SHELF LIFE EXTENSION: A CHANCE FROM BACTERIA

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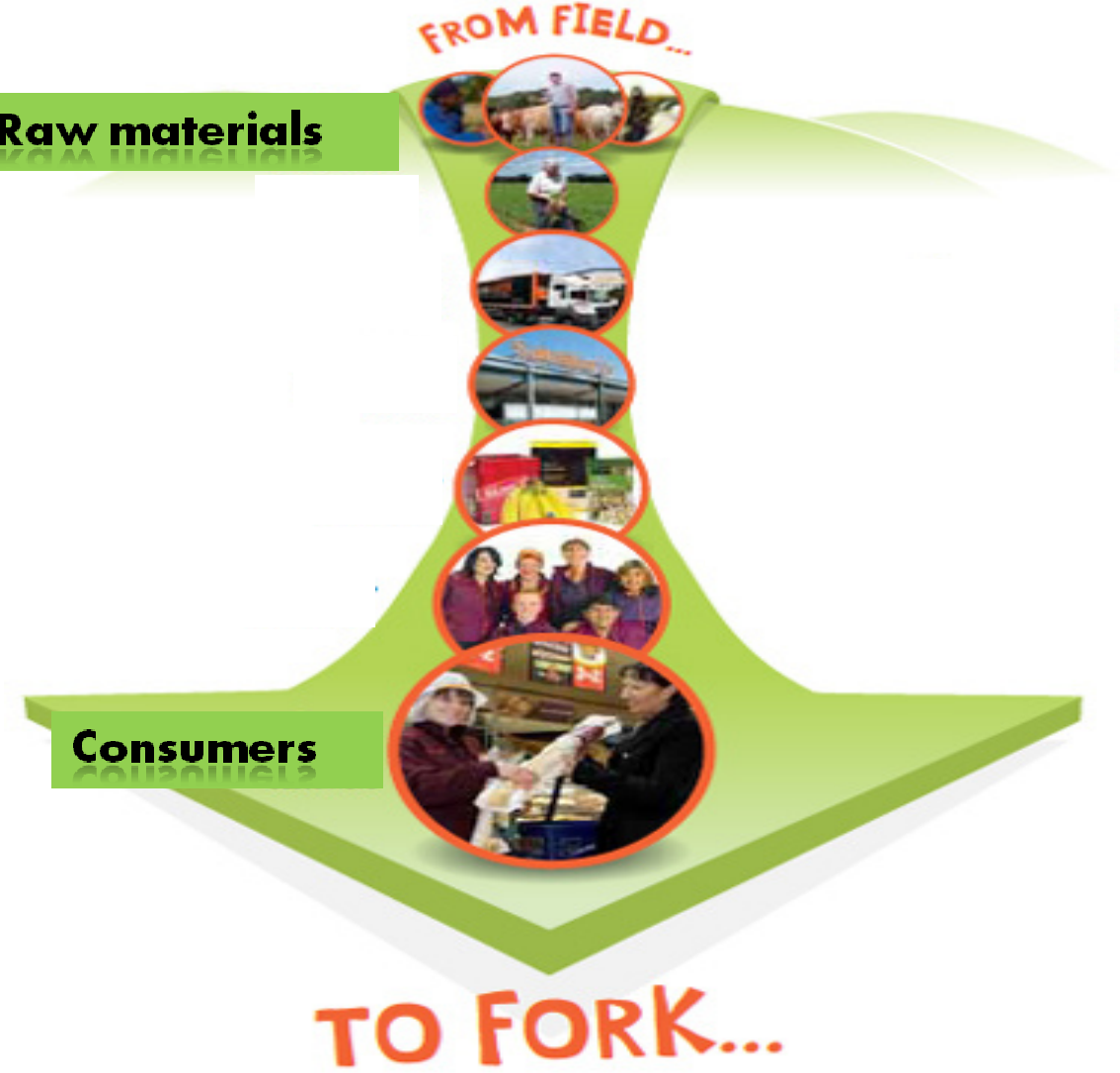
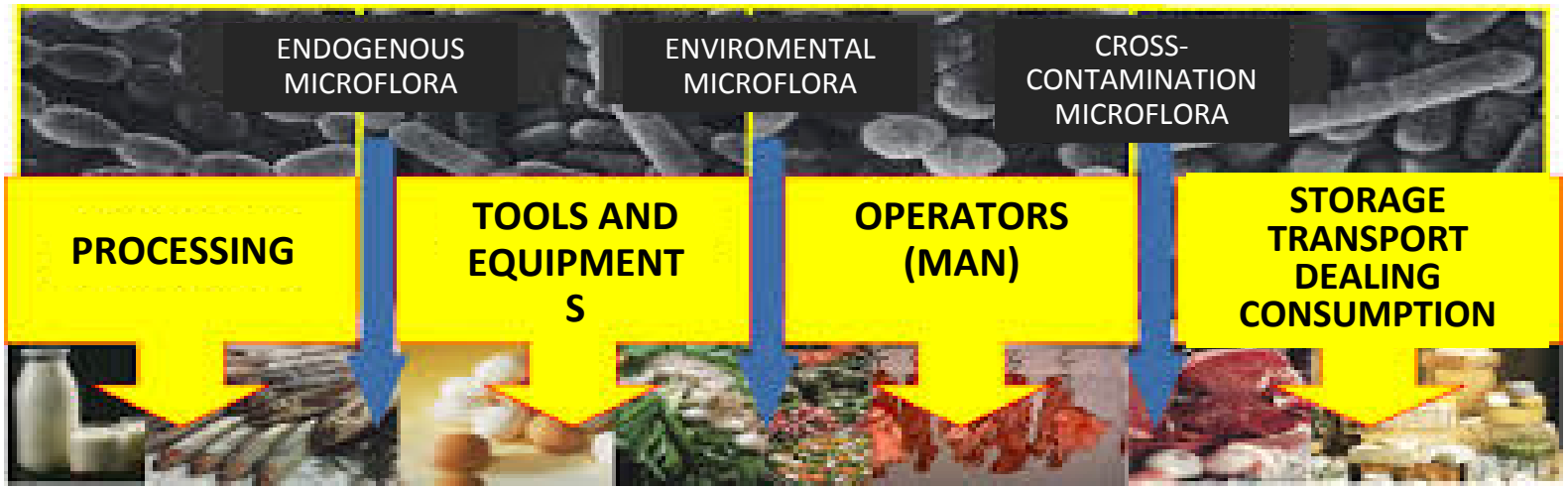
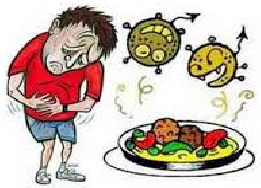
FOOD QUALITY AND SAFETY

All foods should be safe and free from contaminants (biological, chemical and physical) from raw materials and processing to distribution and storage until they reach the consumers.



