



# Packaging Strategies for preservation in Tortilla Wraps

Ambient Air vs. Modified Atmosphere Packaging (MAP)

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## Presentation Overview

Preamble : Presentation with cooperation of the CTCPA from France

- Objective:

- Preservation: share experience on packaging solutions for tortilla wraps to prevent mold
- Provide notions about what is hidden behind a packaging film
- How packaging can help to improve tortilla preservation

### Structure:

**Part 1: Context and Challenge**

**Part 2: Technical Principles of Packaging**

**Part 3: Flow Pack strategies - Ambient VS MAP**



# Context and Challenges



## Context and Challenges

### Current Market Challenges

- Healthy & Soft tortilla
- Food safety, Mold-free
- Transparency in claim
- Cost control
- Clean label trends : E-number hunting for the last decades

#### Reduction of preservatives – 'clean label' trend: Paradox !

- **36% of global consumers think clear of preservatives = cleaner diet**
- **32% of global consumers are willing to accept preservatives** — the highest acceptance among all additives.

Sources: Health & Nutrition survey 2025 – Innova.

Which additives and preservatives are you avoiding?

Answers	Global	BR	CN	FR	DE	MX	ES	UK	USA
1. Artificial sweeteners	46%	45%	33%	43%	50%	45%	43%	44%	37%
2. Artificial food colourings	44%	47%	36%	41%	35%	46%	44%	42%	37%
3. Trans fats	40%	60%	38%	33%	32%	48%	47%	34%	33%
4. Artificial flavours	36%	44%	34%	37%	34%	39%	32%	35%	32%
5. Preservatives	36%	42%	42%	33%	34%	27%	32%	29%	25%



## Context and Challenges

### Role and Functions of Packaging

- **PACKAGING** - isn't just a cost, it's a strategic investment that acts as a marketing, protection, and logistics tool, adding value to the product and influencing the customer's purchasing decision. It serves as the brand's first impression, highlighting the product at the point of sale and strengthening the company's identity.



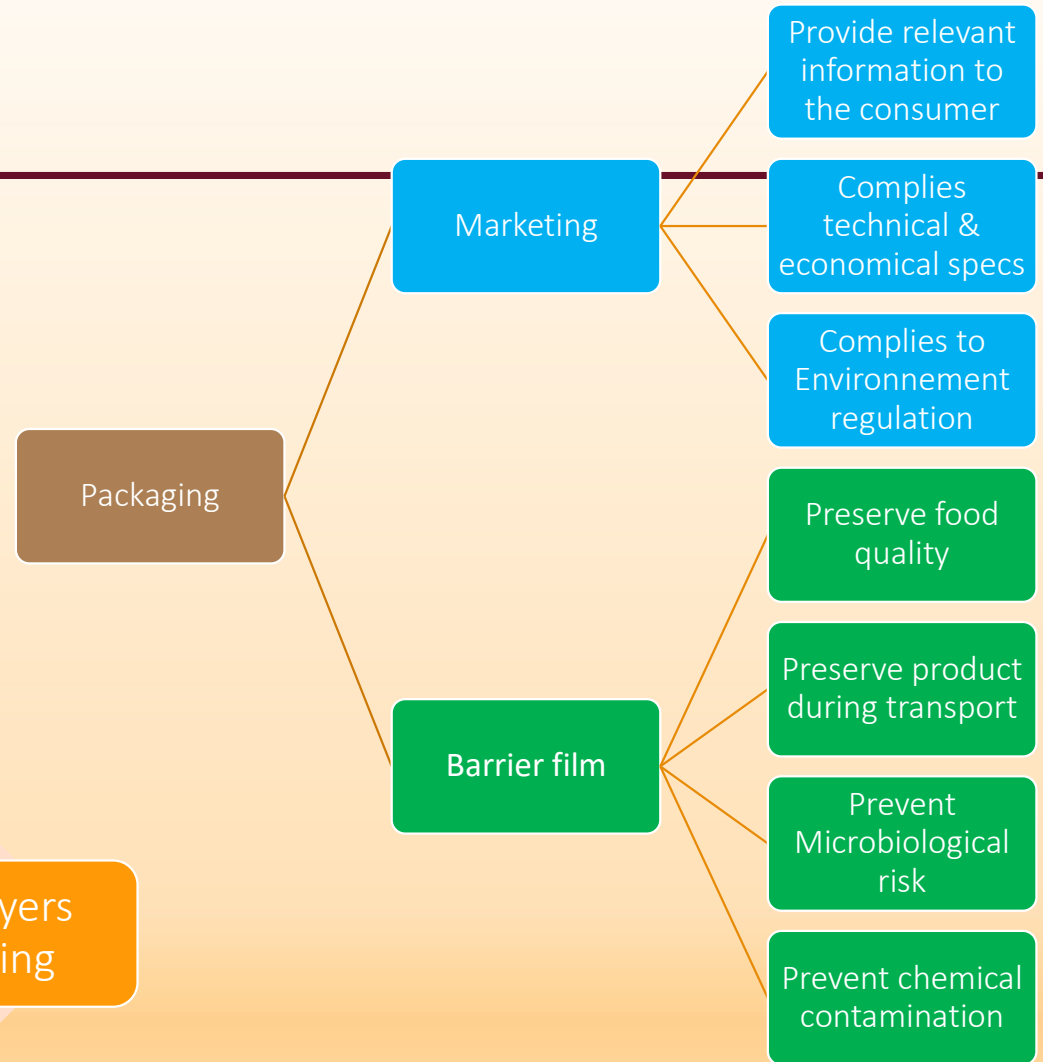
### 3 MAIN LEVERS OF MONITORING FOR SAFE, COMPLIANT, AND FIT FOR LONG SHELF LIFE TORTILLA



## Context and Challenges

### Role and Functions of Packaging

- 7 key functions: protect, preserve, prevent, inform, be strong, sustainable, recyclable
- + convenient, malleable & flexible packaging: key for bakery and flatbread products



