

# Innovating Packaging Solutions

- Fremtidens emballasje - effektiv transport med aktive og intelligente emballeringsmetoder

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# Innovating Packaging solutions for fresh fish



## Outline:

- ✓ Packaging in general and the foods requirements for packaging
- ✓ Packaging of fresh fish
- ✓ Active and intelligent packaging methods

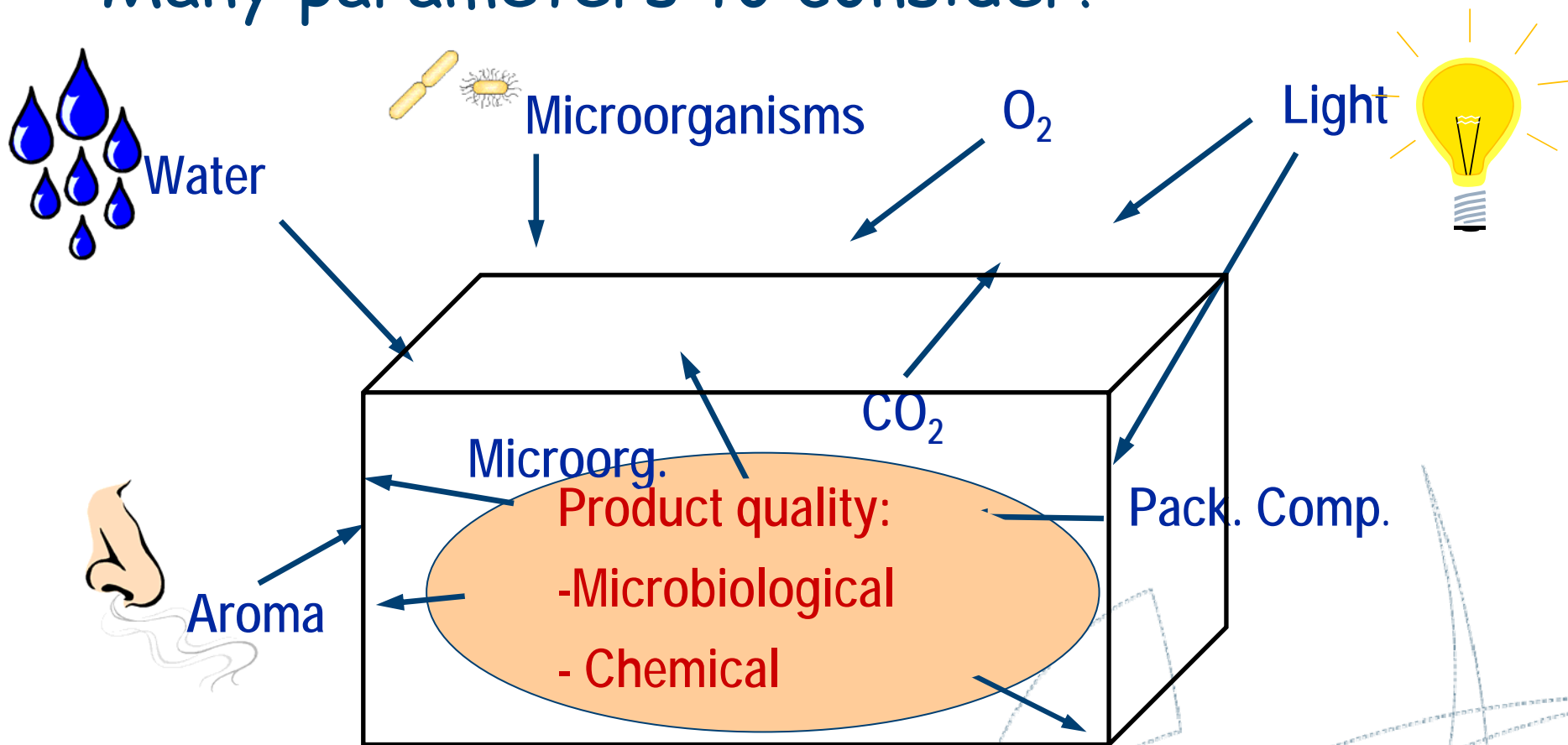


# Packaging in general

- ✓ Function of packaging:
  - ✓ Protect
  - ✓ Preserve
  - ✓ Practical
  - ✓ Containment
  - ✓ Communication
  - ✓ Information
  - ✓ Marketing



# Requirements to food packaging: Many parameters to consider!



# The golden triangle of packaging!

## ◆ Product

- ◆ Raw material
- ◆ Process
- ◆ Hygiene.

