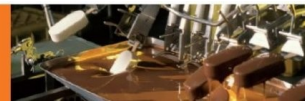


CIPACK

Interdepartmental Center for **PACK**aging

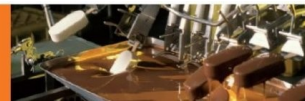
INNOVATIVE SYSTEMS FOR PACKAGING

Certified by Emilia Romagna



Outline

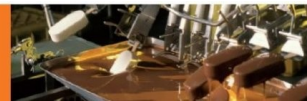
- What is Cipack
- Areas of research
- What can we do? A few examples
 - Innovative materials for packaging
 - Advanced systems for packaging
 - Environmental impact of packaging
 - Quality and hygiene of packaging
- **MASTER IN PACKAGING**



INTERDEPARTMENTAL CENTRE FOR PACKAGING

WHAT IS CIPACK?

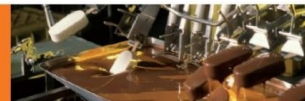
- ✓ The Interdepartmental Center for PACKaging is a research center that works inside the University of Parma, under the agrifood platform for High Technology Network of Emilia Romagna Region.
- ✓ It includes different departments: Industrial Engineering, Chemistry, Physics, Economics, Pharmacy, Life Science and Medicine.
- ✓ It aims to promote and coordinate research activities in basic and applied issues relating to packaging and bottling in particular for food industry and pharmaceutical industry.



INTERDEPARTMENTAL CENTRE FOR PACKAGING

AREAS OF RESEARCH

- A) Innovative materials for packaging
- B) Advanced systems for packaging
- C) Environmental impact of packaging
- D) Quality and hygiene of packaging



INNOVATIVE MATERIALS FOR PACKAGING

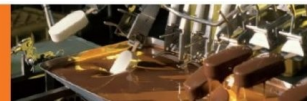
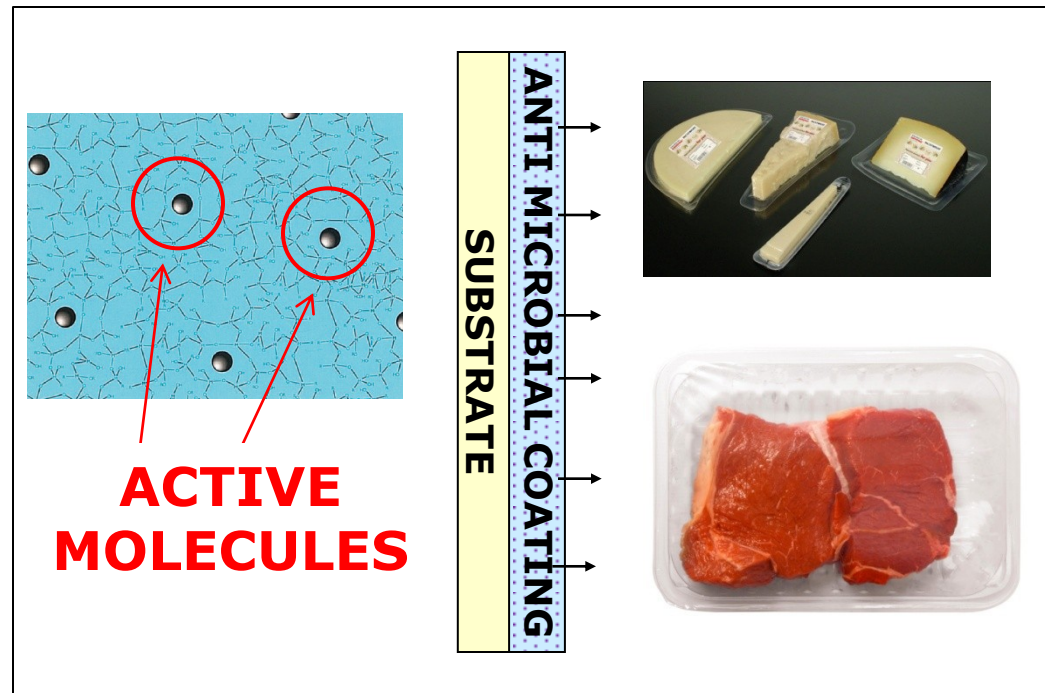
ACTIVE PACKAGING: antimicrobial controlled release

MODEL STUDY

Deposition of a coating containing lysozyme on PET and measurement of the time release.