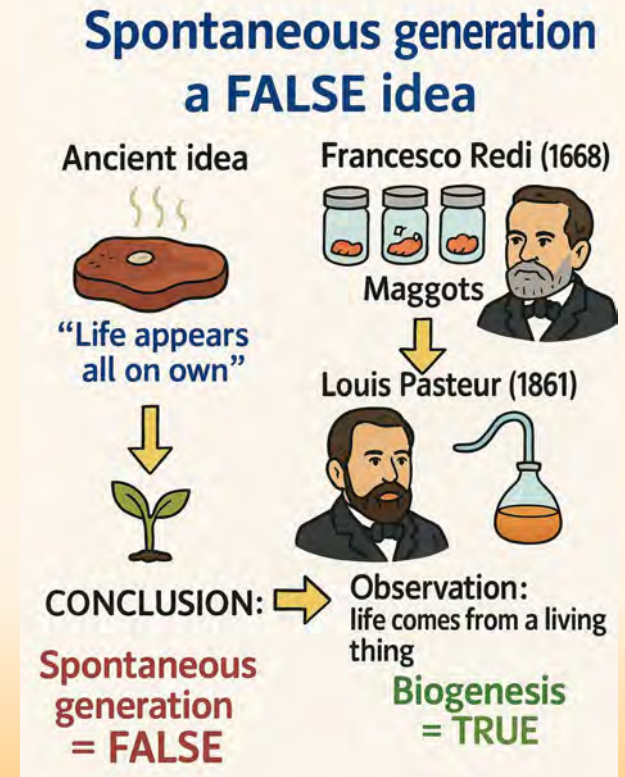
## Context and Challenges

### Product Specificities – Tortilla Wraps

#### Source of contamination ( Memo)

- Spontaneous generation does not exist
- If there's one thing to remember, it's that in most situations, **contamination is already inside the bag when it's closed!**
- However, we've discovered that despite “white & clean rooms” and optimized conditions, contamination can still occur from the outside!
- Spores are present in the air, on production surfaces, equipment, or packaging area and materials.
- At the closure of the bag in the ambient air of the packaging, and then the conditions will favor its development.

→ Head space in the pack can contain spores & germs

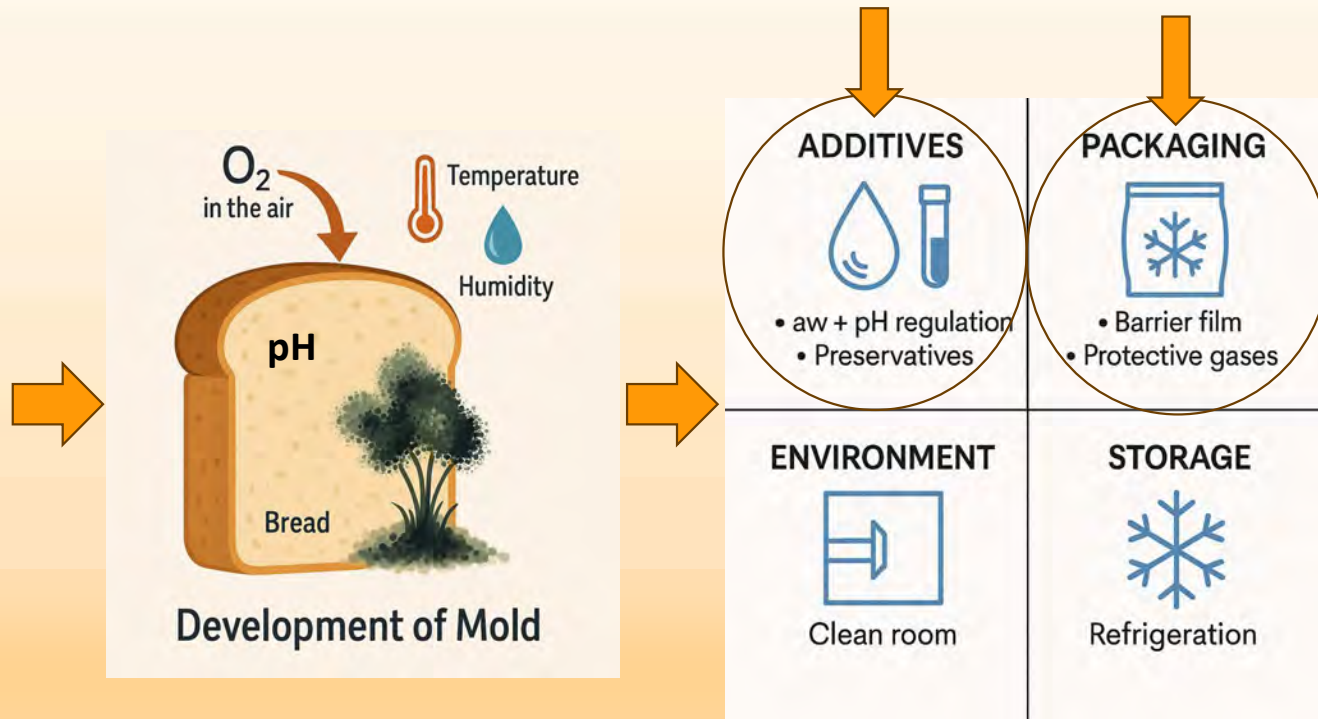


## Context and Challenges

### Source of contamination (memo)

- Bakery products, including tortilla wraps, are a **breeding ground** for mold and bacteria.