## ◆ Packaging-material and -machine

- ◆ Barrier
- ◆ Runability
- ◆ Sealability
- ◆ Design
- ◆ Hygiene.



## ◆ Distribution:

- ◆ Time
- ◆ Temperature
- ◆ Light
- ◆ Mechanical impact
- ◆ Logistics
- ◆ Environment
- ◆ Consumer.

# Packaging of fresh fish



Atlantic Salmon



Lobster

- ✓ Fish
- ✓ Packaging materials and Packaging methods
- ✓ Innovating packaging solutions-  
active and intelligent packaging solutions



Mackerel



Cod

# Fish



945699 [www.fotosearch.no](http://www.fotosearch.no)

# Fresh fish - Contamination and packaging methods

- ✓ Contamination depends on habitat, e.g. sea water, fresh water, pelagic or at the bottom
- ✓ Perishability or stability of the food product:
  - ✓ chemical, biological and physical nature of the product-initial quality
- ✓ Internal factors:
  - Water activity ( $a_w$ )
  - pH
  - Red-Ox potential ( $E_h$ )
  - Nutritive substances
- ✓ Storage conditions and environmental factors
  - Oxygen
  - Light
  - Temperature
  - Humidity
  - Storage time





# Fish and packaging methods

- ✓ Air/Open with ice
- ✓ Vacuum packaging
- ✓ Modified atmosphere packaging
- ✓ Superchilled packaging
- ✓ Active and intelligent packaging



# Fish and packaging methods- Modified atmosphere packaging



- ✓ Modified atmosphere packaging
  - ✓ Gas composition
  - ✓ Effect of  $CO_2$
  - ✓ Solubility of  $CO_2$
  - ✓ Gas/product ratio

**MAP:** the enclosure of a food product in a package (material with gas barrier), in which the gaseous environment has been changed or modified

# Active and intelligent packaging methods

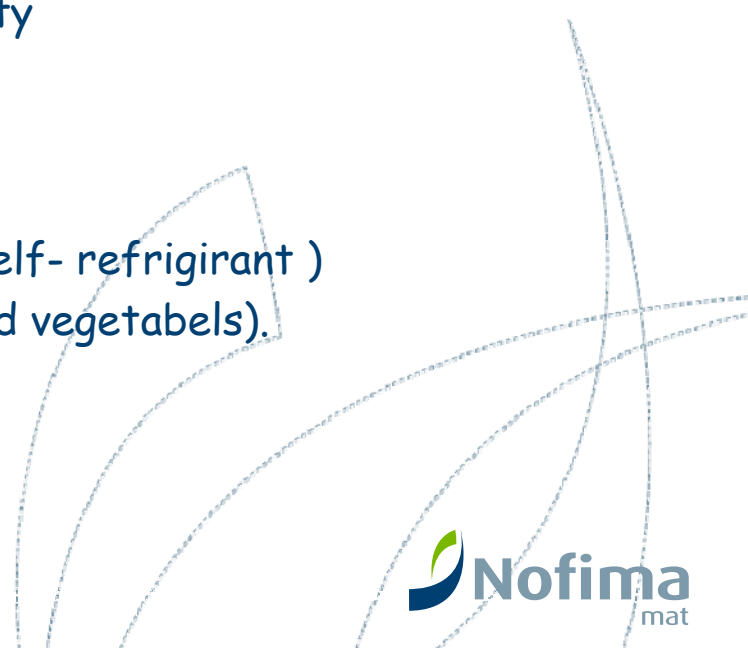


- Active packaging:
  - **INFLUENCE AND ALTER THE SURROUNDINGS** for the packed product
    - Extend shelf life
    - Improve/secure health-related security
    - Improve sensory properties
- Intelligent packaging concepts:
  - **MONITORING SYSTEMS - MONITOR THE SURROUNDINGS** for the packed product
    - Give information about the food products quality during transportation and storage
- Smart packaging
  - Collective name for active and intelligent packaging