QUANTITY $\pm 12 \text{ mg/m}^2$

THICKNESS $\leq 1 \text{ }\mu\text{m}$



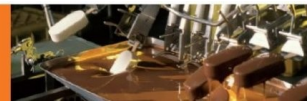
INNOVATIVE MATERIALS FOR PACKAGING

Results

- Quality tests on plates affirm the effectiveness of the release
- Case studies in food simulants confirm the controlled release
- Microbiological studies demonstrate that the antimicrobial activity persists after deposition

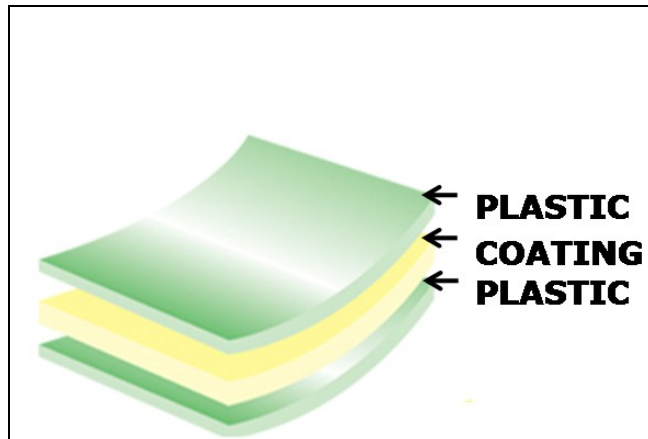
Applications

- Substrates: PE, PP and PLA
- Possibility of modulating the structure of the coating to accelerate, decelerate or stop the release of the substance

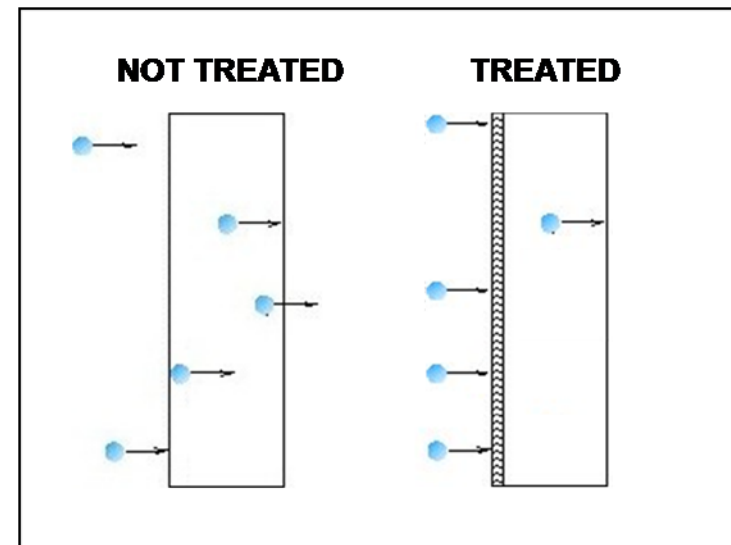


INNOVATIVE MATERIALS FOR PACKAGING

BARRIER PROPERTIES FOR PACKAGING

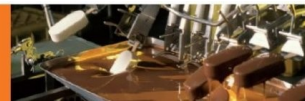


Deposition of nanometric coating to improve the gas barrier properties



TAKE CARE OF ENVIRONMENT!

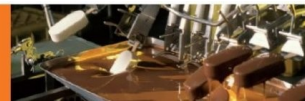
Thin coatings allow a reduction in the thickness of the plastic polymers



O₂ BARRIER COATINGS FOR PLASTIC MATERIALS

Permeability with ~ 1 μm thick coating

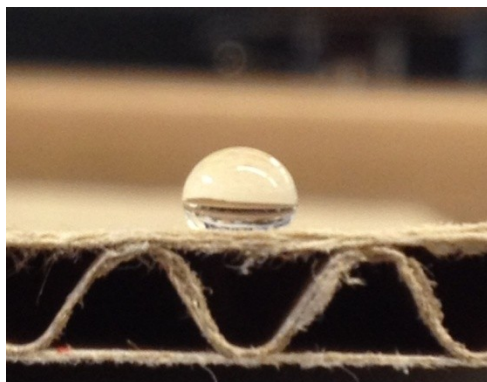
SUBSTRATE	PERMEABILITY <i>cc/(m²*day) 23°C, 0% RH</i>
<i>PET (12μm)coated</i>	0.05 – 0.5 <i>(standard = 30 – 90)</i>
<i>Nylon-6 (20μm) coated</i>	0.02 – 0.5 <i>(standard = 20 - 40)</i>
<i>PP (20μm) coated</i>	0.5 – 1.5 <i>(standard = 1500 - 2500)</i>



