SYM'PREVIUS

SYM'PREVIUS MAP: A WEB APPLICATION FOR THE DESIGN OF FOOD PACKAGING TO IMPROVE THE PRESERVATION OF FOOD PRODUCTS

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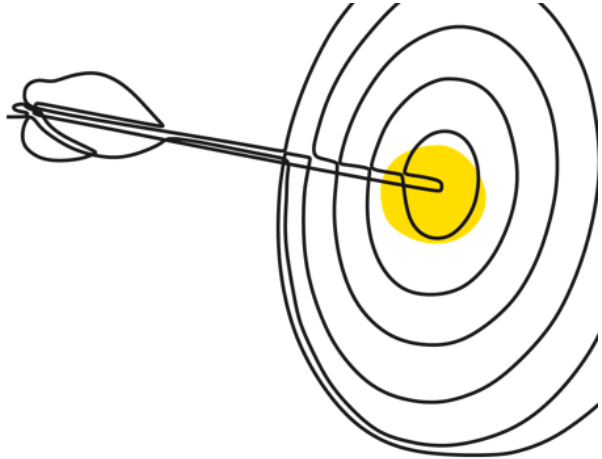
Presentation outline



1. Modified Atmosphere Packaging
2. Models for gas exchanges and bacterial growth
3. Predictive software
4. Take home messages

Modified atmosphere packaging (MAP)

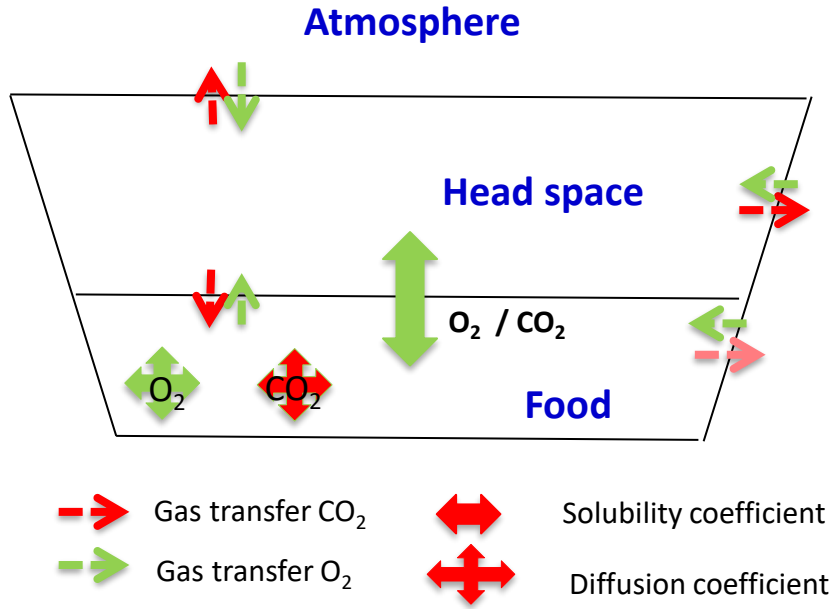
- Modified Atmosphere Packaging (MAP) allows to preserve the appearance, texture and nutritional properties of foods, while limiting the use of preservatives and reducing sanitizing processes

- MAP is mainly used by the food industry to increase shelf-life of packaged products, including microbial shelf-life

Objective: design a predictive tool that will enable manufacturers to design and optimize food packaging to improve the preservation food products under MAP

Modified atmosphere packaging (MAP)

- Design MAP food packaging can be optimized by accounting for the gas exchanges and the inhibitory effects of gas concentrations throughout product shelf life



Models for bacterial growth and gas exchanges

- Predictive microbial models for the effect of CO_2 and O_2 on bacterial growth (Couvert et al., 2017, 2019, 2023)

- A mathematical model for coefficients of solubility and diffusion of CO_2 as a function of nutrition information