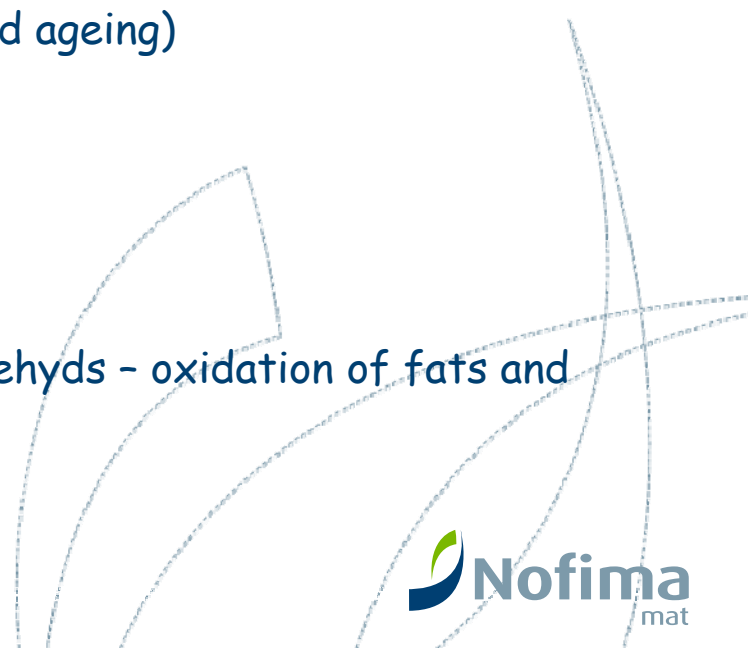
# Active packaging

- Main groups of active packaging:
  - **Absorbers:**
    - Remove /absorb unwanted components in the atmosphere around the food product in order to extend the shelf life and/or improve the quality
  - **Emitters:**
    - Add components into the atmosphere of the food product in order to extend shelf life and/or improve the quality
  - Other concepts:
    - Microwave susceptor
    - Solutions for blocking UV-lys
    - Temperature regulation (self-heating or self- refrigerant )
    - (controlled gas permeable - fresh fruit and vegetabels).



# Absorbers - types and area of applications

- Oxygen
  - Important
  - Reduce oxidation, growth of microorganisms
- Carbondioxid
  - Freshly roasted coffee
- Ethylene gas
  - ("phytohormone" - influence the ripening and ageing)
- Humidity
  - Bags: for dry food products
  - Drip absorbing pads : meat, fish, vegetable
- Unwanted smell and taste
  - Bitter taste - orange juice, TMA - fish, aldehyds - oxidation of fats and lipids
    - NB! EU regulations.....



# Emitters- types and area of applications

- Antimicrobial systems (great potential - many patents)
- Antioxidants
  - BHT/BHA
  - Vitamin E og C
- Carbondioxid
  - Meat, fish, fruits and vegetables, nuts, snacks
- Aroma components
  - Hide unwanted odour
  - Adding aroma components :
    - Ice cream, orange juice
    - Smoking aroma



# Active packaging Bags



**DO NOT EAT**



Multisorb Minipax luktabsorber  
<http://www.multisorb.com>

Ageless O<sub>2</sub> -absorber  
<http://www.keepsafe.ca>



Bioka O<sub>2</sub> -absorber  
<http://www.bioka.fi>

## Active packaging

# Antimicrobial concepts

- Act on the surface of the food - may reduce adding/ the needed amount of preserving agent
- Two main principles
  - Migration - release of preserving agent (into the food or to the surroundings of the food)
  - Not migrating - antimicrobial action when the unwanted microorganism get in touch with the antimicrobial surface.
- Direct contact between the active component and the food is often needed.

Nafispack : Active and intelligent packaging : natural antimicrobial function



Intelligent packaging :

# Intelligent packaging (monitoring)



- Time, Temperature Indicator (TTI), freshness, leakage, ready-prepared
- Tamper evidence
- "Pirate copying"
- Tracking and tracing devices/Supply chain management
- Intelligent film (indicator film)
- Diagnostic inc (e.g. bar code not readable in the presence of a particular microorganism).