BIOLOGICAL CONTAMINATION AND FOOD DETERIORATION





Food preservation

The microbiological safety and stability as well as the sensory and the nutritional quality of foods is based on an application of preservative methods, called **hurdles.**

Example of TRADITIONAL HURDLES

Temperature:

-High: pasteurization, sterilization.
-Low: refrigeration, freezing.

Water activity: drying, curing, salting, sugaring.

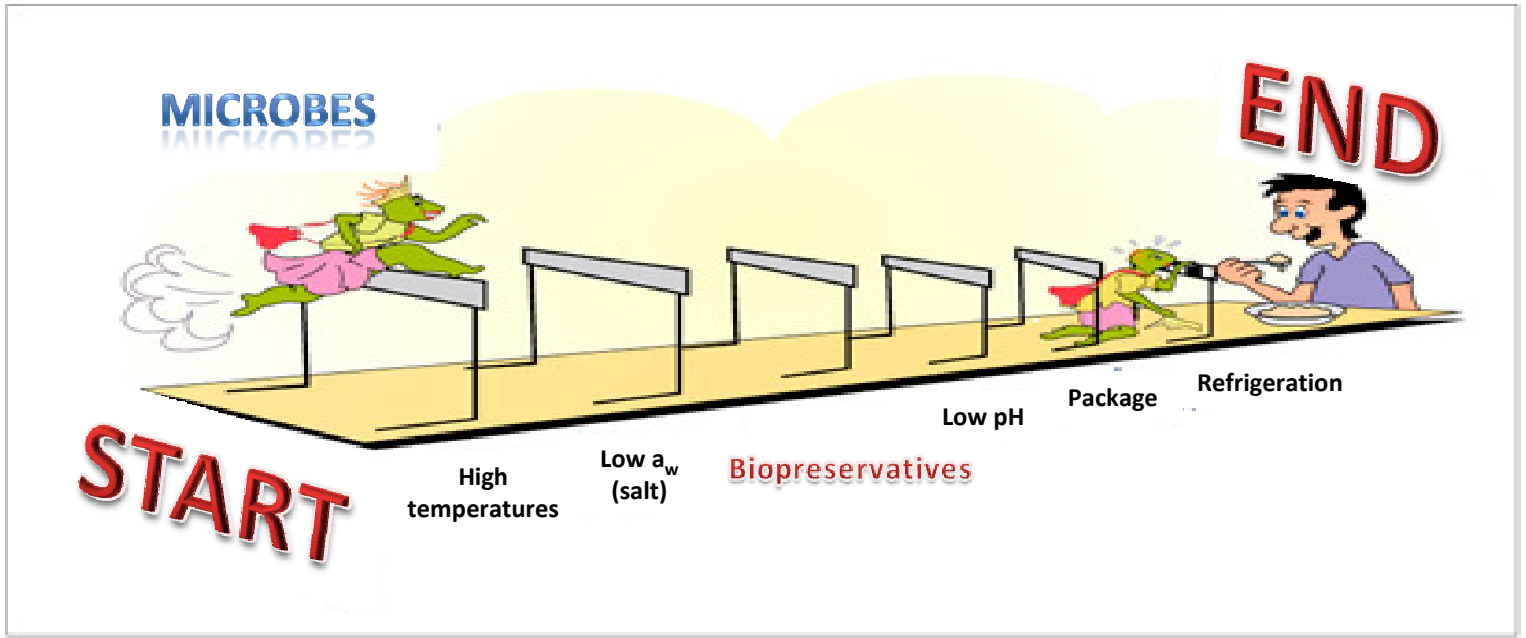
Acidity: adding or formation of acids (e.g. acetic, phosphoric, propionic).

Redox potential: addition of ascorbate, vacuum packaging.

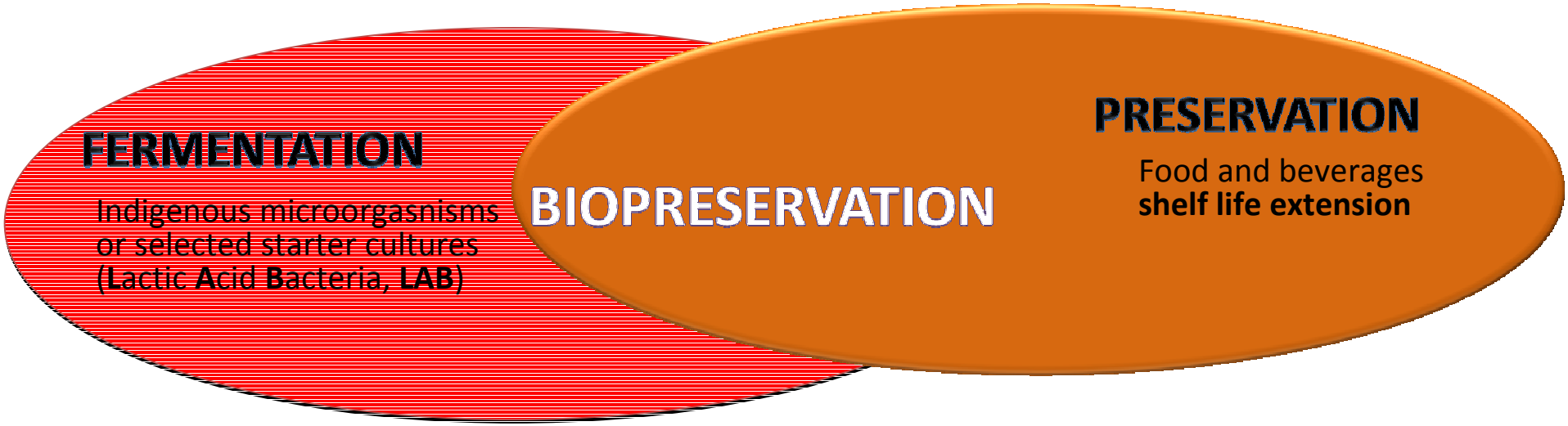
Preservatives: sorbates, nitrites, sulfites.