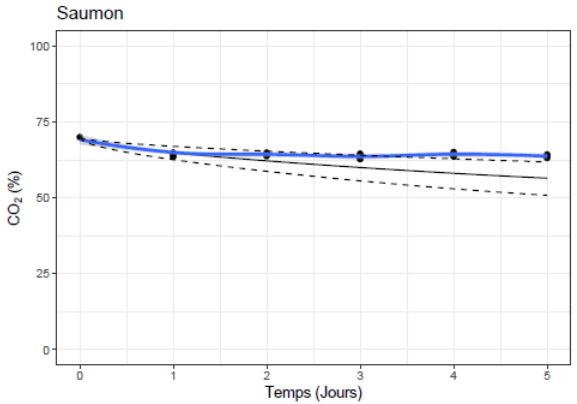
- Mathematical equations for headspace CO_2/O_2 dynamics (Guillard et al., 2016, 2017)
  - $O_2/CO_2/N_2$ transfer between headspace and external atmosphere
  - O_2/CO_2 solubilization and diffusion within the food
  - variations in headspace volume and composition

Models for CO_2 solubility and diffusion

- Quadratic model for the diffusion coefficient and solubility of CO_2 based on nutritional composition data of foods :
  - *Water*
  - *Fat*
  - *Proteins*
  - *NaCl*
  - *Carbohydrates*
  - *Fibers*

→Increase in water and fat content → increase of CO_2 diffusion rate
→Increase in proteins and NaCl content → decrease of CO_2 diffusion rate

The model developed was validated in various food products including e.g. ham, salmon, cheese stored under MAP



- Prediction
- - Confidence interval
● Measured CO_2 in headspace

The Sym'Previus predictive tool

The Sym'Previus software is a set of decision support tools for food safety and quality (www.symprevius.eu)

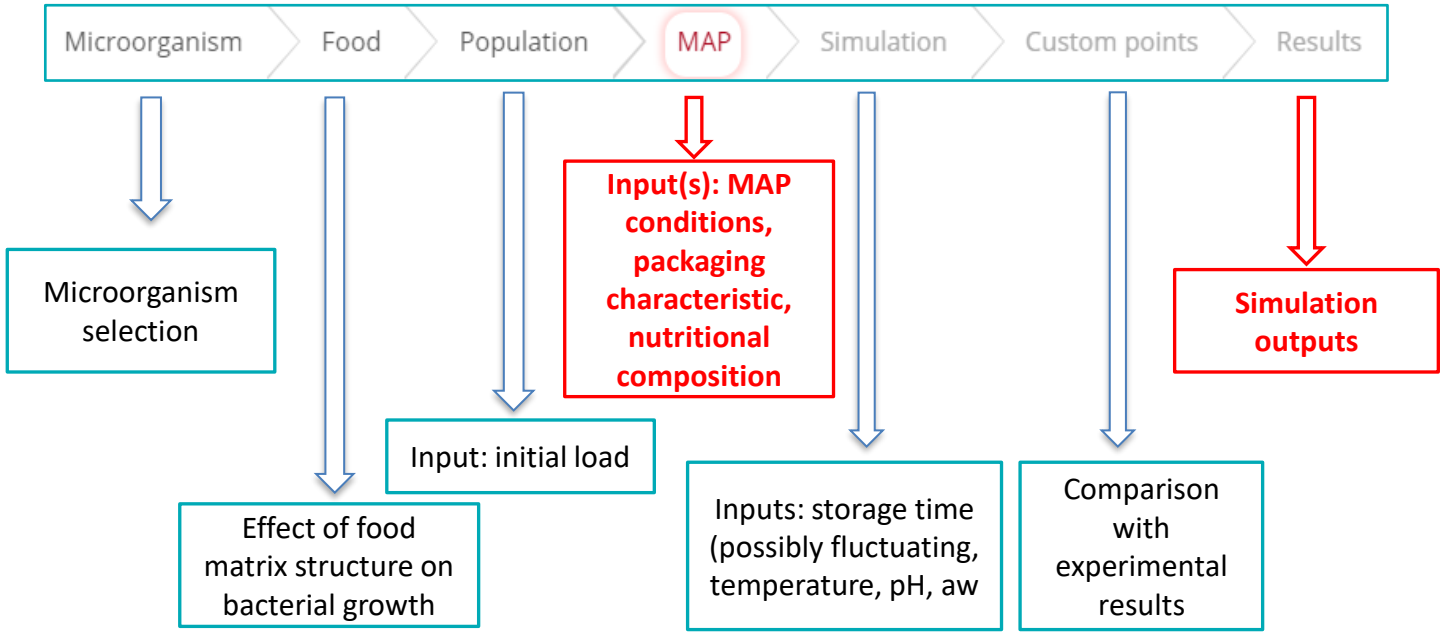
- Identification of critical points (HACCP)
- Determination of the growth potential of microorganisms
- Assist in determining shelf life
- Optimize heat treatments

