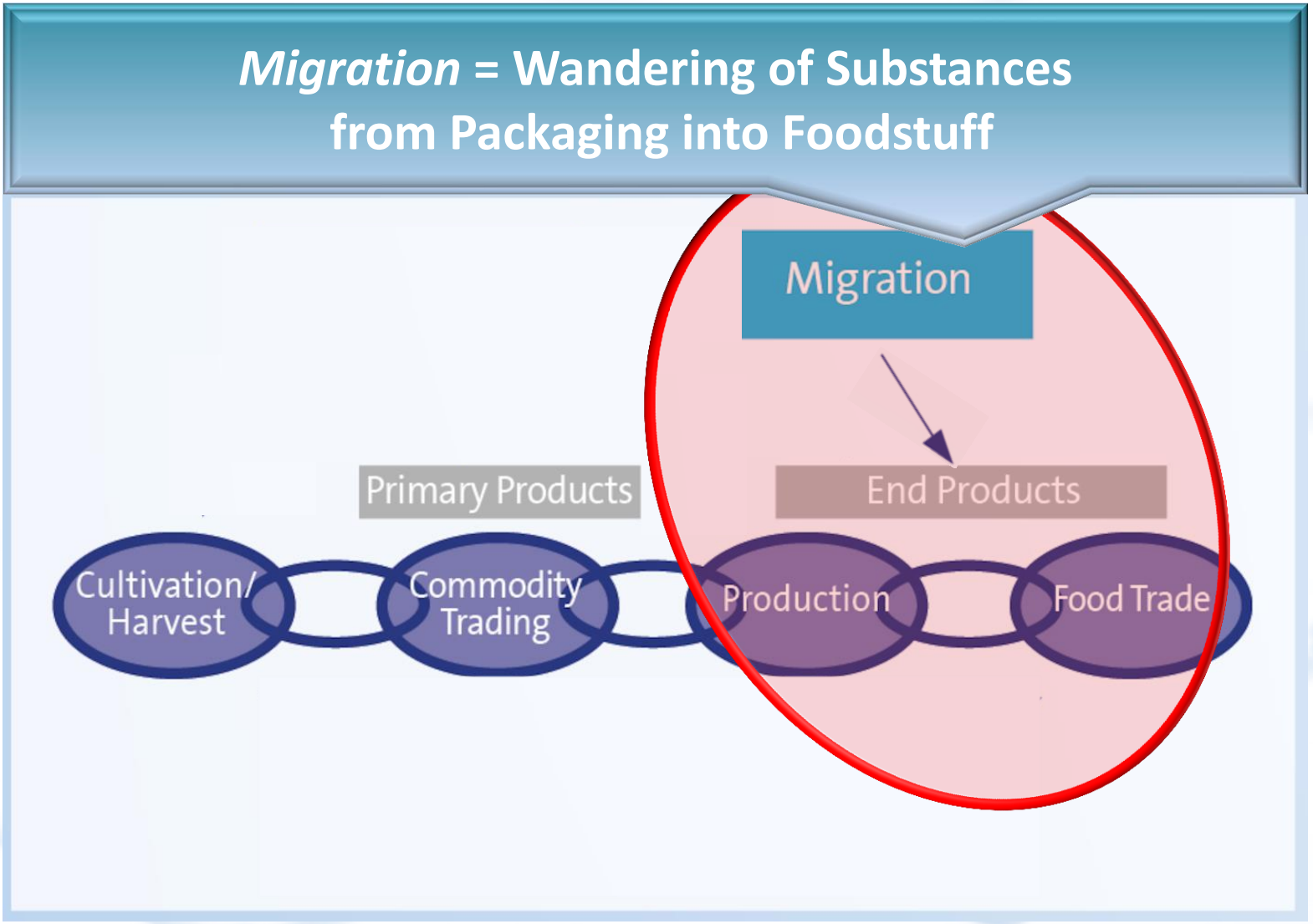
- online LC-GC-FID method *state of the art*
- draft since May 2016
- method should be finalized not before 2017