**Temperature sensitive ink showing if the product hold the right temperature**



# Intelligent packaging: EXAMPLE

## VITSAB® Trippel-indikator: Tolkning



The product is fresh – max. shelf life



The quality of the product is some reduced, but is still acceptable – saleable within "y" days



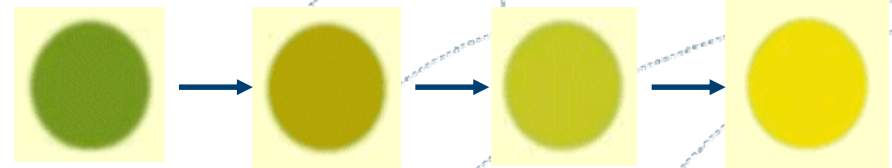
The quality of the product is some deteriorated, salabele within "z"



The product is not salabel  
– must be thrown



Colour change:



# Innovative packaging solutions- active packaging with CO<sub>2</sub> emitter

- ✓ Modified atmosphere packaging
  - ✓ Gas/product ratio
    - ✓ Optimal g/p ratio 3:1
    - ✓ Economically and environmentally unfriendly
  - ✓ CO<sub>2</sub>-emitter
    - ✓ Production of CO<sub>2</sub> after sealing
    - ✓ Reduction of g/p ratio
    - ✓ Proven effect



Wolffish



# CO<sub>2</sub> emitter- project

- ✓ User-led Innovation project
- ✓ Vartdal Plastindustri AS
- ✓ Financed by NFR Matprogrammet



# Requirements to CO<sub>2</sub>-emitter

- ✓ Adjustment to product
  - ✓ Type of fish
    - ✓ pH
    - ✓ Water activity (liquid loss)
  - ✓ Product volume



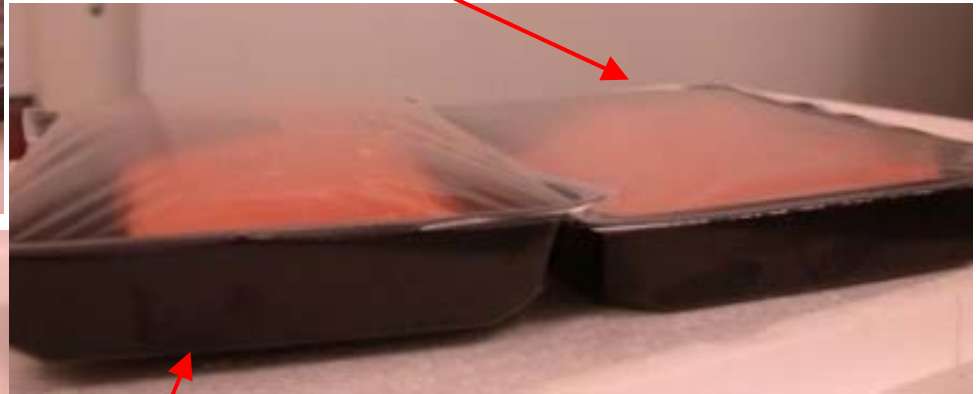
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# Adjustment of CO<sub>2</sub>-production capacity