Hurdle technology

Hurdle technology is defined as an **intelligent combination of hurdles** that secures the microbial safety and stability as well as the organoleptic and nutritional quality of food products (Leistner, 2000. International Journal of Food Microbiology, 55, 181-186)



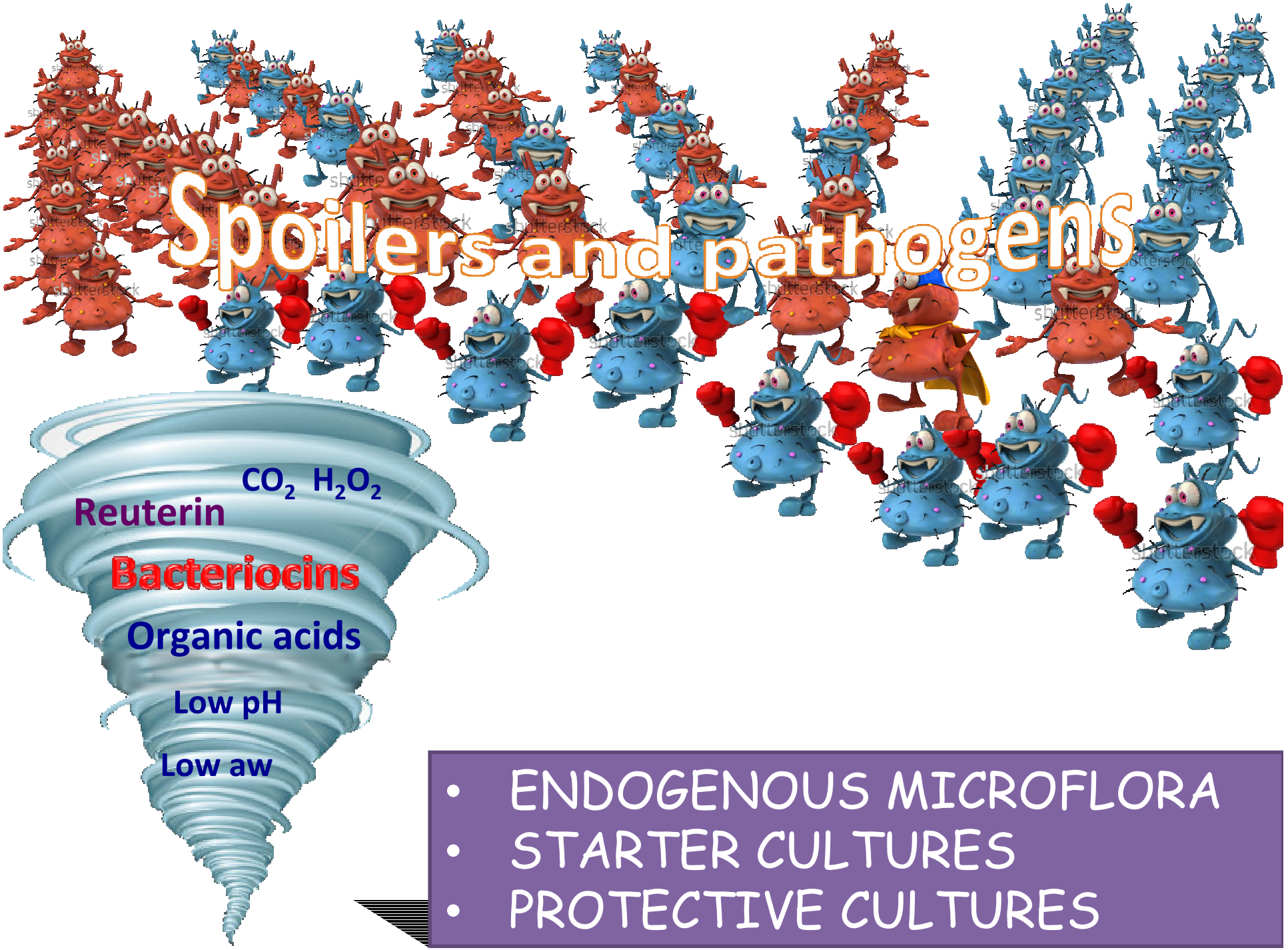
HURDLE TECHNOLOGY:
A FOCUS ON THE CHANCE FROM BACTERIA



BIOPRESERVATION:

use of **natural or added microorganisms** and/or **their metabolites** as a way of **food safety** improving and **shelf life** extension.