Milestone 1: Systematic Approach



In the Beginning: Focusing only on End Products



MOSH/MOAH Migration – Well known Sources

Food Contact Materials – End Products Packagings

- Migration from packagings made **with recycling paper**

- Migration from packagings with mineral oil based **printing inks**

- **Cross Migration from outer packaging** (cardboard/corrugated board/carton)

via gas phase

Migration – MOSH/MOAH≤C25
at room temperature

via direct contact

Migration – MOSH/MOAH≤C35

via indirect contact

Permeation through thin layers
– MOSH/MOAH≤C35

Migration Process *via* Gas Phase

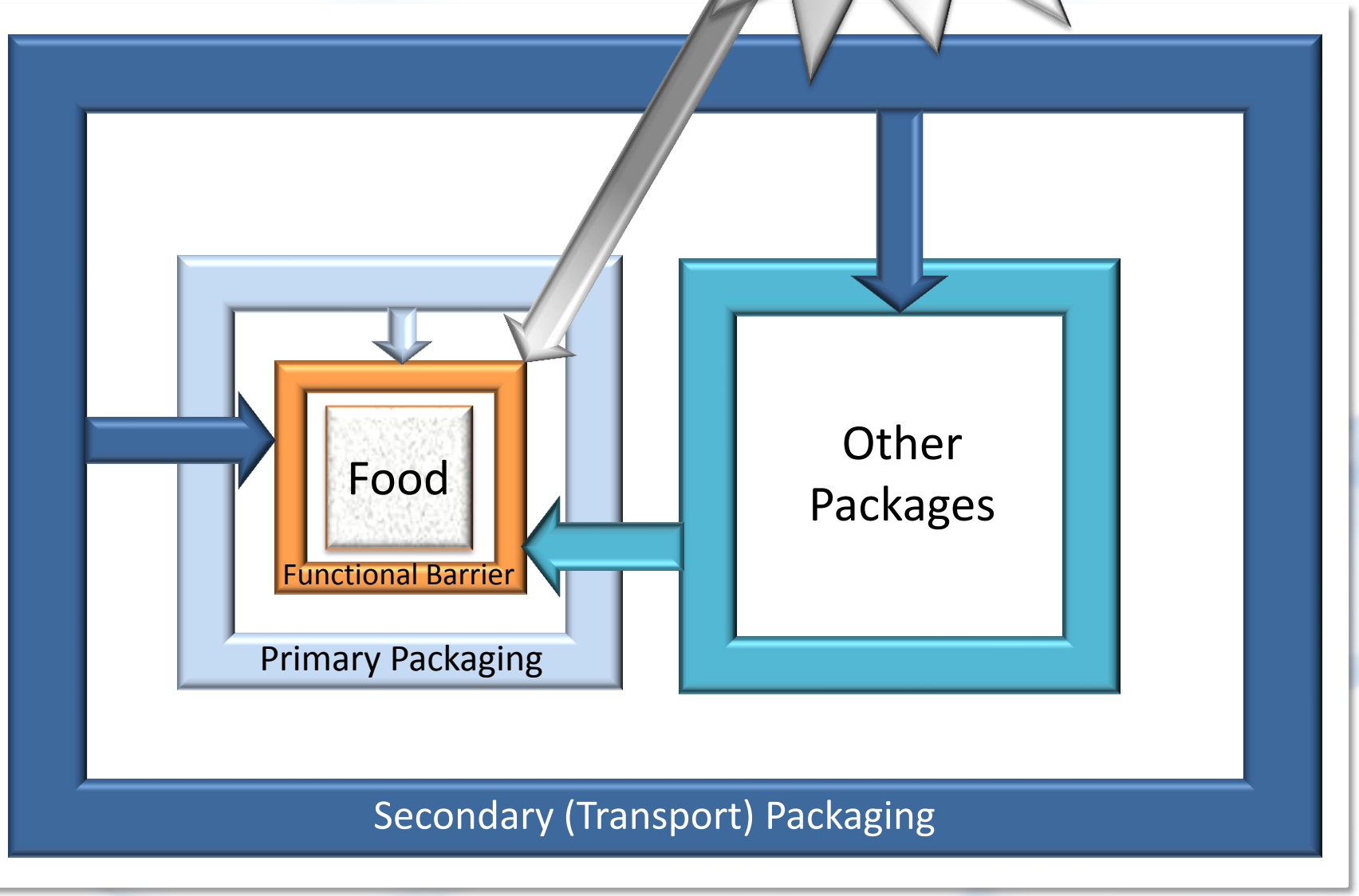
Evaporation at Room Temperatur

(MOH <C25)