INNOVATIVE MATERIALS FOR PACKAGING

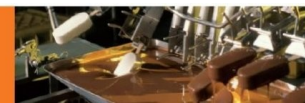
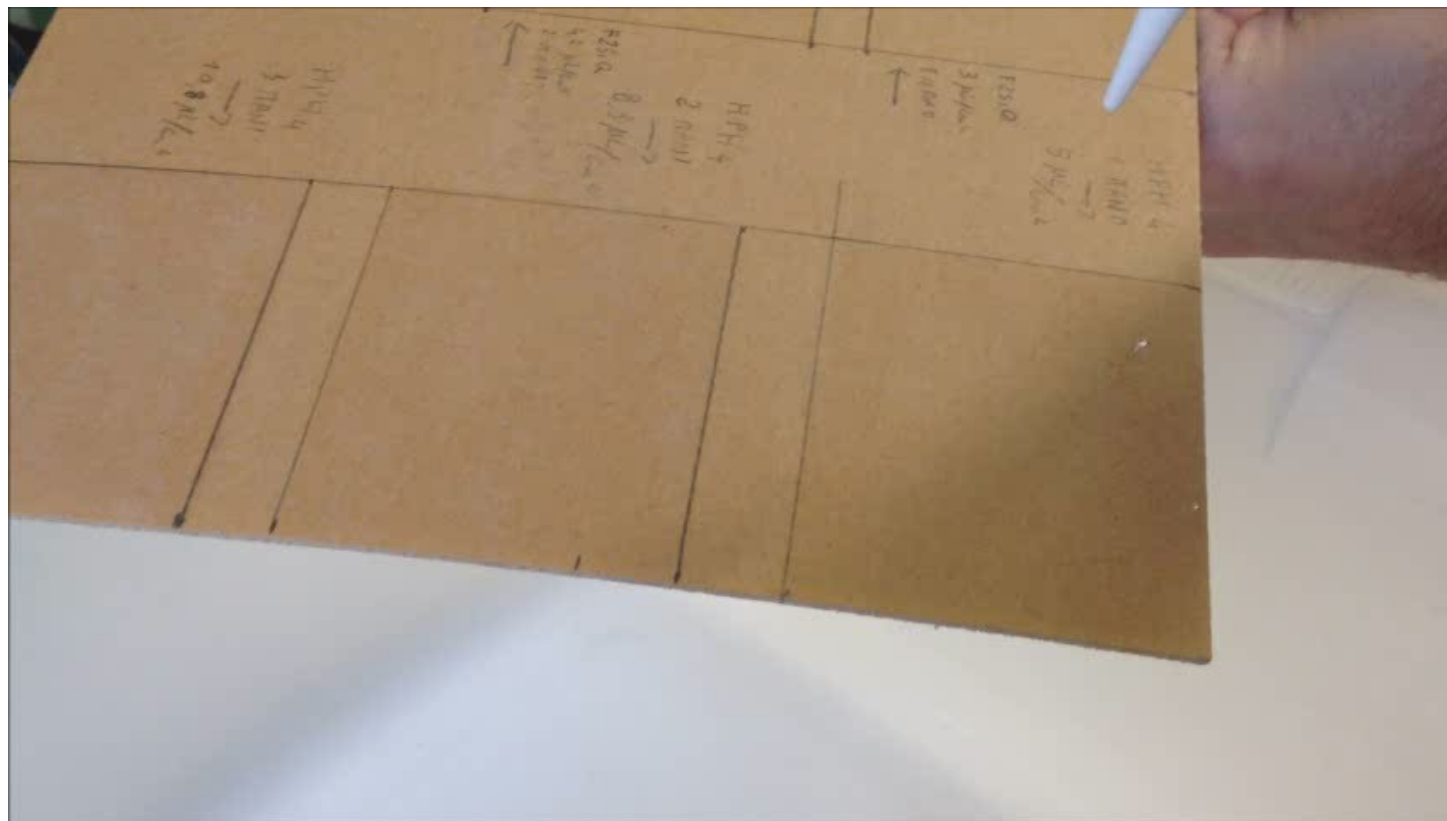
SUPERHYDROPHOBIC TREATMENT FOR WOOD AND CARDBOARD