FIGHTING MICROBES WITH MICROBES

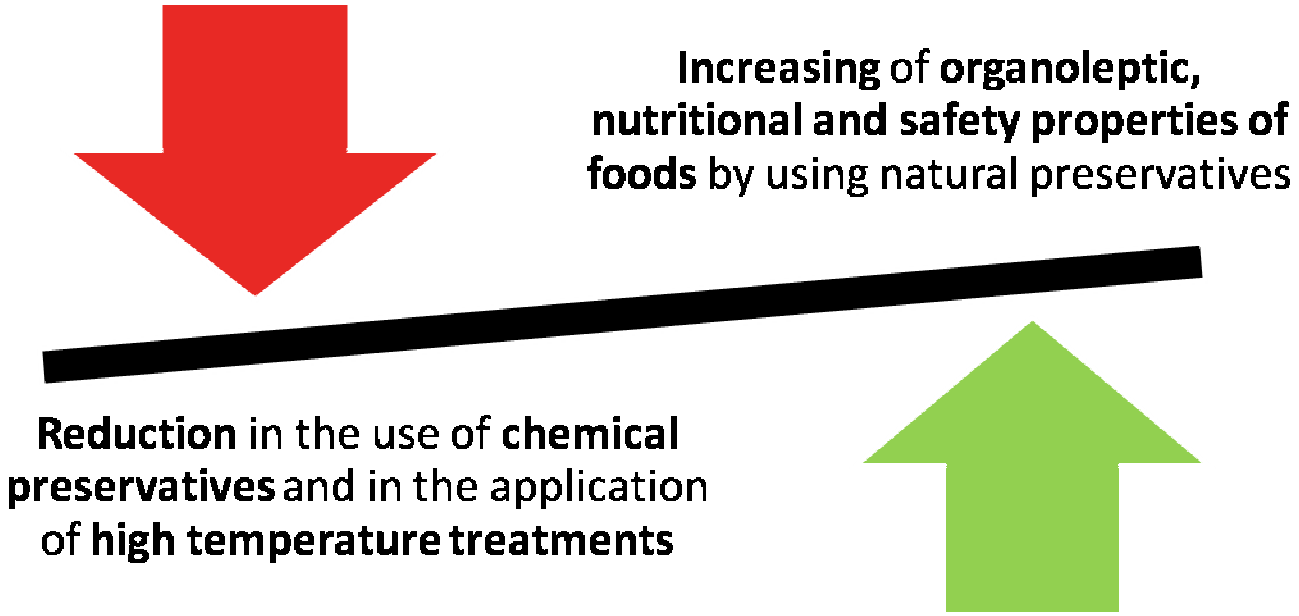


- ENDOGENOUS MICROFLORA
- STARTER CULTURES
- PROTECTIVE CULTURES

A SUBFOCUS ON THE CHANCE FROM BACTERIOCINS

Bacteriocins are **biologically active peptides** with **antimicrobial activity against a wide range of bacteria**. The term "bacteriocins" was coined in 1953 to define colicin produced by *Escherichia coli*.

Use of bacteriocins



USE OF BACTERIOCIN-PRODUCING LAB IN THE BIOPRESERVATION OF FOODS

PRODUCT	MICROORGANISM	TARGET PATHOGENIC MICROORGANISM
Meat products		
• Italian-type salami	*Lactobacillus plantarum*	*Listeria monocytogenes*
• Turkey summer sausages	*Pediococcus acidilactici*	*Listeria monocytogenes*
• Comminutes cured pork	*Lactobacillus sakei* Lb 706	*Listeria monocytogenes*
• Vacuum-packaged frankfurters	*Pediococcus acidilactici* JD1-23	*Listeria monocytogenes*
• Vacuum-packaged wieners	*Pediococcus acidilactici* JBL 1095	*Listeria monocytogenes*
Dairy products		
• Taleggio cheese	*Enterococcus faecium* 7C5	*Listeria monocytogenes*
• Cheddar cheese	*Lactococcus lactis* subsp. *cremoris* JS102	Spores of *Clostridium sporogenes*
Vegetable-type foods		
• Green-olive fermentation	*Lactobacillus plantarum* LPC010	Indigenous lactobacilli
• Ready-to-use mixed salads	*Lactobacillus casei*	Spoilage-associated microflora
• Sourdough	*Lactobacillus plantarum* LM025	*Bacillus subtilis*

