FOOD PACKAGING IN A CIRCULAR ECONOMY: STRATEGIES FROM A SCIENTIFIC VIEW

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Professor Packaging Technology - UGent

Design for recycling van verpakkingen
EMPACK, October 3th 2018

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VISION

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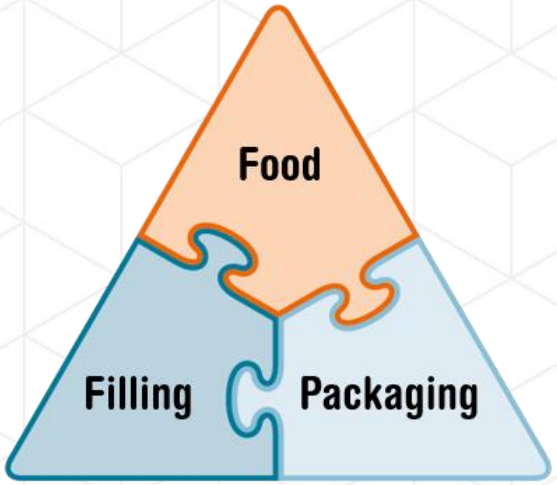
STRUCTURE

INDUSTRY ⟷ **RESEARCH INSTITUTES**



www.Pack4Food.be

Visit us at Food Partner Village

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COMPANIES

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PACKAGING IS?

Independent – 9/05/2016

De Zondag – 21/01/2018

dS De Standaard (/Zoeken)

Schokkende foto's tonen zee van plastic in tropisch paradijs

29/10/2017 om 08:05 door Guy Stevens

Foto: Caroline Power

Ooit was de kustlijn langs de Caraïbische Zee in Roatan (Honduras) een lust voor het oog. Daar is nog erg weinig van over, blijkt uit foto's van een fotograaf die ter plaatse woont, en dat is te danken aan onszelf. De zee ligt er vol met plastic.

Argusactueel.be

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PACKAGING IS?

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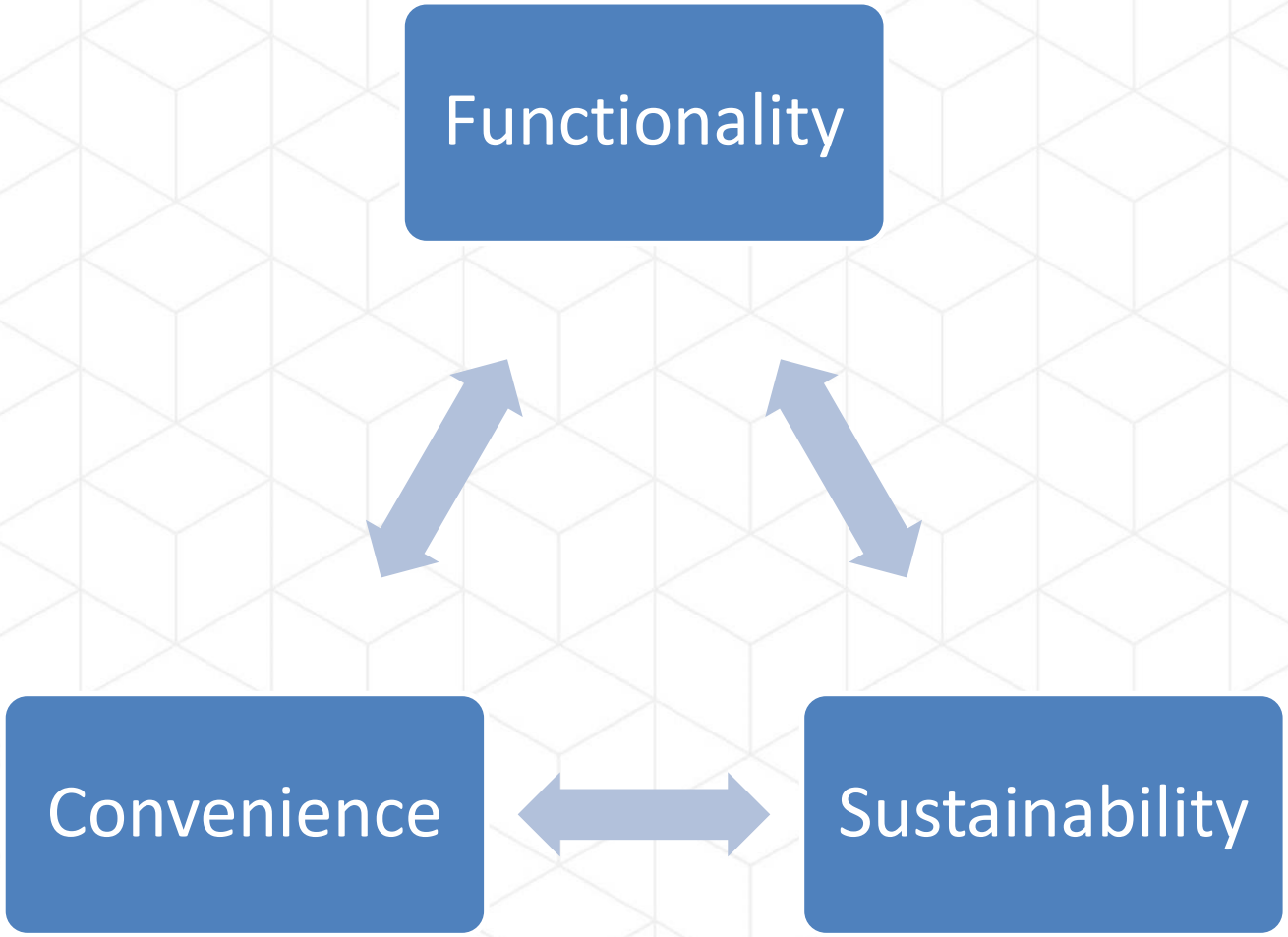
PACKAGING IS?