SOL-GEL technique for the
functionalization of surfaces



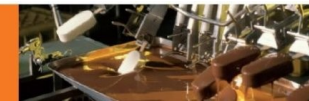
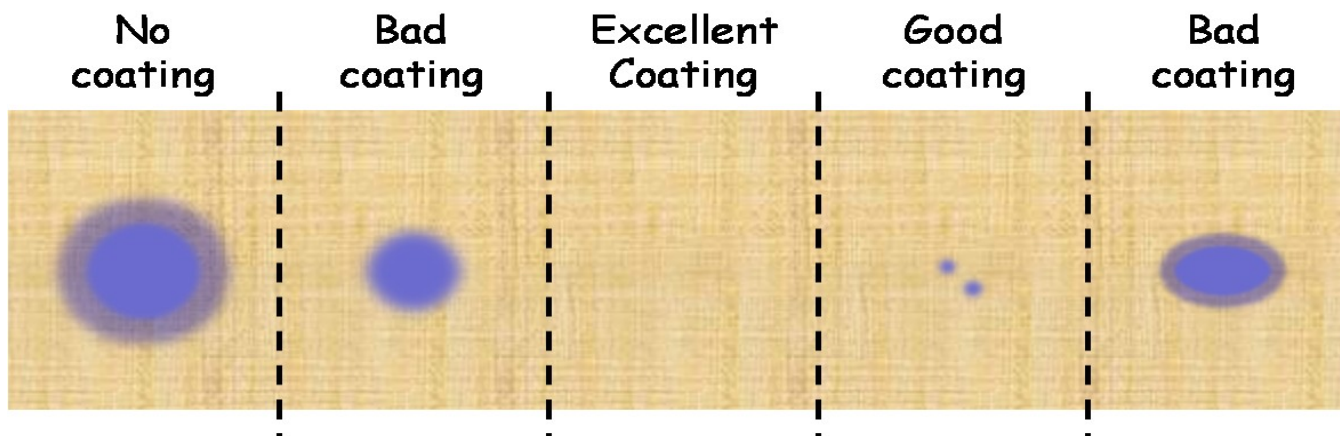
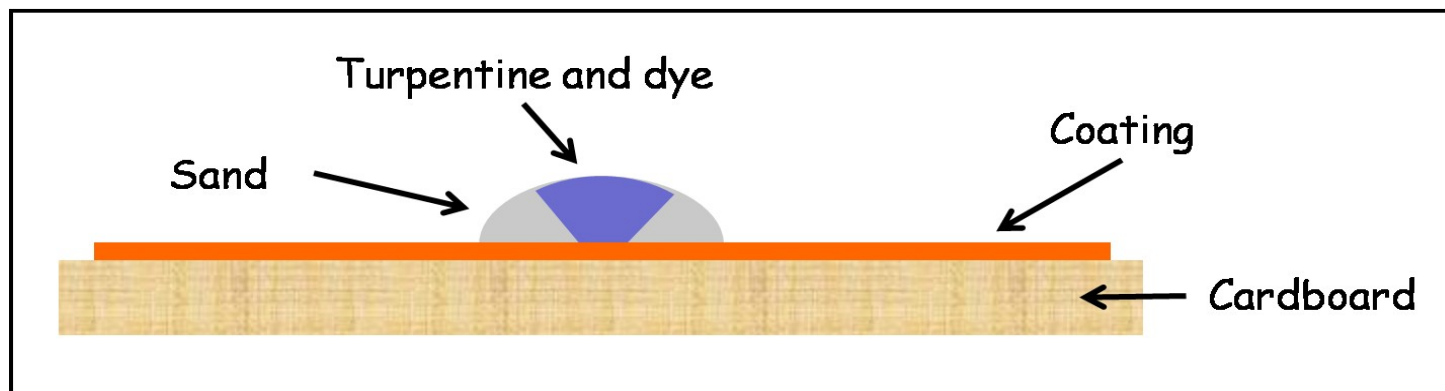
INNOVATIVE MATERIALS FOR PACKAGING