Recognized as safe by **FAO/WHO** and **Expert Commitee on Food Additives**

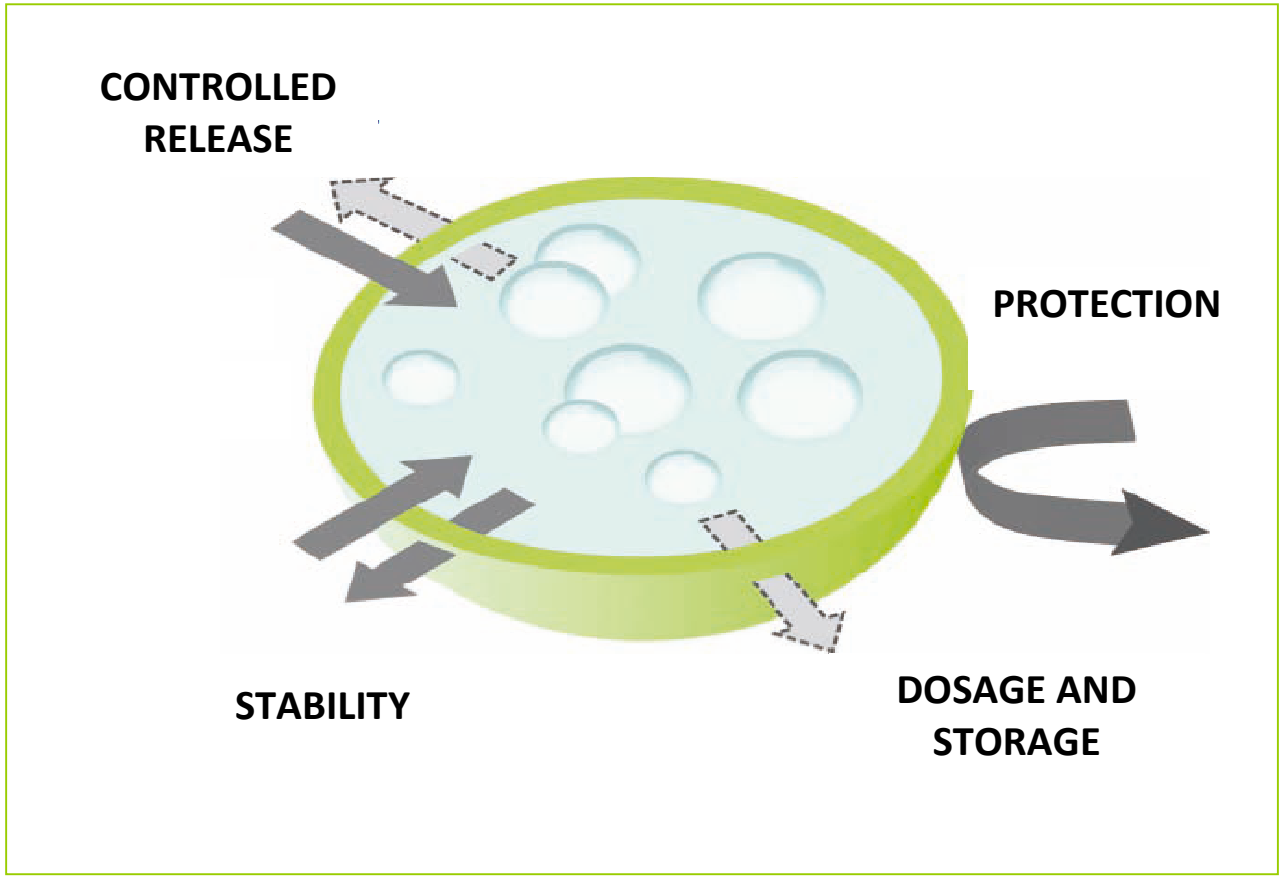
USE OF BACTERIOCINS IN BIOPRESERVATION OF FOODS

PRODUCT	BACTERIOCIN	TARGET MICROORGANISM
Vacuum-pakaged beef	Pediocin AcH, nisin	*Leuconostoc mesenteroides*
Brined shrimps	Carnocin UI49, nisin Z, bavaricin A	Spoilage Bacteria
Ricotta cheese	Nisin	*Listeria monocytogenes*
Bologna type sausage	Nisin	*Brochothrix thermosphacta*
Skinm milk	Nisin	*Bacillus cereus*
Cotta cheese	Nisin	*Listeria monocytogenes*
Canned foods	Nisin	*Clostridium botulinum*

Microencapsulation

MICROENCAPSULATION IS A TECHNIQUE THAT ALLOWS SENSITIVE INGREDIENTS TO BE PHYSICALLY ENTRAPPED IN HOMOGENEOUS OR HETEROGENEOUS MATRIX.

Why microencapsulate nisin?

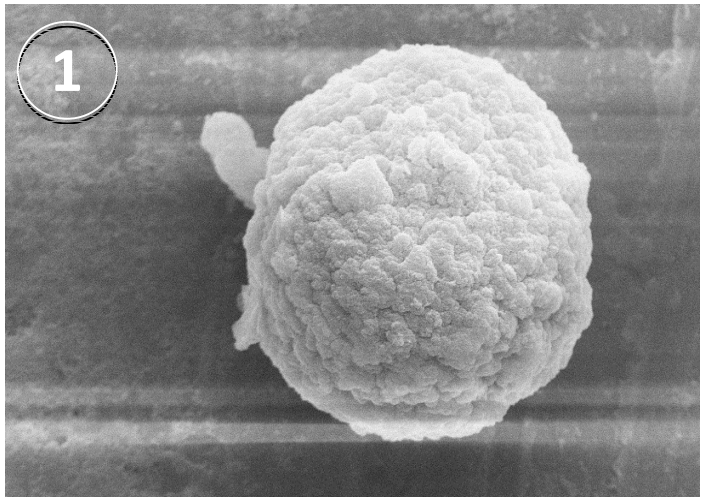


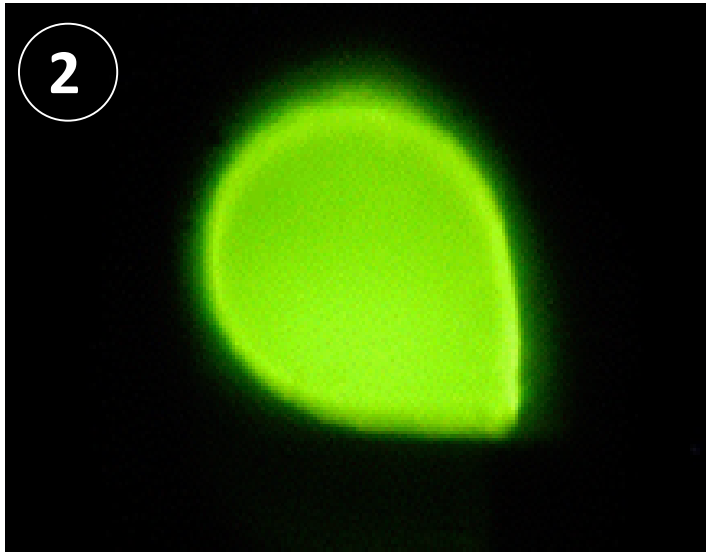
-Protection from rapid inactivation or degradation by proteolytic enzymes.