http://www.fao.org/

Source: https://www.profoodworld.com

PACKAGING IS

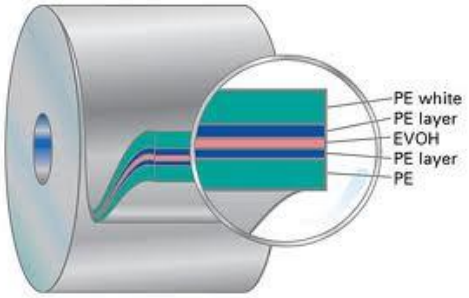


PACKAGING - FUNCTIONALITY

DELICIOUS & HEALTHY FOODS

- Mild preservation technology
- Less use of additives
- Reduction in fat, sugar and salt content
- Globalisation

Stability of food products?



www.lamitubes.com

- Multilayer packaging
  - EVOH, PVdC, aluminium, nanoparticles,AlOx,...
  - Plasmatechnology: SiOx, carboncoating

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PACKAGING - FUNCTIONALITY

DELICIOUS & HEALTHY FOODS

- Mild preservation technology
- Less use of additives
- Reduction in fat, sugar and salt content
- Globalisation

Stability of food products?

- Multilayer packaging
- Modified atmosphere packaging (MAP) + increase in cold storage shelf-life
- Active packaging (e.g. O_2-absorbers)

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FOOD PACKAGING

TOWARDS A CIRCULAR ECONOMY

- Key message 1: always consider the packaged product
  ie. product + package

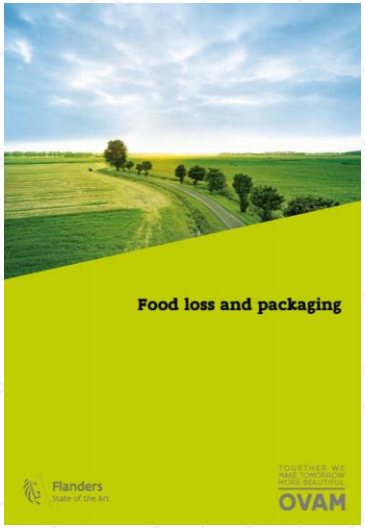
Measure *Per packaging unit 350—500g fresh meat*	Energy usage for packaging (MJ)	Estimated loss (%)	Energy loss through loss (MJ, for pork)	Total packaging + loss (MJ)
Packed under normal atmosphere (NA) (absolute qty.)	0,7	9,00%	7	7,7
From NA to MAP	1,5	-5,00%	-4,3	-2,8 (-37%)
From HiOx MAP to VSP	–1,1	-3,00%	-1,7	-2,8 (-36%)
From HiOx MAP to LowOx MAP	0	-3,00%	-0,4	-0,4 (-5%)
From MAP PET to rPET	-1,1	0,00%	-1,4	-2,4 (-31%)

Table 9: Average reduction (-) or addition (+) of energy usage and percentage of loss per packaging option for fresh meat, calculated on the basis of the results (Van Velzen, 2011).