Why use Sym'Previus

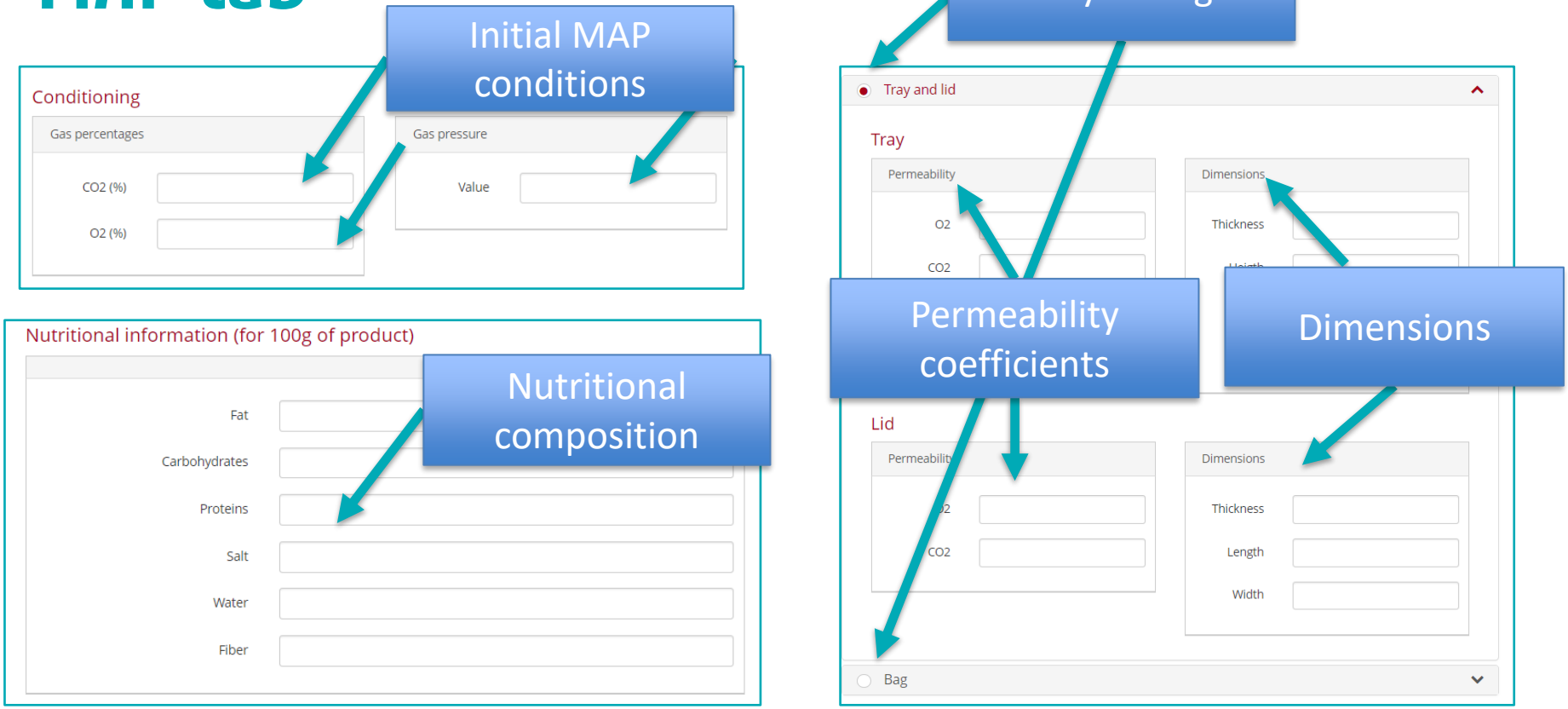
- Designed to support shelf-life determination, product formulation and process optimisation to reduce costs and time to market
- An extensive repositary of predictive models that use recognized scientific approaches and were validated in food
- A user-friendly interface and dynamic plots and charts make the analysis quick and easy
- Referenced in the educational kit "Control of microbiological shelf life" developed by the French General Directorate for Food (DGAL) and the CTN QUALIMA