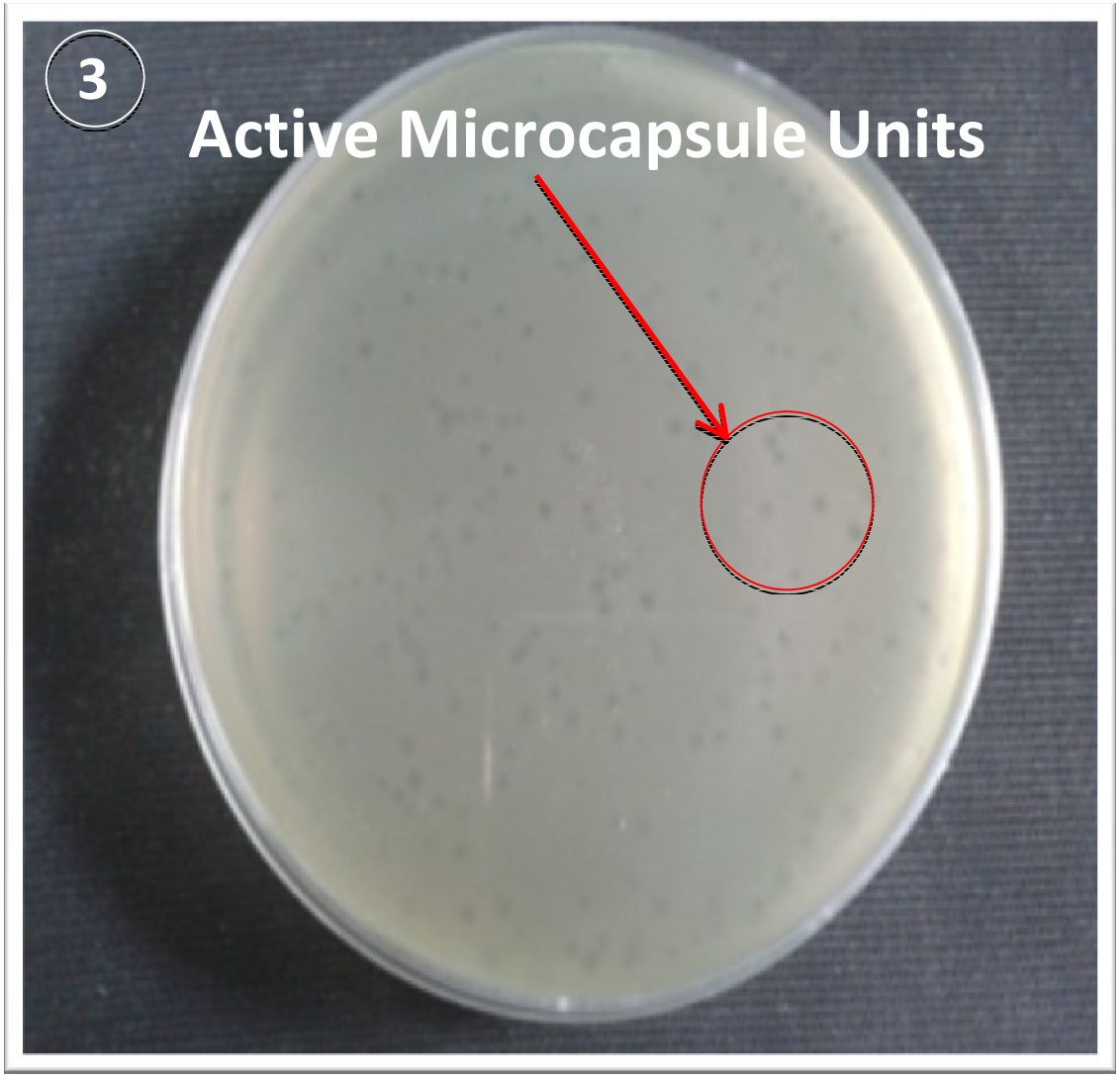
-Stability by limiting their interaction by binds with food components resulting in reduced availability to act against microorganisms in food matrices.

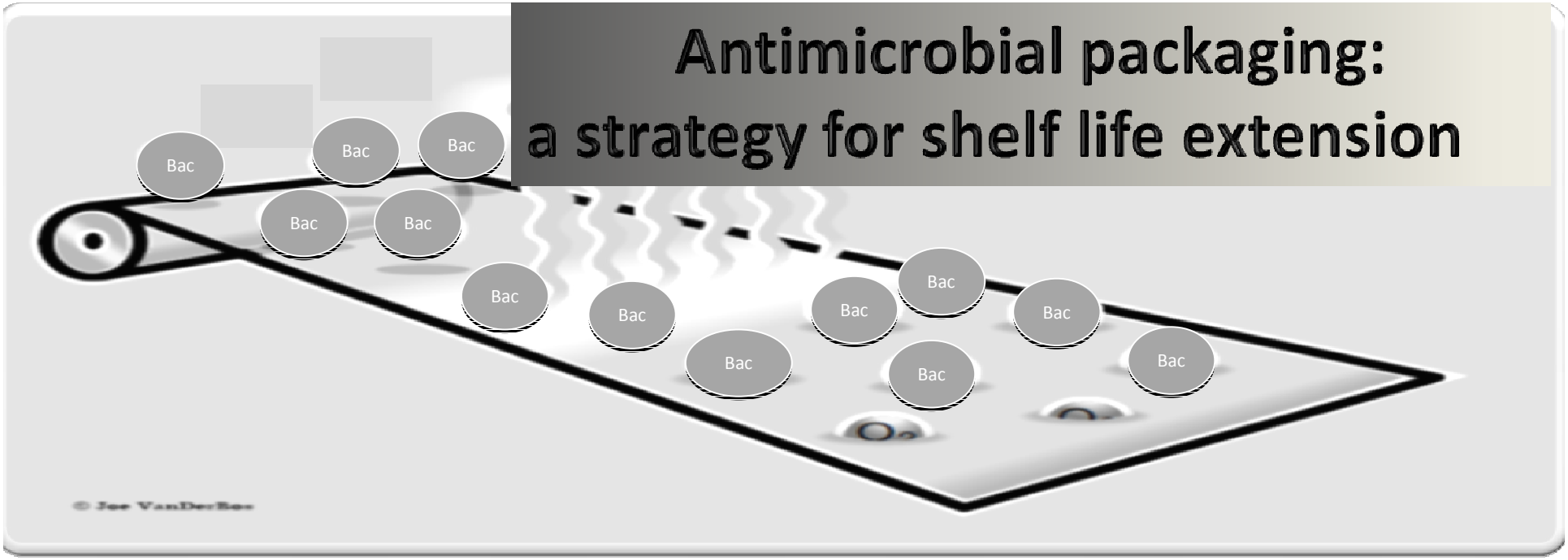
-Controlled release in space and in time.