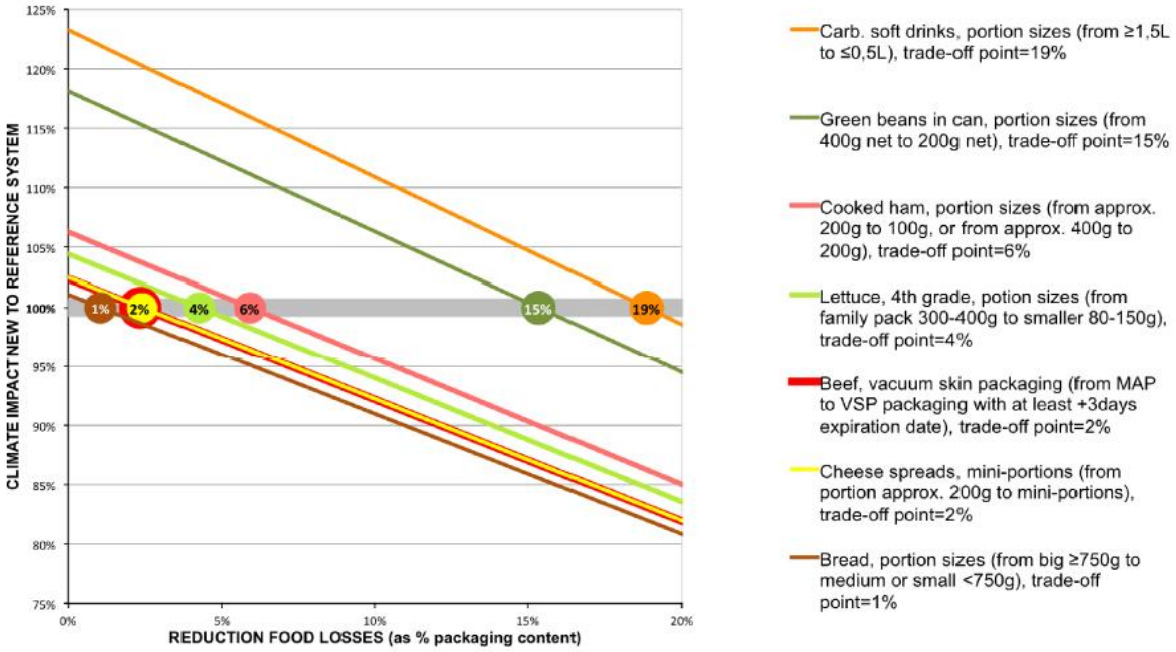
photo: Multivac

FOOD PACKAGING

TOWARDS A CIRCULAR ECONOMY



- Key message 1: always consider the packaged product ie. product + package



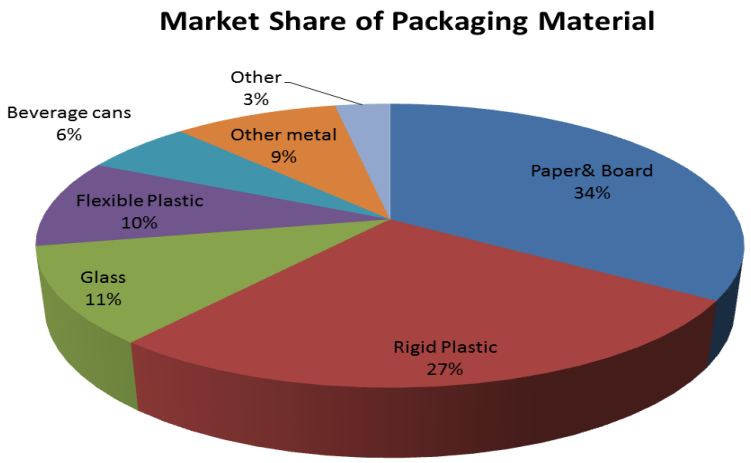
https://www.ovam.be/sites/default/files/atoms/files/2015-Report-OVAM-Food-loss-and-packaging-DEF.pdf

FOOD PACKAGING

TOWARDS A CIRCULAR ECONOMY

- Key message 1: always consider the packaged product
  ie. product + package

- Key message 2: aim for packaging optimization
  - Responsability for all stakeholders in packaging chain
    - How much materials needed?
    - Which type of materials needed?