Facteur	Optimal growth condition for germs and mold	Comments
Nutriments	Riches in glucides (starch, sugar)	Excellent substrat for mold
Free Water (Aw)	Aw > 0,85	High free water moisture
Temperature storage	18 –30 °C (optimum), growth 5–35 °C	Conservation & transport at ambient temperature = risk maximum
Oxygen	Mandatory (strict aerobes)	Mold does not grow in an anaerobic atmosphere
pH	5 à 7	Slightly acid = ideal
Shelf life	> 3 days	Long shelf life



## Context and Challenges

### Shelf-Life Expectations in Tortilla Wraps

- Retail / Food Service

Designation	Retailer West Europe	Retailer East Europe -MEA	Food Services & Exportation
Shelf life	6 – 8 Months	1 – 3 months	6 – 12 months
Type of Customer	Private	Private & professional	Professional
Sensitivness of Additives	High	Low	Low
Packaging trends	Flow pack with neutral gaz (CO2/N2)	Flow pack under ambient air	Flow pack under ambient air

The evolution of packaging film technology makes it possible to support the manufacturer to improve the shelf life

# Technical Principles of Packaging

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0 03 November 2025



# Technical Principles of Packaging

## Notion BARRIER FILM and characteristic

- **Permeability:** ease with which a gas, vapor, or liquid can pass through the package.
- **Porosity :** proportion of micro-holes (holes, cavities, internal channels) in the packaging material.
- One of the most important functions of packaging is to use the most relevant barrier film depending on the application. **The exchanges between the inside and the outside are permanent** until a balance is reached! This is the principle of partial pressure variations.

**PERMEABILITY PRINCIPLES**

**PERMEABILITY PRINCIPLES TO GASES, WATER VAPOR, AND AROMAS**

Inside : Gas at partial pressure  $p_2$  with  $p_2 < p_1$  and concentration  $C_2$   
 Outside : Gas at partial pressure  $p_1$  and concentration  $C_1$

## PRESERVE FOOD QUALITY

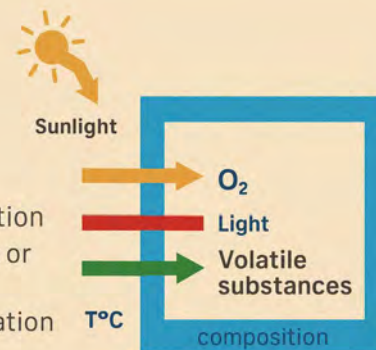
Be barrier to.....

**Oxygen:** Prevent oxidation

**Water:** Limit water loss or hydration of foods

**Light:** Prevent deterioration in light

**Aromas:** Limit trapping or loss of aromas



**WARNING:** temperature exchanges can't be controlled =

Heat conduction

**TEMPERATURE +10°C**  
**PERMEABILITY X 2 to 3**  
**Exponential function...**

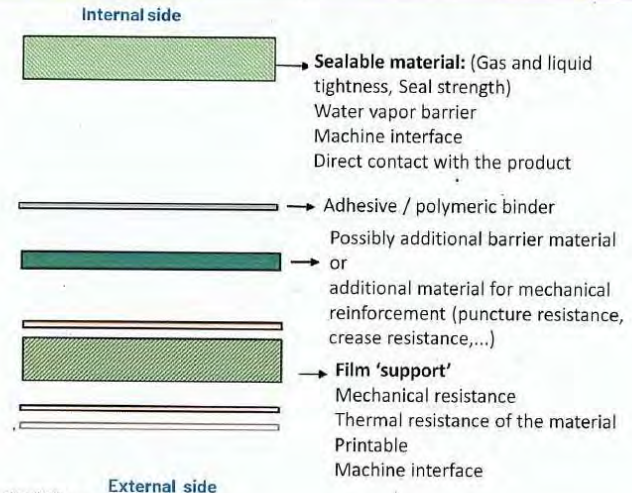
# Technical Principles of Packaging

## Multi-layers structure / Type of Film

- The packaging must meet several specific functions :
  - Thermal resistance / sealable
  - Printing: support film
  - Gas permeability / Barrier O<sub>2</sub>/H<sub>2</sub>O
  - The flexibility of packaging

→ Multi layers film structures by coextrusion process

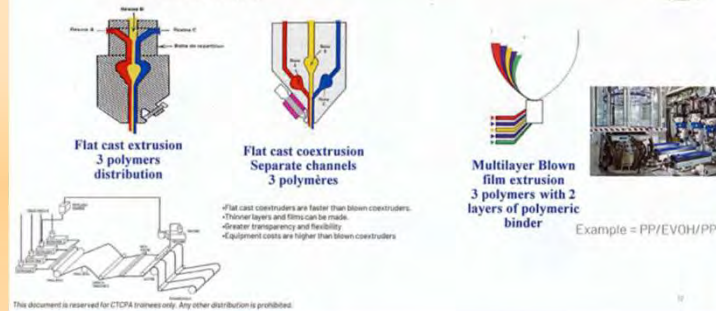
### Example of the structure of a multi-layer material



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### TERMINOLOGY

#### Coextrusion



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## Technical Principles of Packaging

### Barrier Film Principles : Transmission Rate (TR) for a GAZ (H<sub>2</sub>O, O<sub>2</sub>, CO<sub>2</sub>)

- Definition: **TR measure the efficiency of the film for the permeability of a gaz**
- The Oxygen or Water Vapor Transmission Rate (OTR – WVTR) measures the amount of O<sub>2</sub>/H<sub>2</sub>O that passes through a material (film, tray, cap, etc.) per unit area and time, under given conditions (temperature, humidity).
- Measurement in cm<sup>3</sup>/m<sup>2</sup>/day
  - Low OTR (<1 cm<sup>3</sup>/m<sup>2</sup>·day·bar) → very high barrier material (e.g. aluminum, multilayer films with EVOH).
  - High OTR (>1000 cm<sup>3</sup>/m<sup>2</sup>·day·bar) → low-barrier material (e.g. simple plastic films such as PE).

**Outside/inside temperature  
HEAT CONDUCTION**



**IF TEMPERATURE +10°C  
PERMEABILITY X 2 to 3  
Arrhenius-type relation, Exponential  
function...**

# Technical Principles of Packaging

## Multi-layers structure / Type of Film

### 1. Structural Materials

Main role: to give mechanical strength, rigidity, flexibility and seal ability.

Examples:

- o **PE (polyethylene)** → flexibility, weldability, moisture barrier.
- o **PP (polypropylene)** → rigidity, heat resistance, weldability.
- o **PET (polyethylene terephthalate)** → rigidity, transparency, mechanical resistance.

- Characteristics: often thick, dominant in volume (% of film).

👉 These are the "base layers" that ensure that the packaging holds well, is easy to handle and closes properly.