Microencapsulated nisin: case study





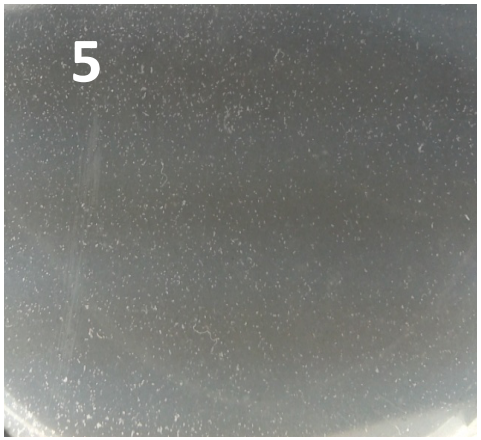


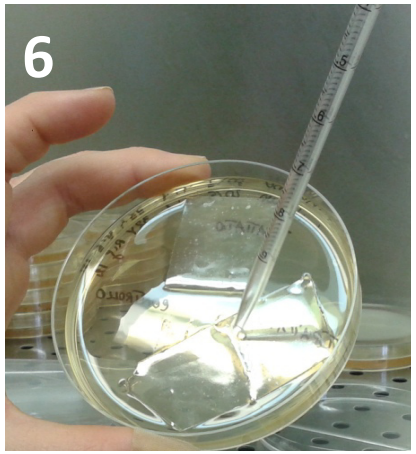


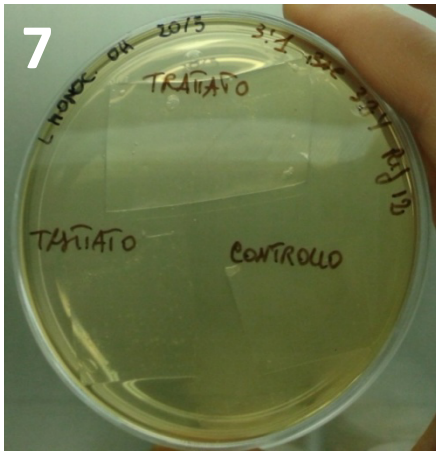
Active packaging is one of the innovative food packaging concepts that have been introduced as a response to demands of consumers for high quality, safety and extended shelf life of food products.

Antimicrobial packaging system is a hurdle to prevent degradation of quality of packaged food providing protection against microorganisms. It allows a controlled release of antimicrobial agent into the food matrix during storage and distribution.

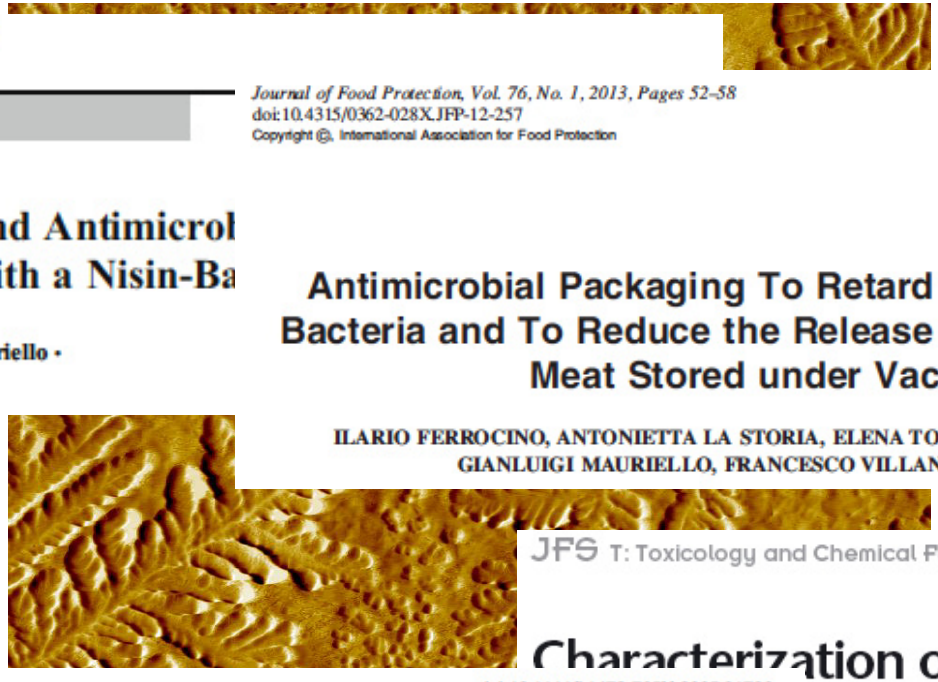
Antimicrobial packaging
Activation of films with microencapsulated nisin: a laboratory scale application







ANTIMICROBIAL PLASTIC FILM BY USING FREE NISIN



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ORIGINAL PAPER

Coating-Activation and Antimicrol
Polyethylene Films with a Nisin-Ba

Antonietta La Storia · Gianluigi Mauriello ·
Francesco Villani · Danilo Ercolini

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Antimicrobial Packaging To Retard the Growth of Spoilage Bacteria and To Reduce the Release of Volatile Metabolites in Meat Stored under Vacuum at 1°C

ILARIO FERROCINO, ANTONIETTA LA STORIA, ELENA TORRIERI, SALVATORE SPAGNA MUSSO, GIANLUIGI MAURIELLO, FRANCESCO VILLANI, AND DANILO ERCOLINI*