Data: Rexam (2011)

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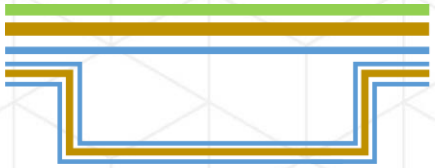
TOWARDS A CIRCULAR ECONOMY

- Tray + topfilm

PP < PET << EVOH

MONOLAYER

MULTILAYER BARRIER TOPFILM



MULTILAYER BARRIER TRAY + TOPFILM

- Higher barrier = better protection?

Investigated in project OPTIBARRIER

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OPTIBARRIER

WHAT IS THE OPTIMAL BARRIER?

FLANDERS INNOVATION & ENTREPRENEURSHIP

Flanders State of the Art

- Collective research project
- 61 companies, 20% cofinancing
- 6 research institutes
- 80% funded by Flanders
- €2.000.000
- 4.3 FTE
- 2015 - 2019

Can the same shelf life be reached in a packaging with less barrier?

Does a higher barrier correlate with a longer shelf life?

Is a light barrier necessary?

Which materials are a functional barrier for migration?

What is the optimal barrier?

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OPTIBARRIER

RESEARCH INSTITUTES

GHENT UNIVERSITY

NU3 chem FOOD

VFMPA

PMT

VerpakkingsCentrum IMO-IMOMEC

UHASSELT imec

KU LEUVEN

LABORATORIUM VOOR LICHTTECHNOLOGIE

IBE-BVI

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OPTIBARRIER

CASE: READY-TO-EAT MEAL

Product	Ready-to-eat meal
Shelf life	8 days at 4°C
Packaging Concepts	**LOW barrier:** OPA/EVOH/PP foil + PP tray **MEDIUM barrier:** PET tray + PET foil **HIGH barrier:** PP/EVOH/PP tray + OPA/EVOH/PP foil
MAP	50 % CO_2 – 50% N_2

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OPTIBARRIER

CASE: READY-TO-EAT MEAL

O_2 barrier of package	Low	Medium	High
Foil			
Material	OPA-EVOH/PP	PET	OPA-EVOH/PP
Thickness	65µ	40µ	65µ
OTR*	6 cc/m²/d	33 cc/m²/d	6cc/m²/d
Tray			
Material	PP	PET	PP/EVOH/PP
OTR*	2 cc/tray/day	0,07 cc/tray/d	0,001 cc/tray/d