👉 These are the "functional layers" that guarantee the protection of the product.

### 2. Barrier materials

Main role: prevent the penetration or exit of gas, water vapor, aromas, UV, greases.

Examples :

- o **EVOH** → barrière O<sub>2</sub> exceptionnelle (mais sensible à l'humidité).
- o **Aluminium** → barrière totale (gaz, vapeur, lumière).
- o **PVDC** (polychlorure de vinylidène) → barrière O<sub>2</sub> + H<sub>2</sub>O.
- o **PET orienté (BOPET)** → intermediate gas barrier.

- Features: Thin layers, added specifically to improve shelf life.

👉 These are the "functional layers" that guarantee the protection of the product.

# Technical Principles of Packaging

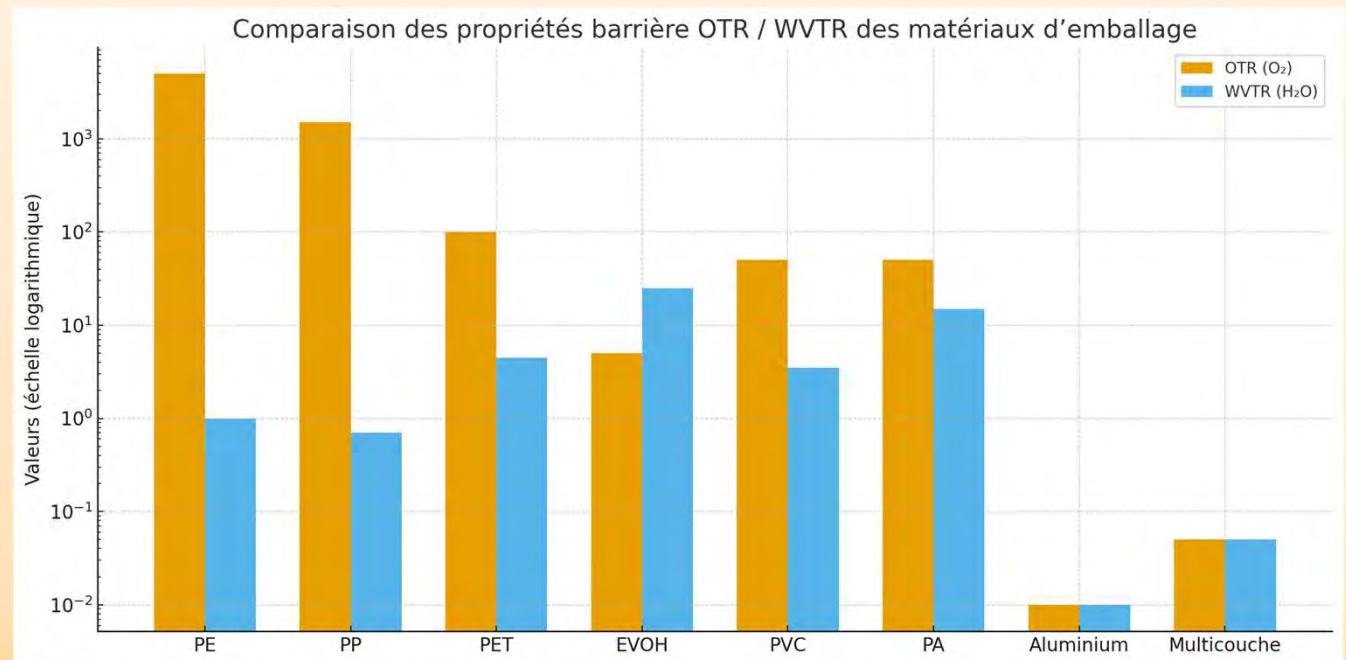
## Multi-layers structure / Type of Film

Material	Gas barrier (O <sub>2</sub> , CO <sub>2</sub> )	Water vapor barrier	Microbial barrier	Thermal resistance	Usages typiques (Flow Pack)
PE (polyethylene)	✗ Bad	✓ Excellent	✓ Total	⚠ Low (60–80 °C)	Ambient Air Flow Pack: ideal for short-lived products (2–5 days), protects against drying out. Neutral Gas Flow Pack (CO <sub>2</sub> /N <sub>2</sub> ): requires multi-layer film to limit O <sub>2</sub> .
PP (polypropylene)	⚠ Average	✓ Good	✓ Total	✓ Average (100–120 °C)	Biscuit packaging, dry or slightly damp wraps, good steam barrier and heat resistance.
PET (polyethylene terephthalate)	✓ Good	✗ Low	✓ Total	✓ High (up until 150 °C)	Outer layer in multilayer films for rigidity and gas barrier; useful as a MAP Flow Pack or Heatable Dishes.
EVOH (ethylene vinyl alcohol)	🚀 Excellent (O <sub>2</sub> < 1 cm <sup>3</sup> /m <sup>2</sup> -day-bar)	✗ Very bad	✓ Total	⚠ Average (90–100 °C)	O <sub>2</sub> barrier layer in complex films (PET/EVOH/PE). Essential for Neutral Gas Flow Pack (CO <sub>2</sub> /N <sub>2</sub> ) and long shelf life (7–30 days).
PA (polyamide / nylon)	✓ Very good	⚠ Average to low (hygroscopic)	✓ Total	✓ High (120–150 °C)	Excellent mechanical film and O <sub>2</sub> barrier. Used in PA/PE or PA/EVOH/PE for Flow Pack under gas or vacuum.
Aluminium (foil)	✓ ✓ Total	✓ ✓ Total	✓ ✓ Total	✓ Very high (>200 °C)	PET/Alu/PE complex films: absolute barrier. Used for shelf-stable wraps, sterilized products.
Box paper/cardboard	⚠ Average (selon revêtement)	⚠ Average	⚠ Good	⚠ Low (non-sterilizable)	Artisanal packaging, wraps consumed quickly. "Natural" look.