JFS T: Toxicology and Chemical Food Safety

Letters in Applied Microbiology 2005, **41**, 464–469

doi:10.1111/j.1472-765X.2005.01796.x

Antimicrobial activity of a nisin-activated plastic film for food packaging

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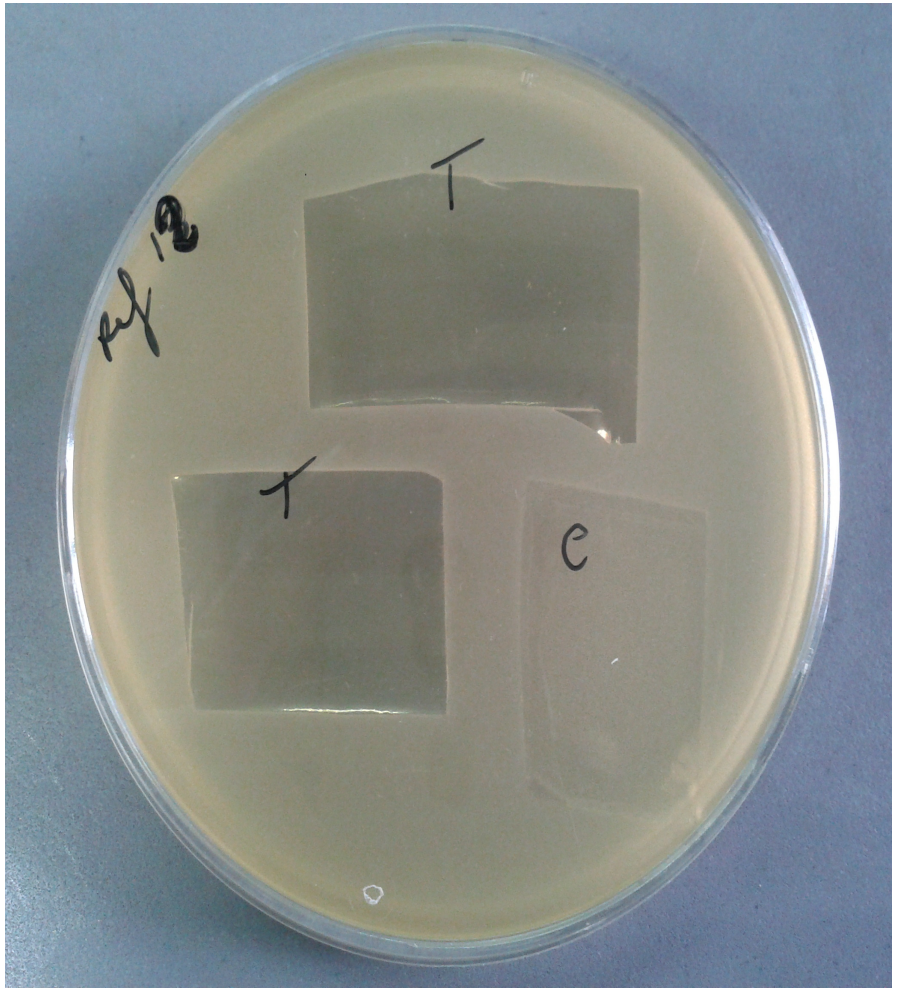
Characterization of Bacteriocin-Coated
al Polyethylene Films
orce Microscopy

MARINELLO, AND G. MAURIELLO

Atomic Force Microscopy image of nisin activated plastic film

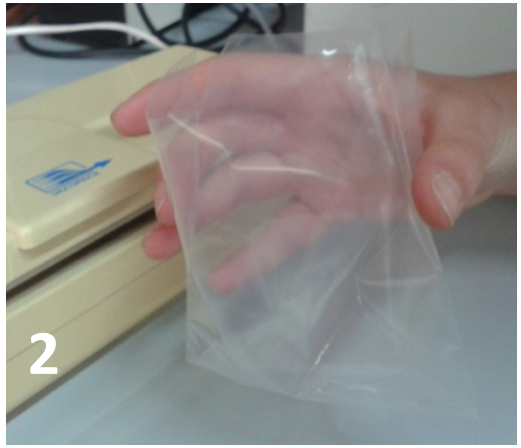
ANTIMICROBIAL ACTIVITY OF PLASTIC FILMS ACTIVATED WITH:

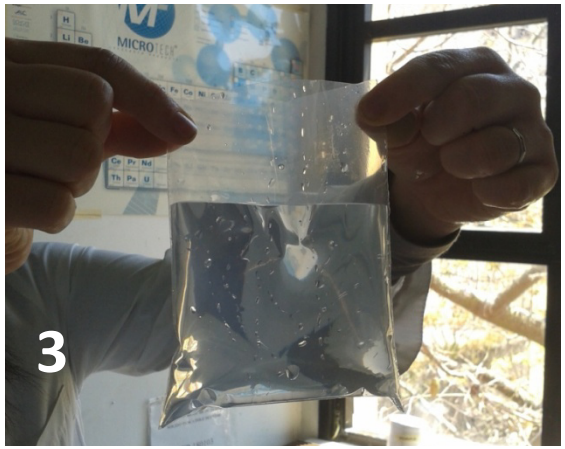
FREE NISIN

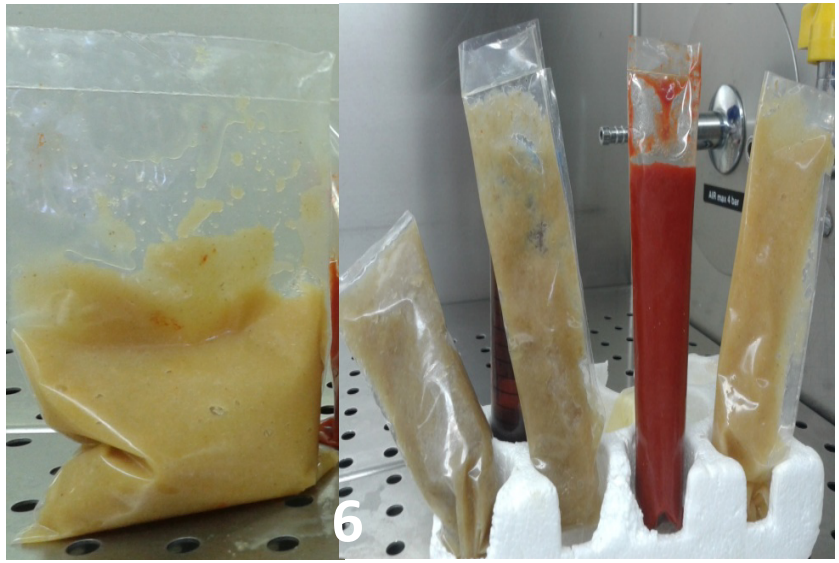


MICROENCAPSULATED NISIN

Antimicrobial packaging
Activation of films with microencapsulated nisin: a laboratory scale application







BACTERICIDAL ACTIVITY OF ANTIMICROBIAL PACKAGING

SAMPLES		CFU/ml		
		T_0	T_3	T_{24}
Film with free nisin	ACTIVATED	**250000**	6000	**<10**
	CONTROL	260000	330000	340000
Film with microencapsulated nisin	ACTIVATED	**170000**	5500	**<10**
	CONTROL	200000	220000	320000

THANKS FOR YOUR ATTENTION