SUPERHYDROPHOBIC TREATMENT FOR CARDBOARD

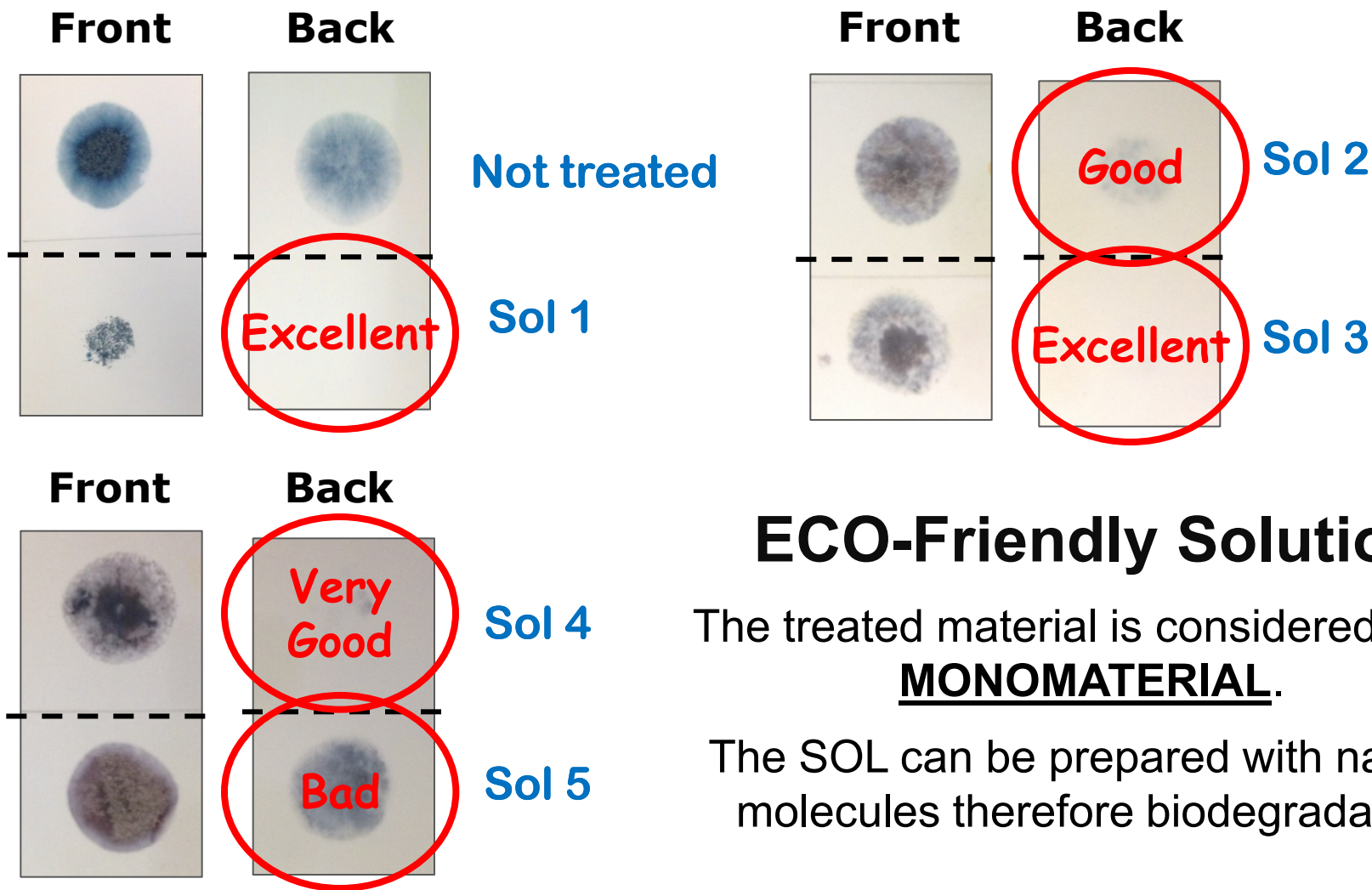


INNOVATIVE MATERIALS FOR PACKAGING

MOH and GREASE BARRIER, cardboard treatment



RESULTS



ECO-Friendly Solution

The treated material is considered to be **MONOMATERIAL.**

The SOL can be prepared with natural molecules therefore biodegradable.



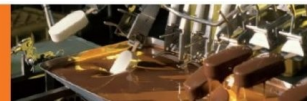
ADVANCED SYSTEM FOR PACKAGING

DISCRETE EVENT SIMULATION IN THE DESIGN OF PACKAGING SYSTEMS

- ✓ The simulation is the virtual reproduction in time from a system or real process
- ✓ The system is represented as a chronological sequence of events
- ✓ Each event changes the state of the system