# Technical Principles of Packaging

## Barrier Film performances

Material	Typical OTR (cm <sup>3</sup> /m <sup>2</sup> ·day·bar)	Typical WVTR (g/m <sup>2</sup> ·day, 23°C, 85% RH)
PE (polyethylene)	2000 – 8000	0.5 – 2
PP (polypropylene)	1000 – 2000	0.5 – 1
PET (polyethylene terephthalate)	50 – 150	3 – 6
EVOH (ethylene vinyl alcohol)	0.1 – 10	> 20 (very sensitive to humidity)
PVC (polyvinyl chloride)	20 – 100	2 – 5
PA (polyamide / nylon) <small>NEW</small>	10 – 100	10 – 20 (absorbs moisture)
Aluminium (foil)	≈ 0	≈ 0
Multilayer PET/Alu/PE or PET/EVOH/PE	< 0.1	< 0.1 (with aluminium)

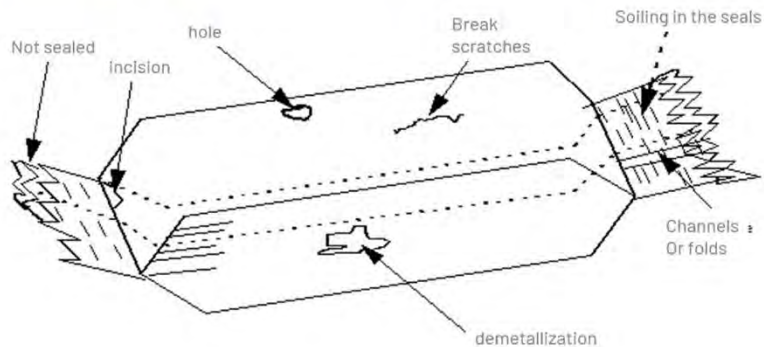


# Technical Principles of Packaging

## Sealing performance: Importance of Weld (heat) Quality for Excellent Sealing

### Leak-proof packaging:

Ability to prevent any passage of fluid (liquid, gas) through the walls or closure system, whether incoming or outgoing.



Passage through leak channels, porosity, scratches... = physical phenomena

### SEALING MEASUREMENTS

#### Seals performances tests

- Evaluation of sealing strengths

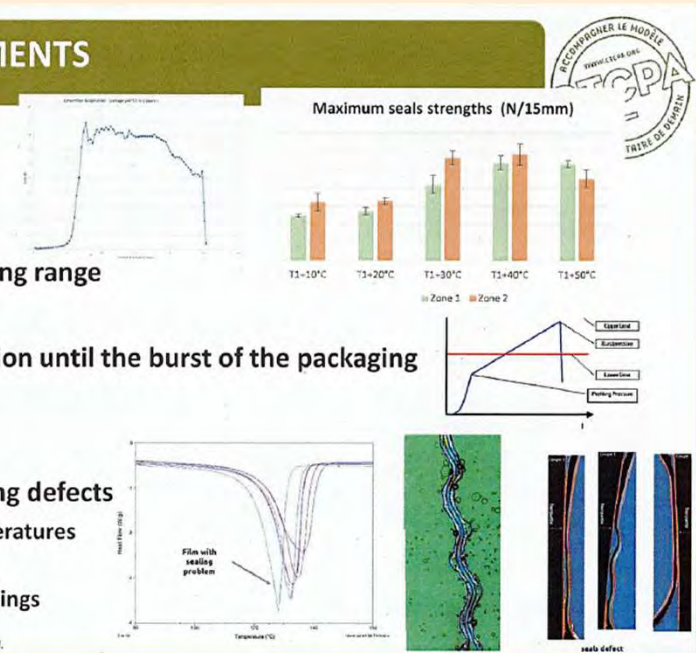
- Evaluation of the optimal sealing range

- « Burst-Test » → Pressure injection until the burst of the packaging

- Other tests to characterize sealing defects

characterization of melting temperatures

micrographic observations of sealings



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# Special Thanks

## CTCPA FRANCE

- CTCPA supports manufacturers in packaging and users of packaging in general
- Centre of expertise in connection with the analyses carried out in the laboratory

2 laboratory specialized on Packaging studies

Lab Packaging Chemistry

- Measures the interaction between the container and the content
- Packaging features
- Measures Lab Shelf life and physical performance of packaging

### Barrier properties

#### WHY PERMEABILITY MEASUREMENTS :

- Check the performances announced by film suppliers

#### Examples

Perméabilité à la vapeur d'eau	g/m <sup>2</sup> /24h	7,994	Température : 38 °C / Hr : 90 % Méthode : Calcul interne
Perméabilité à l'oxygène	cm <sup>3</sup> /m <sup>2</sup> /24h	1,958	Température : 23 °C / Hr : 0 % Méthode : ASTM D 3985

Theoretical calculations

Perméabilité vapeur d'eau	23°C/0-85%hr	estimation	1,2	g/m <sup>2</sup> .24h
Perméabilité oxygène	23°C/50%hr	estimation	3,0	cc/m <sup>2</sup> .24h
Oxygen permeability (OTR)	<= 13		cm <sup>3</sup> /m <sup>2</sup> d bar	23°C 50 % RH DIN 53380
Carbondioxyde permeability	<= 47		cm <sup>3</sup> /m <sup>2</sup> d bar	calculated (at 50% RH)
Water vapour transmission (H <sub>2</sub> O)		g/m <sup>2</sup> .24h.bar	ISO 2528 (23°C ; 85% HR)	< 5
Oxygen transmission (O <sub>2</sub> )		cm <sup>3</sup> /m <sup>2</sup> .24h.bar	ASTM D3985 (23°C ; 0% RH)	< 5

Less than ...  
?? What is the real value

Perméabilité à l'oxygène	cm <sup>3</sup> /m <sup>2</sup> /24h	17,935	Température : 23 °C / Hr : 0 % Méthode : Interne
<b>PERMEABILITE VAPEUR D'EAU</b>		g/m <sup>2</sup> /24h, 23°C/0-85%RH	<b>0,3</b>
<b>PERMEABILITE OXYGENE</b>		cc/m <sup>2</sup> /24h, 23°C/50%RH	<b>20,0</b>
VAPEUR D'EAU / TO STEAM	NFH 00 - 044	g / m <sup>2</sup> / 24 h / 38°C/ 90%HR	0,80
OXYGENE / TO OXYGEN	ASTM D 3985 81	cc / m <sup>2</sup> / 24 h / 23°C/ 50%HR	0,90

Different standard used  
Different temperature and humidity  
conditions between suppliers

49  
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Flow pack  
strategies

Ambient VS MAP



## Flow Pack strategies: Ambient VS MAP

### Overview of Two Flow-Pack Technologies

Mold does not appear because it passes through plastic, but because:

Pack already contains spores → working environment & practice

Wraps are an excellent substrate for their development

Packaging can allow oxygen to pass through (if the barrier is insufficient),

Temperature variation create condensation of moisture which promotes their growth.