Transport into Gas Phase

Recondensation into Food

Migration Process (schemati



Migration Process – Influences

Temperature

Properties of the Food

Functional Barrier (e.g. aluminium foil, PET)

Duration

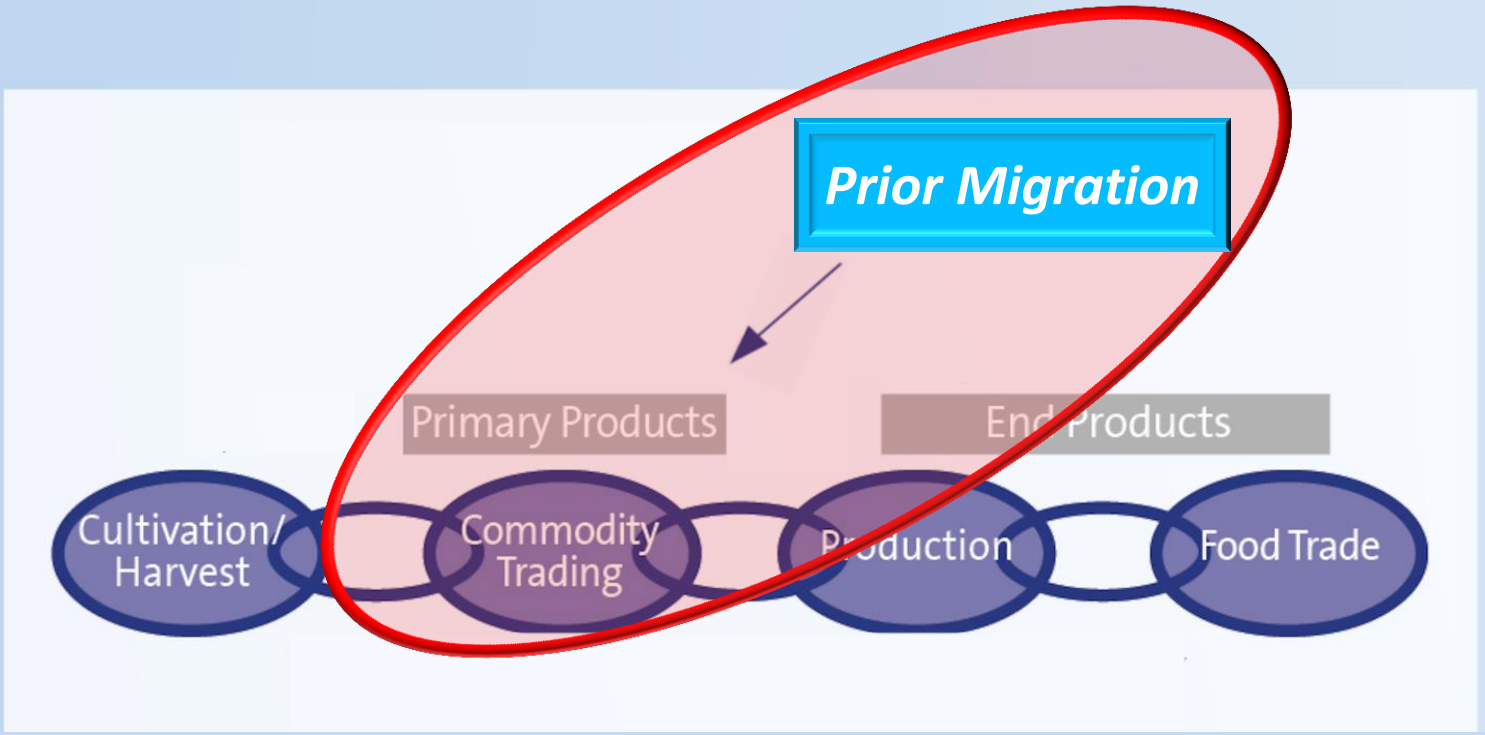
Tempory Barrier (e.g. PE, PP)