**OTR measurements conditions: 23° C*

50% RH outside of package, 90% RH inside of package

Foils: 100% O_2, trays: 21% O_2

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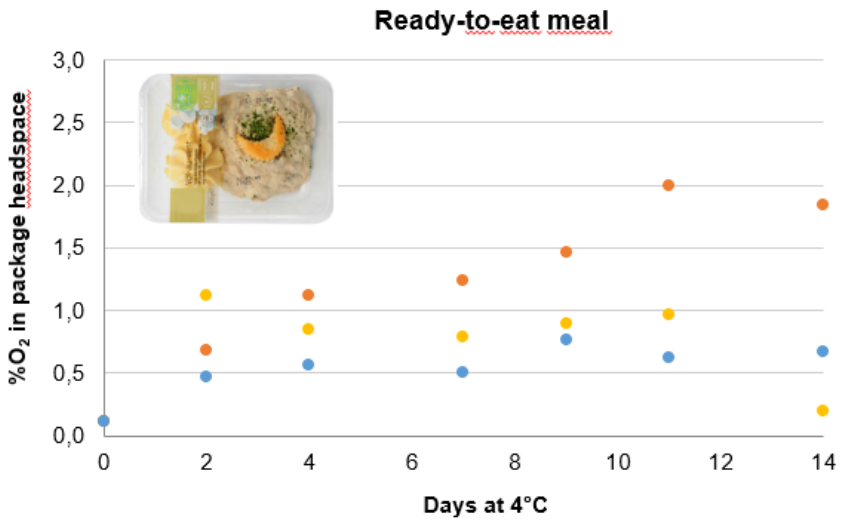
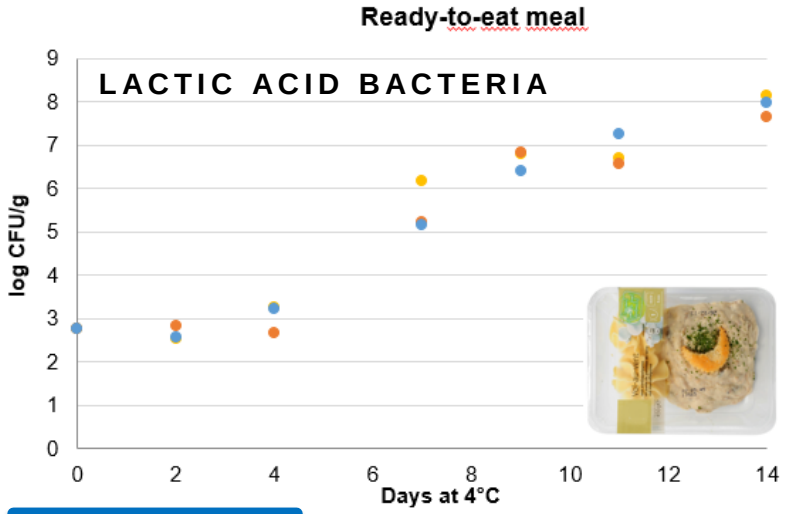
OPTIBARRIER

CASE: READY-TO-EAT MEAL (STORAGE IN DARK CONDITIONS)





Top foil	OPA/PE/EVOH/PE/PP	PET	OPA/PE/EVOH/PE/PP
Tray	PP	PET	PP/EVOH/PP
O_2 Barrier	LOW	MEDIUM	HIGH

- Promising results in terms of using monolayer materials
- OPTIBARRIER will further investigate: effect of light conditions, effect towards pathogens

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TOWARDS A CIRCULAR ECONOMY

- Key message 1: always consider the packaged product
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- Key message 2: aim for packaging optimization
  - Responsability for all stakeholders in packaging chain
    - Multilayer vs mono-layer
    - Alternatives for multilayers
      - Replace layers (e.g. EVOH, PA) by coatings (e.g. AlOx, SiOx)
      - Integrate different properties in one single layer
      - Investigate new polymers: e.g. PEF (polyethylene furanoate)

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- Key message 3: explore different collection, sorting and recycling strategies

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SORTING AND RECYCLING STRATEGIES

- Efficient collection systems
  - Worldwide approach needed: role of policy!
  - Important role of consumers (e.g. responsability towards waste in the environment)
- Performance sorting equipment
- Quality recycling processes: in case of multilayers
  - Delamination of multilayers by dissolving adhesives e.g. Saperatec-technology
  - Use of compatibilizers during recycling process (e.g. increase compatibility between PET and PE): cfr. research project ReFOIL

    https://www.ugent.be/ea/match/cpmt/en/research/refoil

ReFOIL

FLANDERS INNOVATION & ENTREPRENEURSHIP

Flanders State of the Art

GHENT UNIVERSITY

KU LEUVEN

VKC a division of CENTEXBEL

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SORTING AND RECYCLING STRATEGIES

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  - Selectively dissolve a polymer in a multilayer structure (e.g. recycling of PA/PE by the Newcycling process, developed by APK/DSM)
  - Pyrolysis process:
    - Thermal treatment of plastics at high temperatures in absence of oxygen
    - Leading to liquid and gaseous products, which can be used as resources

Environmental impact of the different processes?

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TOWARDS A CIRCULAR ECONOMY - TAKE HOME MESSAGES

- Key message 1: always consider the packaged product
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- Key message 2: aim for packaging optimization
  - Responsability for all stakeholders in packaging chain
    - Multilayer vs mono-layer
    - Alternatives for multilayers

- Key message 3: explore different collection, sorting and recycling strategies
  - Food quality ánd food safety remain very important!

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THANK YOU FOR YOUR ATTENTION!

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Pack4Food helps companies to improve food packaging.

We bring together companies and research institutes to achieve large and small improvements in the packaging chain.

We initiate and coordinate research, build a network and offer training and advice.