Temperature impact on Permeability performance

- **Standard** → short-shelf life, suitable for fresh food consumed quickly (bakery, snack).
- **Cleanroom** → extends shelf life through hygiene, without changing the gas.
- **MAP** → best solution for long service life, especially in combination with a cleanroom.

### • Comparison Lab test of Packaging Strategies (Preservative-Free, Ph regulation-Free and Aw regulation-Free)

Type of packaging	Air content (headspace)	Packaging environment	Shelf life	Advantages	Limitations
Standard Flow-pack (PET/PE)	Ambient air (21% O <sub>2</sub> )	Standard workshop	2–3 days at room temperature	Simple, economical	Rapid risk of mould, staling
Flow-pack in clean room (overpressure) (PET/PE)	Ambient air (21% O <sub>2</sub> )	Filtered air, low microbial contamination	7–10 days	Fewer spores → less mould	Heavy investment (room, HEPA filters, procedures)
Flow-pack MAP (N <sub>2</sub> /CO <sub>2</sub> ) (OPA/PE/EVOH/PE)	Protective atmosphere (O <sub>2</sub> < 1%)	Standard or clean room workshop	14–30 days	Excellent oxidation and mould barrier	Higher cost (gas, MAP machine), depends on the barrier of the film



**Flow Pack strategies: Ambient VS MAP**

**FLOW PACK with AIR AMBIENT**

## Flow Pack strategies: Ambient VS MAP

### Ambient-Air Flow Pack – Principle

Air, no gas injection

Flow-pack "Ambient Air" (without gas injection) so headspace filled with ambient air  $\approx 21\% \text{ O}_2$

#### ◆ Conservation constraints

In this case, the packaging does not block the oxygen present in the air ( $\approx 21\% \text{ O}_2$ ), therefore:

Risk of drying out of the product

Risk of rapid mold (especially for wraps, breads, pastries)

Risk of loss of suppleness or rancidity if fat is present → staling

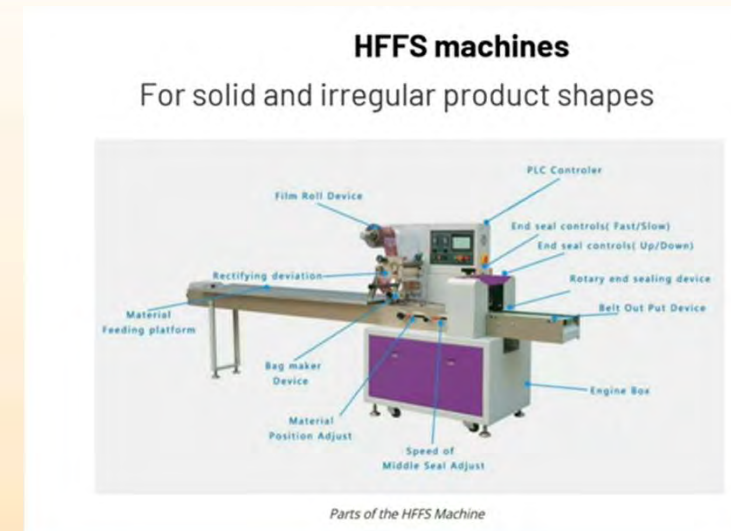
#### ◆ Requires

High amount of Additive Usage: preservatives, acidity, pH and free water regulator (Aw)

Requires control of the relative humidity and temperature conditions at the packaging


Environmental hygiene conditions and packaging equipment

Cold condition



## Flow Pack strategies: Ambient VS MAP

### Ambient-Air Flow Pack – Pros and Cons

-  In short:
- Advantages: low cost, simple equipment, easy to manage !
- Drawbacks: full of additives with Preservatives, etc...
- The type of packaging (film + environment) acts as an external barrier,
- The additives and preservatives in the recipe as an internal barrier.
- Manufacturers must combine optimized recipe + adapted packaging + Good working practice to limit the contamination
- To extend shelf life and reduced additives, the Cold transport and storage +4°C is a good option



## Flow Pack strategies : Ambient VS MAP

FLOW PACK with MODIFIED AIR (gas)

## Flow Pack strategies: Ambient VS MAP

### MAP (Modified Atmosphere Packaging) – Principle

- Injection of neutral gases ( $N_2$  /  $CO_2$ )

#### Definition:

Replacing the air inside the package with an inert gas (e.g. **100% Nitrogen**) or with a controlled gas mixture ( $CO_2/N_2$ ), in proportions adjusted to the specific food product and desired shelf life.