## Gas content and appearance



Optimal appearance and CO<sub>2</sub> production



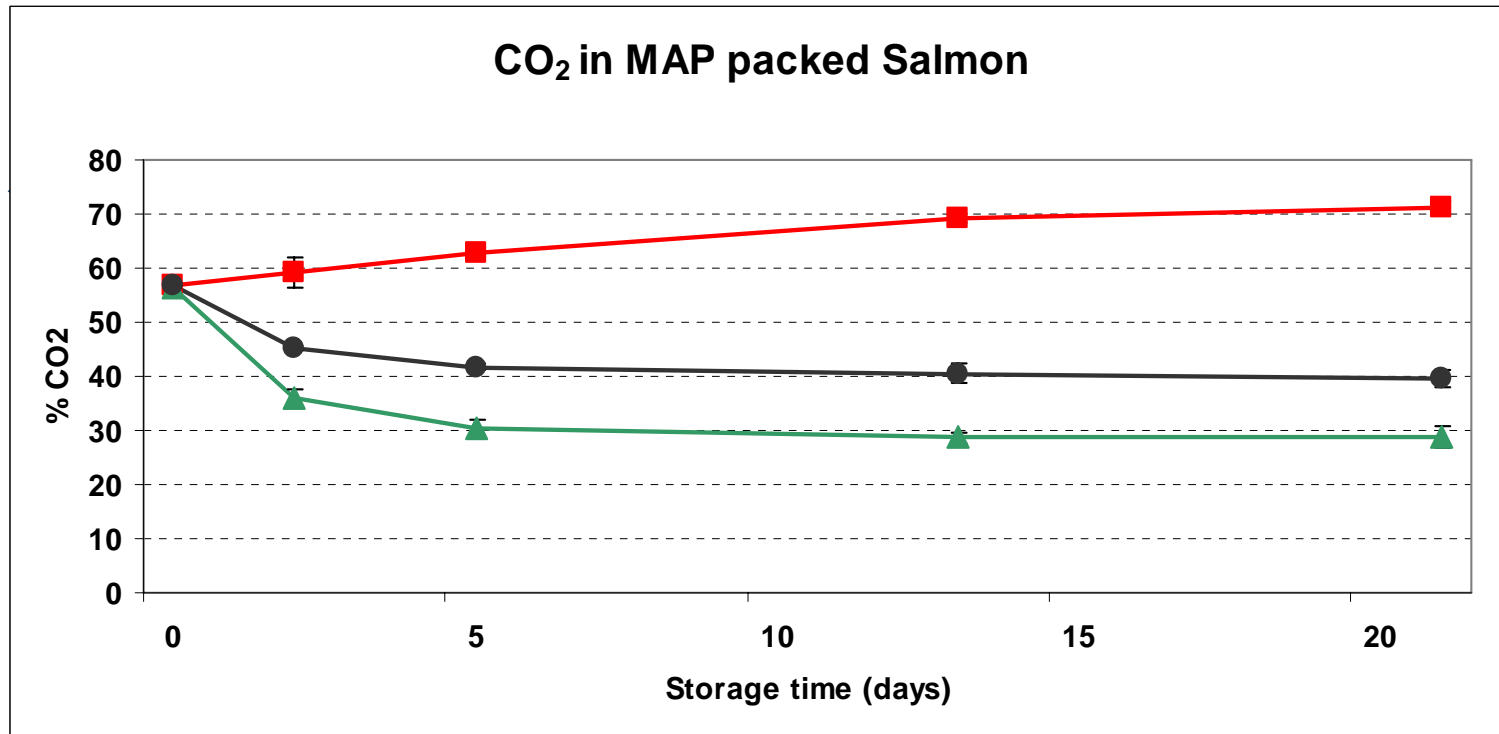
baloon effect : too high CO<sub>2</sub> production