Implementation in the predictive software Sym'Previus

Modification of the usual software framework



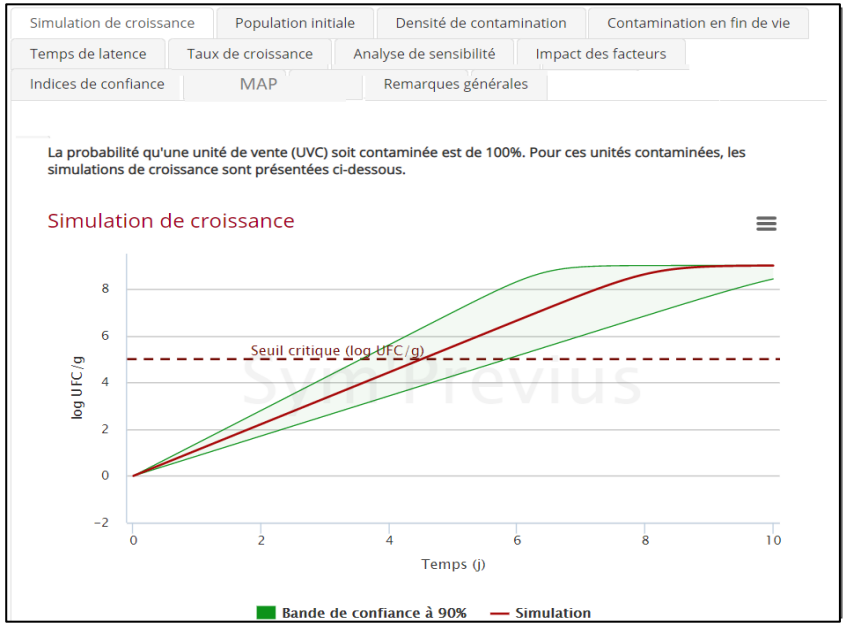
MAP tab


Initial MAP conditions
Conditioning
Gas percentages
CO2 (%)
O2 (%)
Gas pressure
Value
Nutritional information (for 100g of product)
Nutritional composition
Fat
Carbohydrates
Proteins
Salt
Water
Fiber
Tray or bag
Tray and lid
Tray
Permeability
O2
CO2
Dimensions
Thickness
Permeability coefficients
Dimensions
Lid
Permeability
CO2
Dimensions
Thickness
Length
Width
Bag

Results tab

Main outputs

- Bacterial growth kinetics as a function of time
- Probability to exceed a threshold concentration (specified by the user) at the end of stockage time
- Evolution of gas (CO_2 and O_2) in the head space



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Take home messages

- A simulation tool that will support design and optimisation MAP and food packaging (available in French and English)

- Simulations of growth under MAP available for different pathogenic or spoilage microorganisms

- The simulations use only data that is readily available to manufacturers (e.g., nutritional composition). Shiny app tools will be made available to facilitate unit conversion (for e.g., gas permeability)

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Acknowledgments

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anr agence nationale de la recherche AU SERVICE DE LA SCIENCE

machine atmosphère packaging OPTI MAP

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UMT ALTER'IX FOOD SPOILAGE BY SPORE-FORMING BACTERIA AND MOULDS

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ADRIA