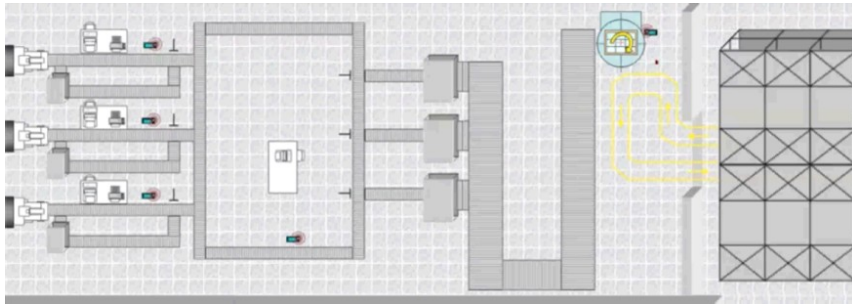
Applications

- Support tool for the design phase: it provides important information on the performance of a system before its physical implementation
- What-if analysis: to evaluate different configurations of the same system, identifying bottlenecks in a system



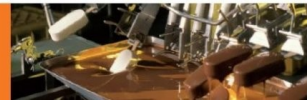
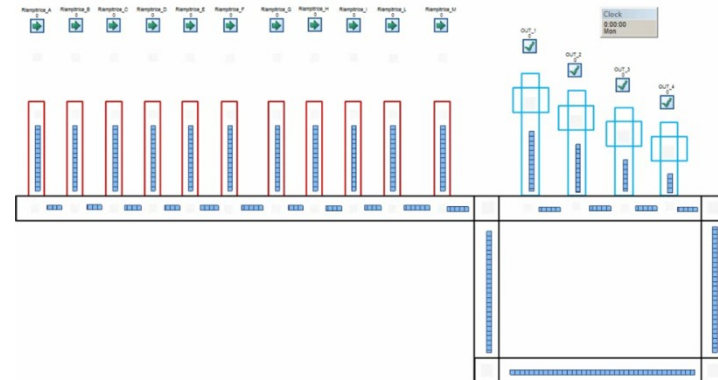
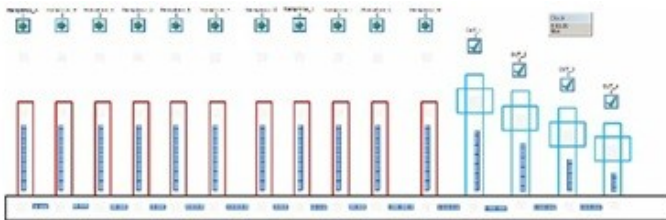
DISCRETE EVENT SIMULATION IN THE DESIGN OF PACKAGING SYSTEMS

SIMULATION OF MATERIAL HANDLING



It's possible to analyze the performance of a system by identifying bottlenecks.

PERFORMANCE EVALUATION: TRANSFER SYSTEM FROM FILLING TO WAREHOUSE



ADVANCED SYSTEM FOR PACKAGING

COMPUTATIONAL FLUID DYNAMICS SIMULATION

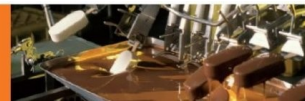
CFD (Computational Fluid Dynamics)