Vacuum effect : too little CO<sub>2</sub>

# Why CO<sub>2</sub>-emitter?

✓ Production of CO<sub>2</sub> after sealing

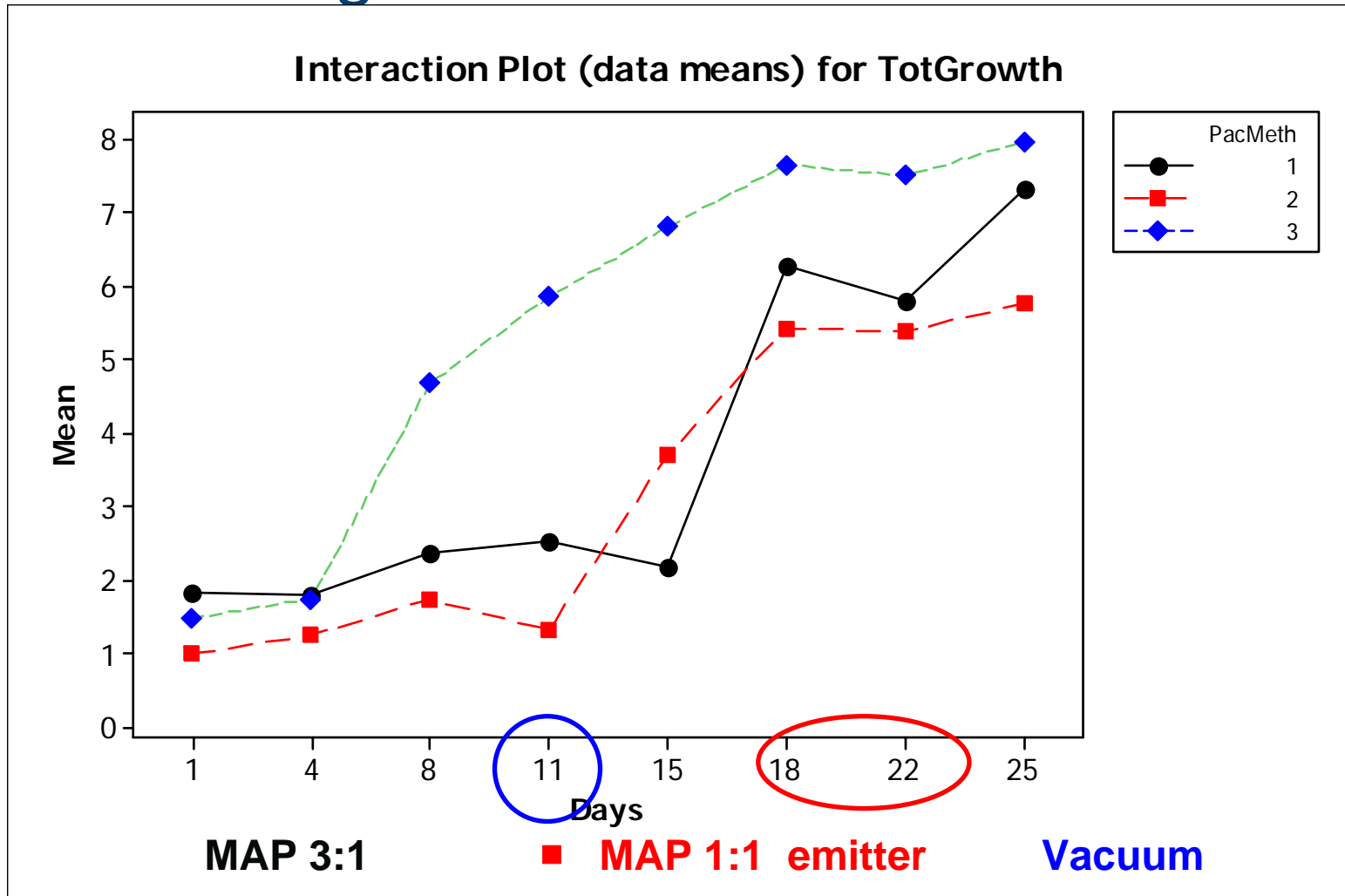


■ **MAP 1:1 emitter**

**MAP 2:1**

**MAP 1:1**

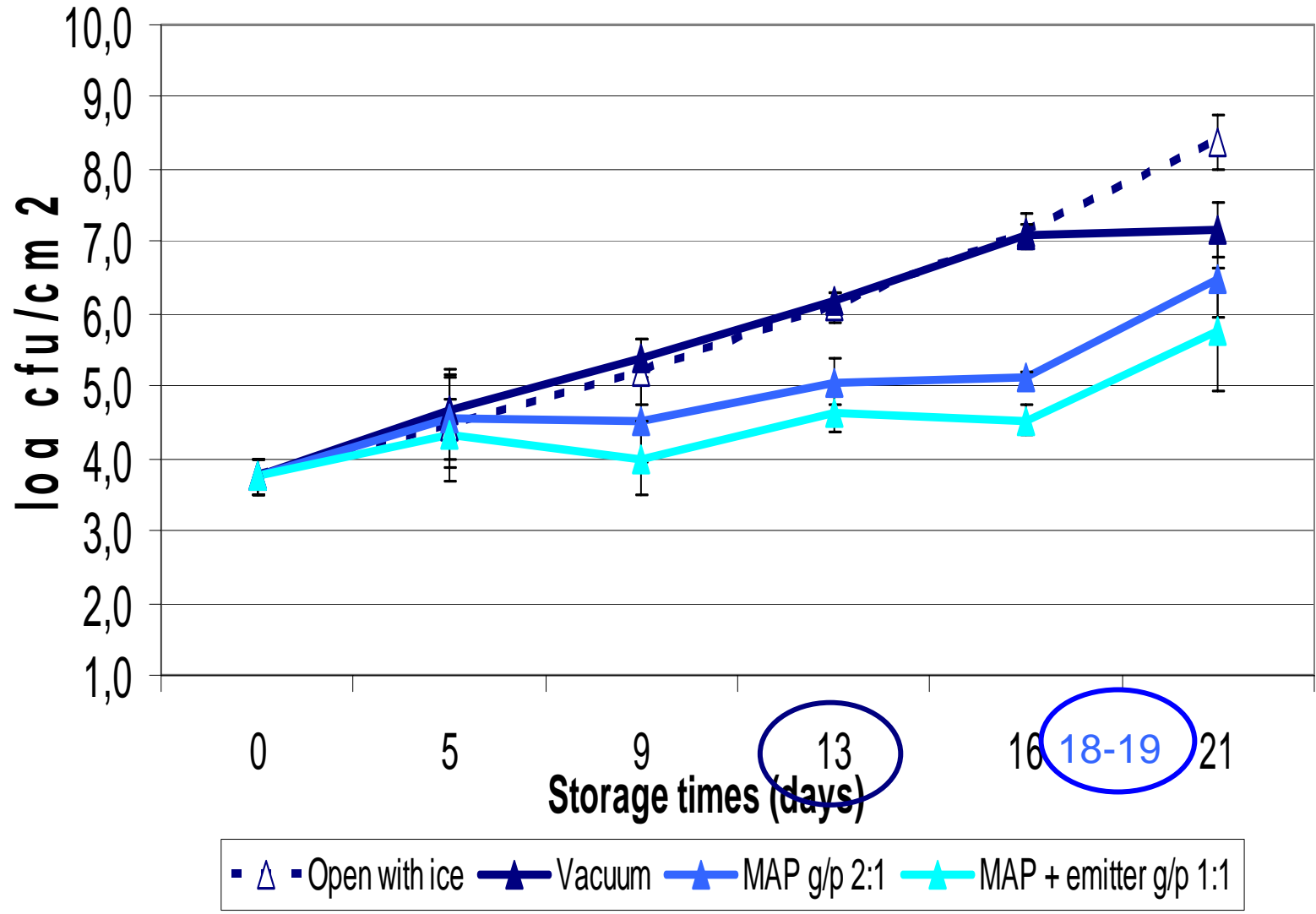
# Bacterial growth in Salmon - TVC



Salmon stored at 1°C with 60% CO<sub>2</sub> / 40% N<sub>2</sub>



# Lactic acid bacteria in COD



# Why CO<sub>2</sub>-emitter?

- ✓ Production of CO<sub>2</sub> after sealing