Amount of Substances which are capable of Migration

PE Polyethylene; PP Polypropylene; PET Polyethylenterephthalate

Milestone 2: Prior Migration

Potential Points of Entry



Identified Main Sources:

- Use of Recycled Cardbord
- Use of not really *mineral oil free* Bags (Jute/Sisal, Inks)

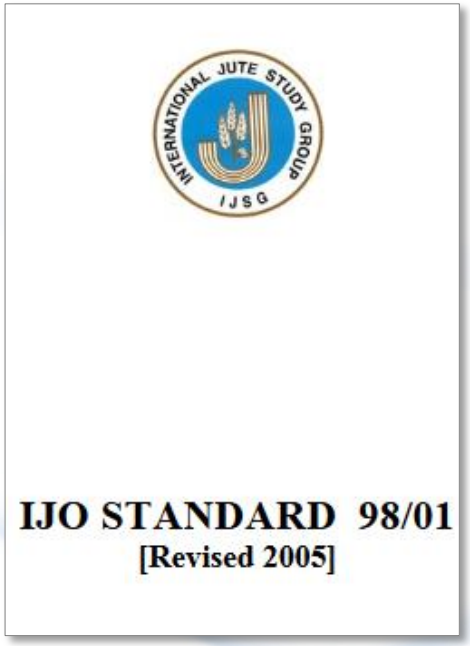
Shipping Container: Transport of Coffee, Cocoa, Nuts, Rice

Quelle: Matissek 2013

Quelle: http://legroupindustries.com/wp-content/uploads/2013/05/25kg-bags-LE-Group-Industries.jpg

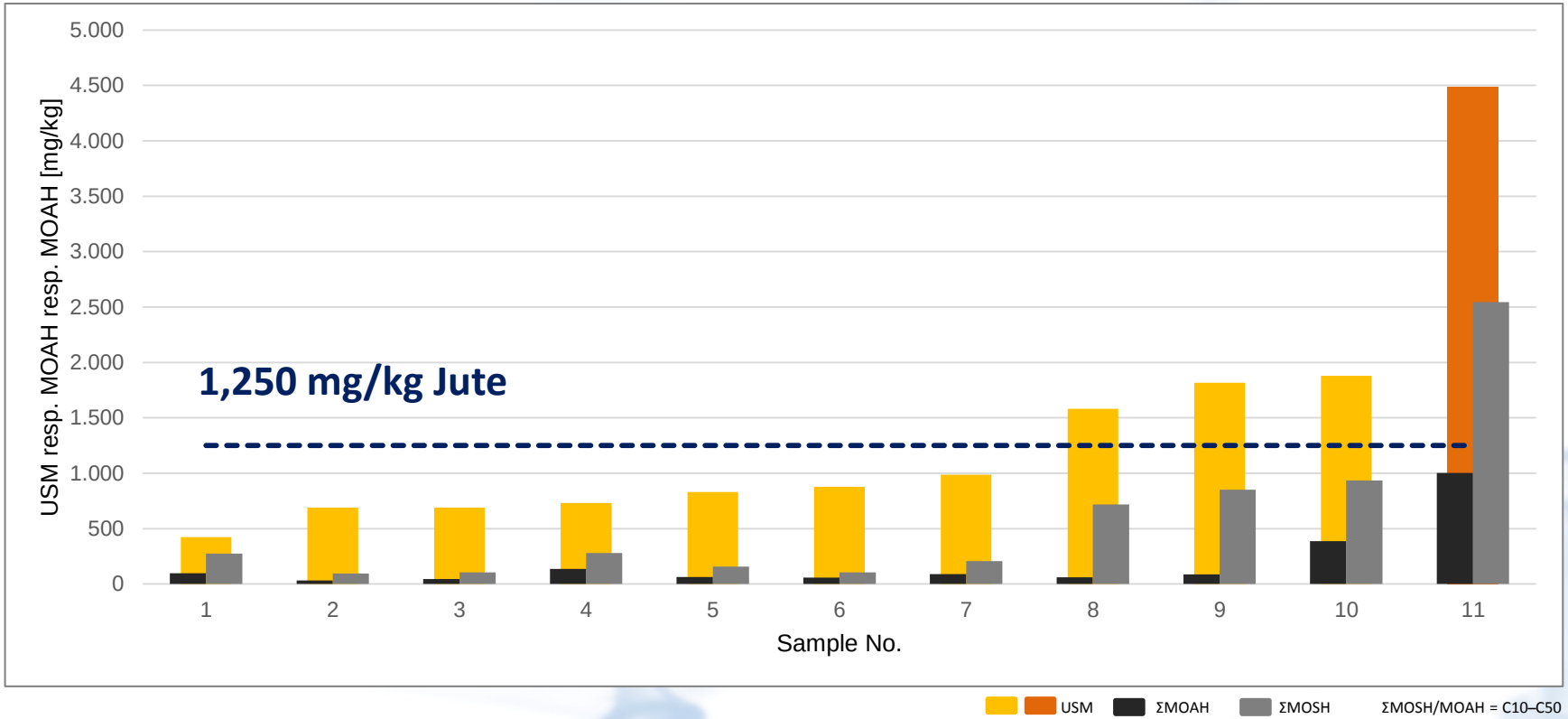
Quelle: http://vnfoodco.com/images/042012/IMG_2239.jpg