Fluid dynamics problem solving using computer

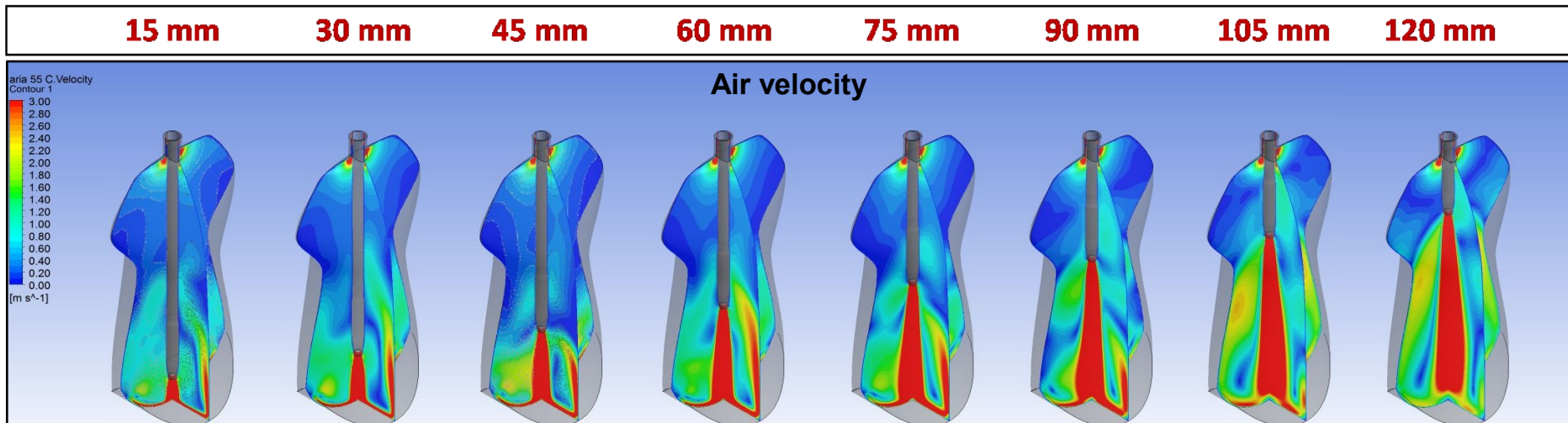
Applications

1. Mixing and dissolution of species.
2. Heat treatment.
3. Study of the motion of fluids within pipes.



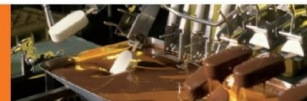
INDUSTRIAL APPLICATION OF CFD

STERILIZATION OF FLEXIBLE PACKAGING

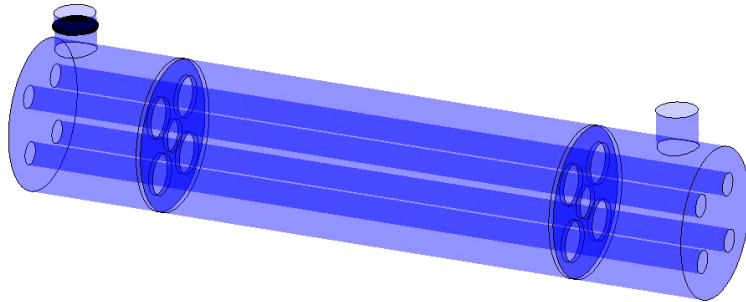


✓ Determination of the optimal flow of sterilizing mixture (with H_2O_2 , hydrogen peroxide).

✓ Optimization of the process for the removal of the aseptic mixture using sterile air.



UV REACTOR FOR THE DISINFECTION OF WATER

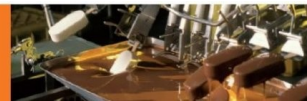
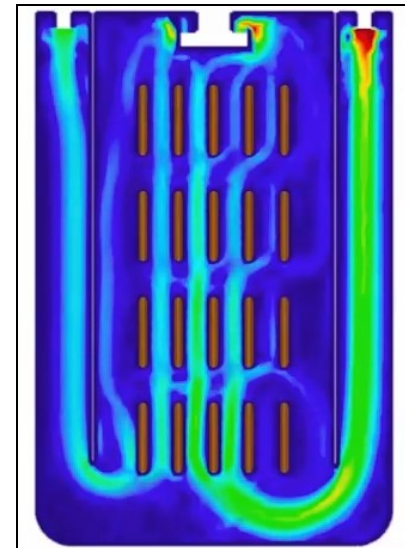


It's possible to:

- ✓ calculate the amount of UV radiation absorbed by the particles of water
- ✓ find the optimal layout and lamp
- ✓ calculate the speed of water flow

MATURATION ROOM OF SALAMI (SAUSAGES)

- ✓ Modifying the flow rate and the input mode of the air it has been possible to obtain a flow able to ensure a more uniform seasoning of sausages



ENVIRONMENTAL IMPACT OF PACKAGING

LIFE CYCLE ASSESSMENT

The LCA is a process that allows you to evaluate and quantify the environmental impacts associated with a product, process or activity.



The entire life cycle of a product it's considered, from raw material extraction to disposal.

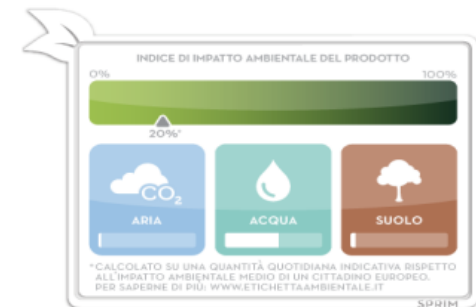


ENVIRONMENTAL IMPACT OF PACKAGING

INSTRUMENT OF COMMUNICATION AND GREEN MARKETING

- ✓ Large-scale distribution requires that the companies declare the impacts of products.
- ✓ Eco-friendly products are considered more attractive by consumers