  - ✓ Stable level of CO<sub>2</sub> during storage
- ✓ Proven effect
- ✓ Reduction of gas/product ratio
- ✓ Transport efficiency

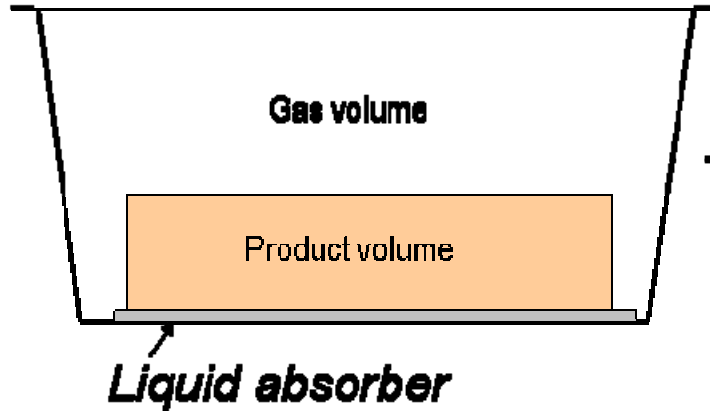


# How to reduce the number of trucks?

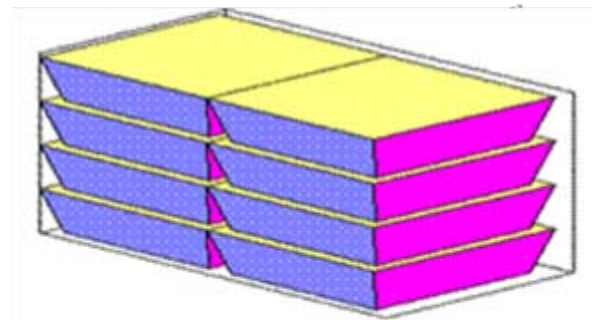
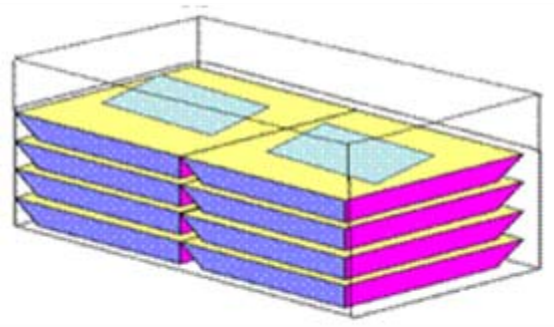
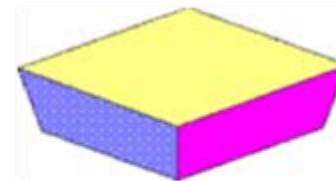
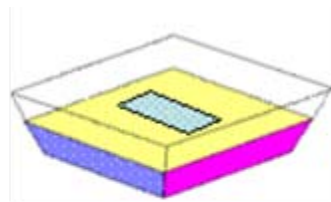