#### Benefits:

- Eliminates oxygen to inhibit the development of spoilage microorganisms.
- Maintains the nutritional, enzymatic, and mineral qualities of the product → thermo resistant enzyme will remain active !
- Slows down oxidation and preserves product freshness during storage.
- Reduces or eliminates preservatives

## Flow Pack strategies: Ambient VS MAP

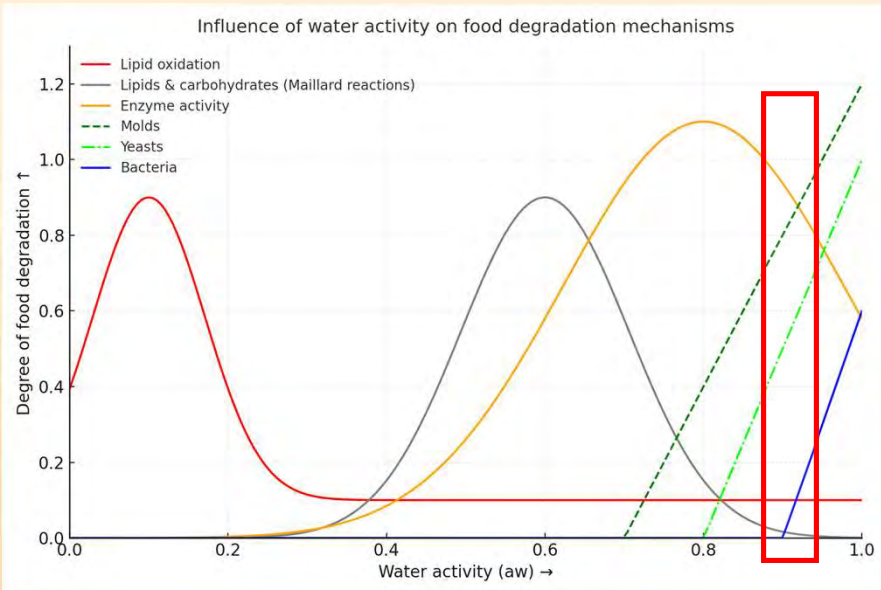
### MAP (Modified Atmosphere Packaging) – Principle

- Injection of neutral gases ( $N_2$  /  $CO_2$ )

Gas	Properties	Effects
<b>Nitrogen (<math>N_2</math>)</b>	<ul style="list-style-type: none"><li>• Inert and odorless</li><li>• Prevents pigment oxidation</li><li>• Inhibits bacterial growth by replacing oxygen</li><li>• Protects fragile products from crushing</li><li>• Poorly soluble in water and fats</li><li>• No fungistatic or bacteriostatic properties</li></ul>	<ul style="list-style-type: none"><li>• Prevents pigment oxidation</li><li>• Inhibits the proliferation of aerobic bacteria (<math>N_2</math> replaces <math>O_2</math>)</li><li>• Protects products from mechanical damage</li></ul>
<b>Carbon Dioxide (<math>CO_2</math>)</b>	<ul style="list-style-type: none"><li>• Bacteriostatic and fungistatic effects above certain concentrations</li><li>• Highly soluble in water and fats</li></ul>	<ul style="list-style-type: none"><li>• Effective at concentrations above ~20%</li><li>• Inhibits the growth and limits the multiplication of aerobic bacteria and molds</li></ul>

# Flow Pack strategies: Ambient VS MAP

## Importance of the Gaz composition: Ratio CO2/N2 fct Free water activity (Aw)



Aw	Risque de développement			Film Barrier		MODIFIED ATMOS		
	Yeast	Mold	Bact.	Water Barrier	O2 barier	Y/N	N2	CO2
<0,6	no	no	No	Y	Y if Fat	n	0%	0%
0,6 - 0,75	YES	No	no	Y	Y	Y	100%	0%
0,75 - 0,85	YES	YES	No	Y	Y	Y	50%	50%
> 0,85	YES	YES	YES	Y	Y	Y	20%	80%
> 0,9	YES	YES	YES	Y	Y	Y	0%	100%

**TORTILLA WRAP**

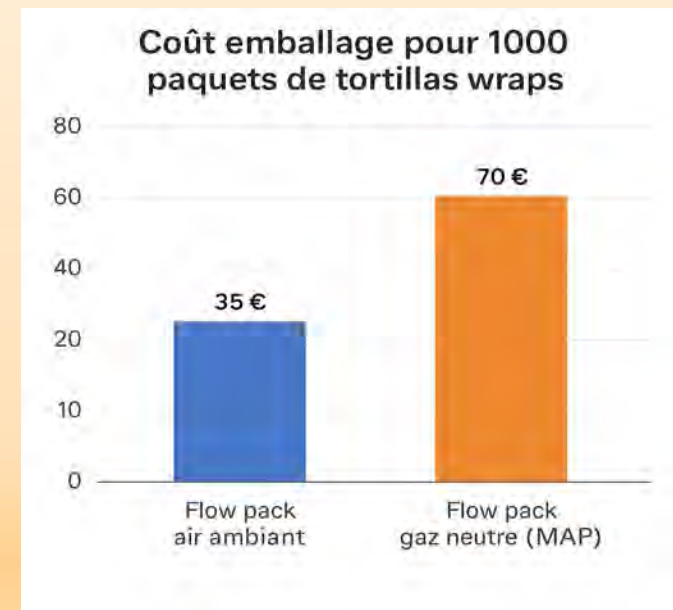
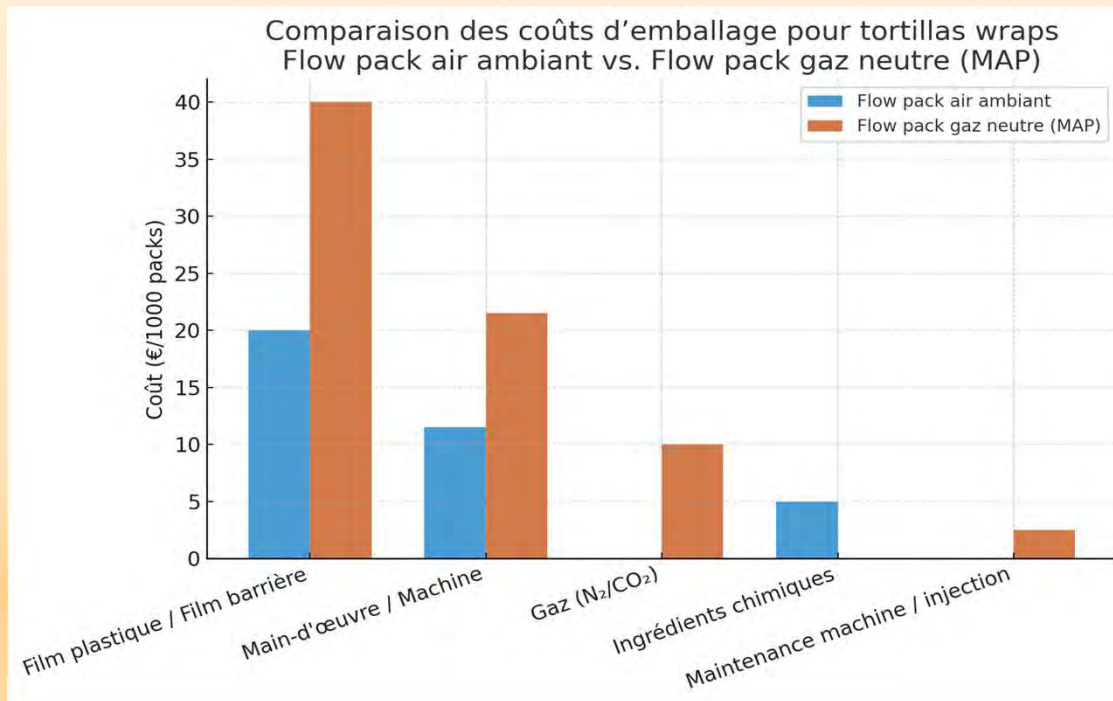
<b>CO2</b>	<b>&gt;80%</b>
<b>N2</b>	<b>&lt;20%</b>