Examples of eco-labels

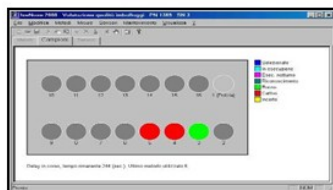
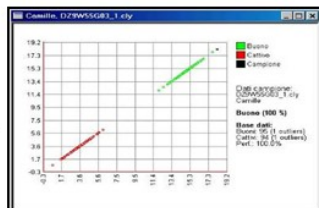
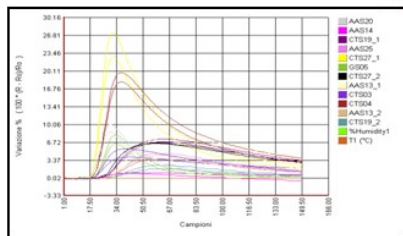


QUALITY AND HYGIENE OF PACKAGING

ARTIFICIAL OLFACTORY SYSTEMS



Optimized for “QUALITY CONTROL” applications



PRACTICAL APPLICATIONS

**Parmigiano Reggiano
cheese quality control**



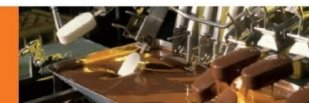
**Paperboard quality
control**

Olive oil defects



**Evaluation and control of
raw materials**

**Packaging quality
control**



QUALITY AND HYGIENE OF PACKAGING

ADVANTAGES of Artificial Olfactory Systems

BEFORE

AFTER

Sample analysis



Analysis of all the incoming batches

Response after 3 days



Response in real time
(10min)

~ 30 € for analysis



~ 2,9 € for analysis

Experienced staff dedicated



Not experienced staff in
quality control



QUALITY AND HYGIENE OF PACKAGING

AGEING AND MIGRATION TESTS

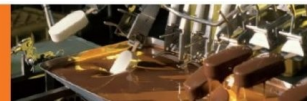
Evaluation of packaging resistance

Variable parameters:

- Temperature
- Humidity
- Light



- ✓ Global and specific migration
- ✓ Specific migrations in tenax
- ✓ Gas chromatographic determination of residual solvents
- ✓ Sensory evaluation for transmission of taste
- ✓ IR and UV-Vis spectroscopy analysis



Master Universitario di primo livello (60 CFU)



Master in Packaging

QUALIFICA RICHIESTA

Laurea di primo livello o magistrale in:

- Scienze Matematiche, Fisiche e Naturali;
- Ingegneria e Architettura;
- Farmacia;
- Medicina e Veterinaria;
- Agraria;
- Economia e Giurisprudenza;

PROGRAMMA DEL MASTER 2012/2013

- 3 mesi di lezione (da lunedì a venerdì)
- 3 mesi di stage aziendale



CORSI D'INSEGNAMENTO

Valutatori di Sistemi di Gestione per la Qualità UNI EN ISO 9001:2008

Materiali Metallici

Materiali Polimerici

Materiali Vetrosi

Conformità dell'imballaggio ai Regolamenti Europei

Materiali Cellulosici ed Accoppiati

Marketing e Brand Identity

Tecniche Analitiche per il Controllo e la Caratterizzazione

Tecnologie di Stampa per Imballaggio

Contaminanti e Cessioni

Tecnologie e Impianti per il Confezionamento alimentare

Fondamenti di Microbiologia

Package Design e Comunicazione

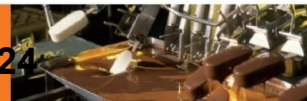
Progettazione per la Distribuzione ed il trasporto degli Imballaggi

Metodi di Progettazione Meccanica

Automazione Industriale

Tecnologie per Imballaggio e Confezionamento

Tecnologie di Condizionamento e Shelf-life dei prodotti Confezionati



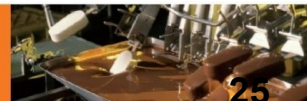
MISSION

Il Master forma studenti che conoscono i materiali e i prodotti da confezionare, le loro incompatibilità e resistenza alle aggressioni chimiche; sono in grado di progettare gli imballaggi valutandone anche gli aspetti normativi ed economici con un'attenzione sempre maggiore al recupero degli imballaggi e all'ambiente. Inoltre ha nozioni di logistica, di controllo di qualità, di marketing, di comunicazione e delle legislazioni connesse.

NOVITÀ 2012-2013: SPECIALE UDITORI

L'edizione 2012/2013 del Master in PACKAGING prevede anche la possibilità di accesso agli "uditori". La presenza come uditori consentirà a persone già inserite in contesti aziendali di partecipare ai singoli momenti formativi di interesse per un limitato periodo di tempo.

www.masterpackaging.it



THANKS FOR YOUR ATTENTION!

FOR MORE INFORMATION:

nicola.zucchetto@unipr.it

WWW.CIPACK.IT