# Innovative packaging solutions- active packaging with CO<sub>2</sub> emitter

Traditional MAP



MAP with CO<sub>2</sub> emitter

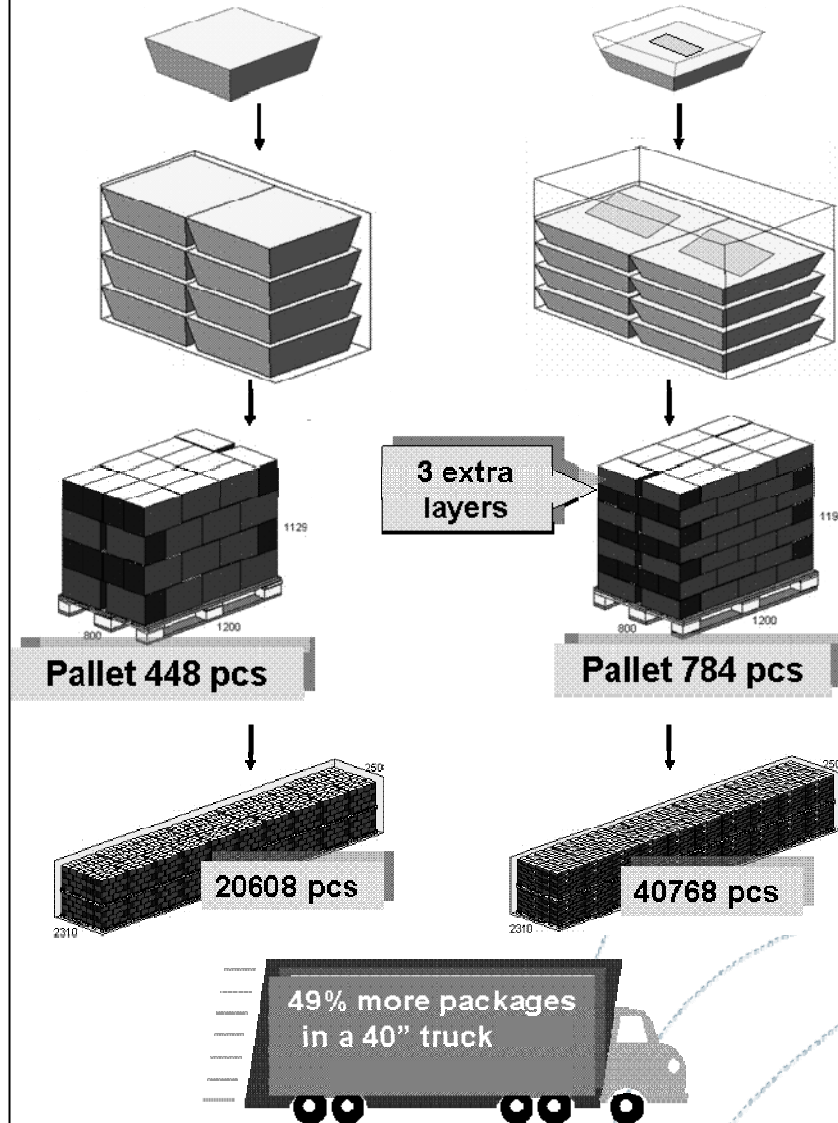


MAP with CO<sub>2</sub>-emitter

Traditional MAP

### Traditional MAP

### MAP with CO2-emitter



# MAP and use of CO<sub>2</sub>-emitter- Summary



- ✓ Better quality and longer shelf life compared to vacuum packing and open/ice packing
- ✓ Equal or better quality and shelf life compared to optimal g/p ratio in traditional MAP
- ✓ Reduction of package volume
  - ✓ Higher transport efficiency
    - ✓ Economically and environmentally better solution
    - ✓ Packaging material reduction



Thank you for  
your attention!

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