# Flow Pack strategies : Ambient Vs MAP

## Economic & Marketing Comparison

### Cost Analysis

- Ambient: low cost, preservatives cheap
- MAP: gas + films + investment (10 000 pcs/min)



💰 **Indicative cost** (€/ 1000 packs – 6 X25cm)

# Flow Pack strategies : Ambient Vs MAP

## MAP – Pros and Cons

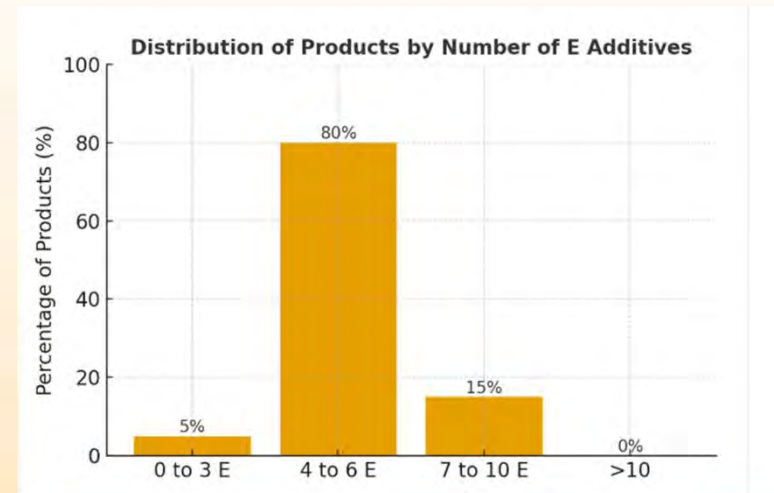
- Advantages:
  - Reduce or eliminate the preservatives and E number
  - Premium packaging meets market demand
- Drawbacks:
  - Cost of packaging per pieces
  - CAPEX: Equipment cost
  - Complex validation in production ! Maintenance, etc... Gaz regulation..
  - Slow process: needs sometimes 2 machines per medium prod line
  - Be very careful about the permeability of the films after deformation during thermoforming.

## Flow Pack strategies : Ambient Vs MAP

### MARKETING : Case Studies & Field Feedback (Nielsen et AB MAURI work)

#### Conclusion : Comparative ingredients list in RETAILERS for 3 to 6 monthsSL

- **90%** Tortilla sold in France supermarket are packed with modified Atmosphere
- **80 %** use between **4 to 6** additives
- **50%** of Tortilla sold in supermarket are using Preservatives
- **There is no relation between Nutri-score and E numbers !**
- Conclusion :
- → some producers are still using some preservatives with MAP packaging
- → Benefit = reduced E numbers from 10 to 5/6



additif	Top 5 additives	
	Count	Percentage
E422	20	100%
E500	19	95%
E471	18	90%
E296	11	55%
E282	10	50%
E920	10	50%

# Flow Pack strategies : Ambient Vs MAP

## conclusion

### Ambient vs. MAP – Comparison

- Side-by-side table: cost, complexity, shelf life

Criterion	Flow pack air ambient	Flow pack gaz neutre (MAP)
Principe	Conditioning with atmospheric air	Neutral gas injection (N <sub>2</sub> /CO <sub>2</sub> )
Film used	Standard (PE/PP)	Film barrière (PA-PET/EVOH/PP)
Mold protection	Limited (oxygenated air)	Improved (CO <sub>2</sub> INJECTION)
Packaging Cost	Weak	Higher (gas + film)
Machine investment	Standard	Expensive Requires gas dispensers
Cost per pack ( x 6)	3,5 CTS	7 CTS
Image/marketing	Cost-based & simple	More premium, technological
Preservatives	mandatory	sometimes
E number	> = 10	< = 6
Recommended Use	Circuits courts, rotation rapide	Retailers, Exportation

# Packaging Strategies in Tortilla-Wrap

## Conclusion



# Packaging Strategies in Tortilla-Wrap – Conclusion

## Summary – Key Takeaways

**Over time, conservation has become a science:**

Objective of this presentation =

- What is hidden behind the plastic film of packaging?
- How to use the film?

There is a **whole strategy** and the **constant pressure** from the consumer on "cleaner" ingredient lists and the pressure from food service customers on demanding price-quality expectations

**No universal solution:** depends on market and cost goals of each producers

**Packaging has become a strategic lever for the development**

**The choice is yours!**

**History in preservation evolution**

**19<sup>th</sup> century :**

Appertization, pasteurization

**20<sup>th</sup> century :**

Industrial refrigeration, chemical preservatives, modified atmospheres

**21<sup>st</sup> century:**

Clean label ingredients innovations, packaging active films, control of pH, Aw, oxygen.

AB | MAURI

Thanks for  
your attention !

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