Jute Sacks – Food Grade Quality?



- **According to the International Jute Organisation – IJO (1998)**
  - Objectives: Substitution of mineral oils in jute sacks by vegetable oils
  - No toxic substances allowed
  - Definition of „Unsaponifiable Matter (USM)“ as an (unspecific) quality parameter was introduced
    - Specification of analytical method
    - USM_{max}=1,250 mg/kg Jute

Jute Sack Study

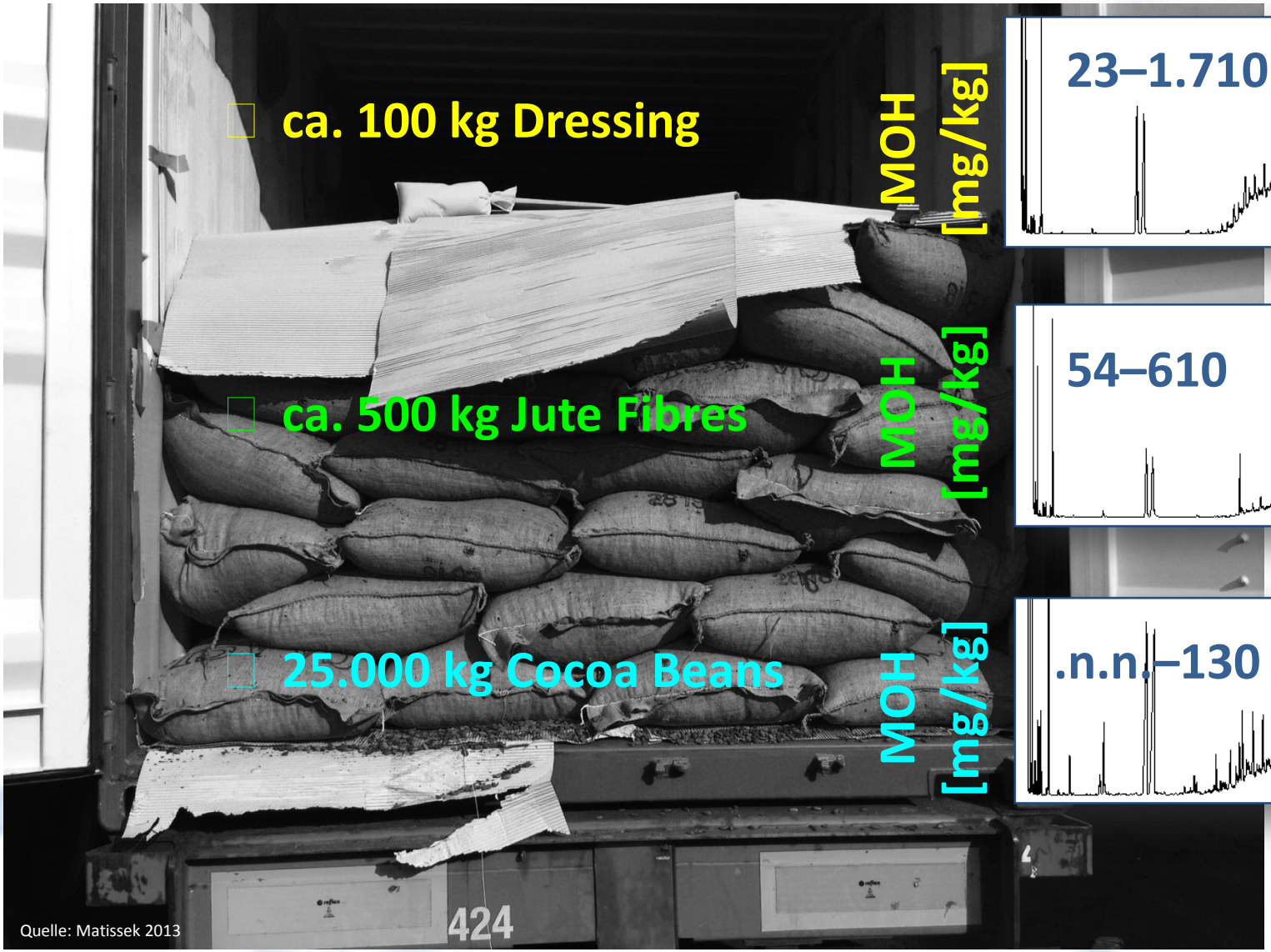


„Food Grade“ Jute Sacks can exceed the IJO Maximum level

They can contain remarkable amounts of MOSH/MOAH

Transport of Cocoa in Shipping Containers

Criss-Cross Exchange



MOH [mg/kg]

n= 16

MOH [mg/kg]

n= 32

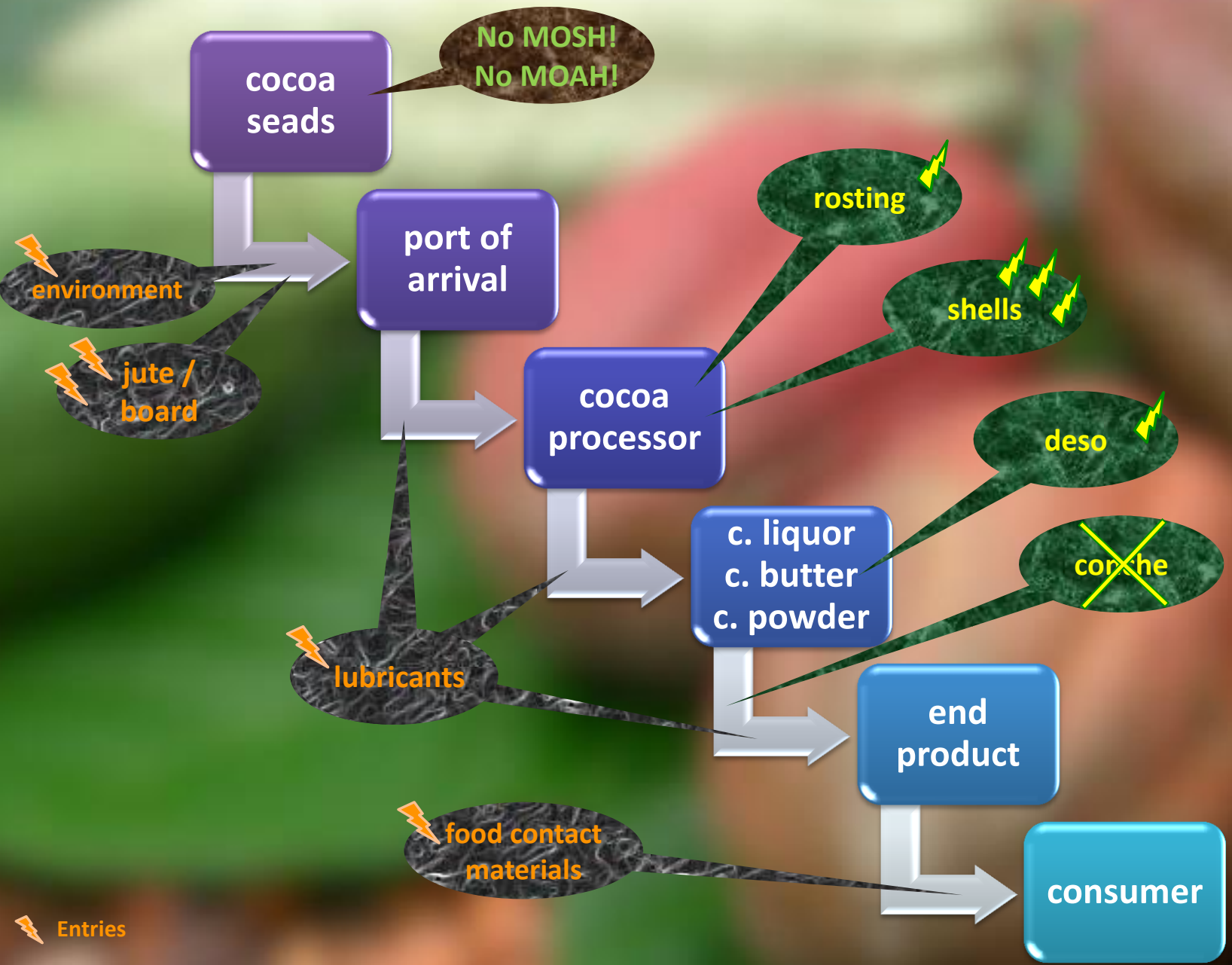
MOH [mg/kg]

n= 94

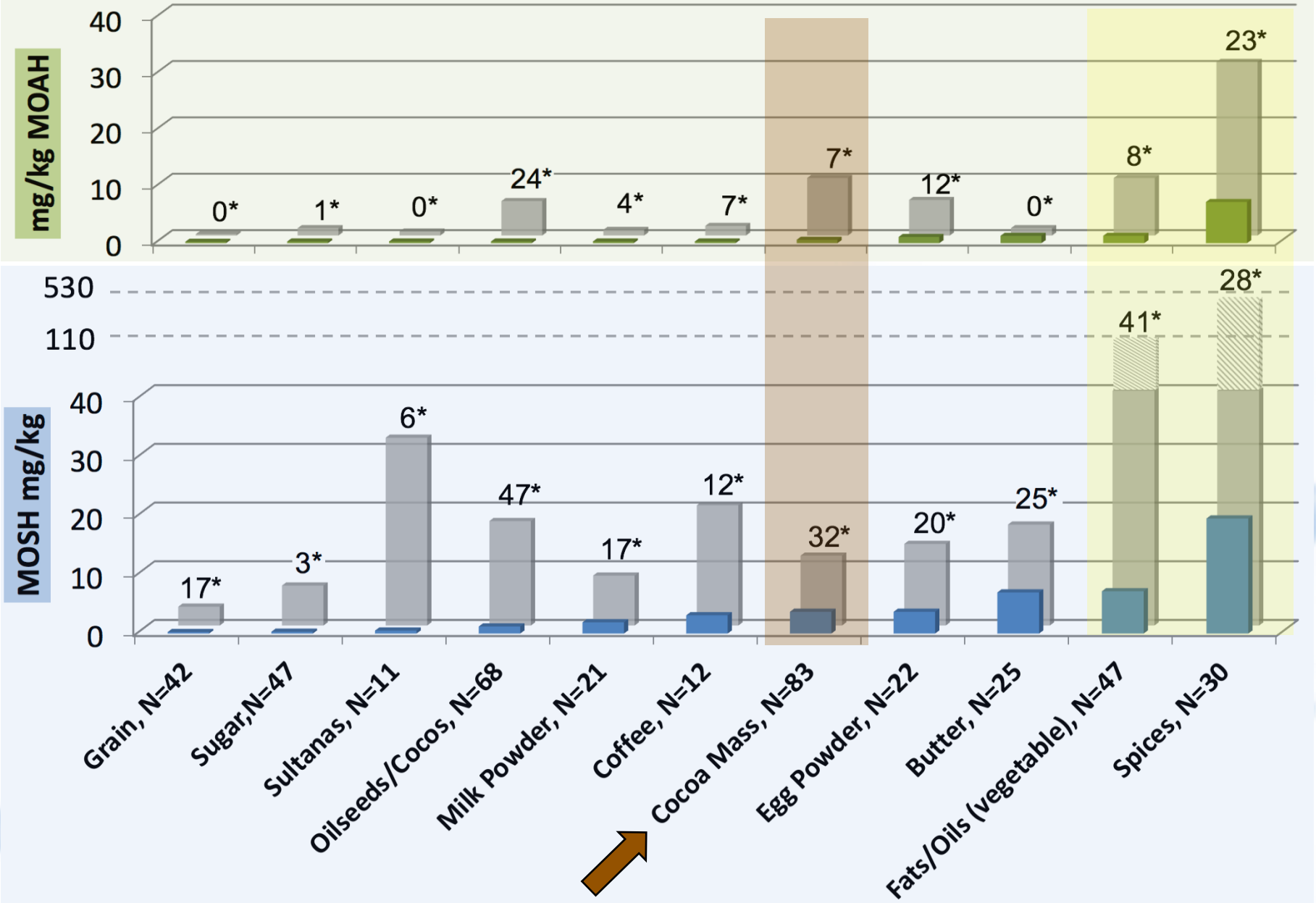
Quelle: Matissek 2013

MOH = ∑MOSH/MOAH

From „Bean to Bar“



MOSH/MOAH Contents in various Food Raw Materials

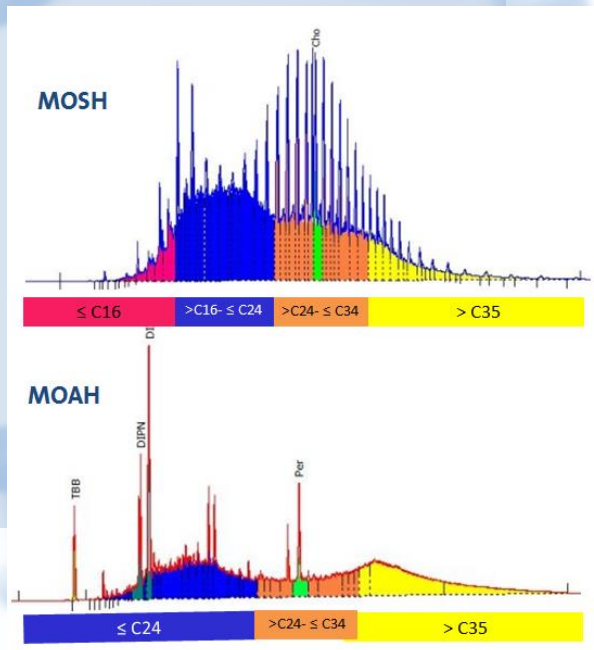


Median MOSH sorted by increasing order / Median MOAH sorted by increasing order MOSH-Content as well / Maximum / 2013–2016

* N>LOQ

Key Findings: In General

- MOSH/MOAH occur in the environment all around us and can therefore migrate into foods in very different ways
- Main source of migration of MOSH/MOAH into both raw materials and foods:
  - printing inks in recycled cardboard boxes, paper and corrugated cardboards
- Another importance source of entry:
  - Jute Bags



Key Findings: Jute Bags

- Jute Bags are used along the whole cocoa supply chain from farm to factory
- Approved Jute Bags („Food Grade Quality“) are not MOSH/MOAH free
- Migration of MOSH/MOAH *via* Jute Bags has to be avoided from the beginning

Actions: In General

Minimisation of the intake of MOSH/MOAH through finished products: BDSI TOOLBOX (continously updated – including recommendations):

- Fresh fibre packaging
- Mineral oil free inks
- Use of barriers in packaging
- others

Actions: Minimisation in the Cocoa Sector

Minimise the intake of MOSH/MOAH through commodities and semi-finished products:

- No contact with mineral oil components in the supply chain of cocoa (and other raw materials)
- Mineral oil free shipment/transport
- Mineral oil free jute/sisal bags

Milestone 3: The Master Plan