Control y eliminación de los biofilms de Listeria monocytogenes en la industria alimentaria

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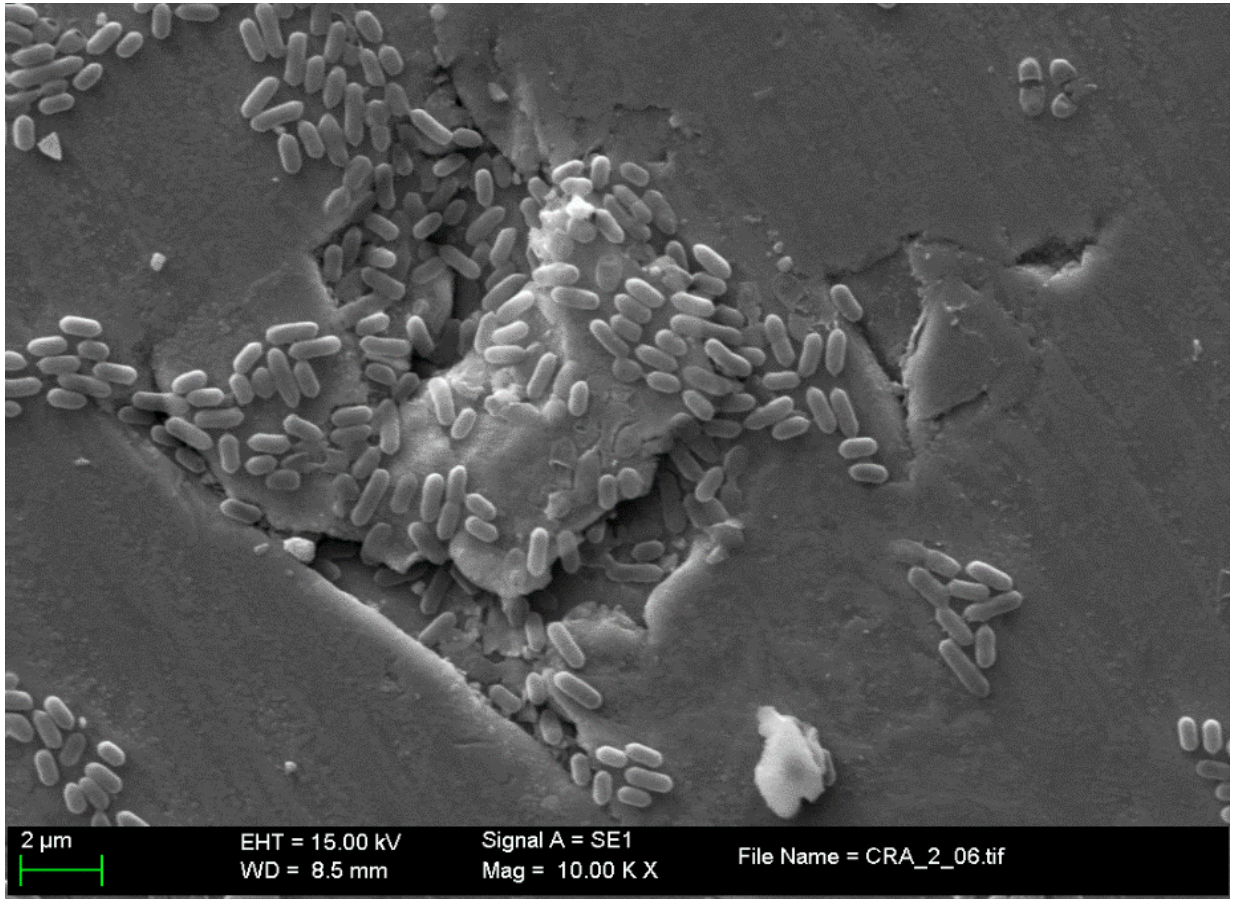
Importancia de la microbiota acompañante en el desarrollo de biofilm con *Listeria monocytogenes*

Dr. José Juan Rodríguez Jerez

UAB
Universitat Autònoma de Barcelona

Microorganisms ocultos

- Microorganismos en superficie:
  - Aerobios,
  - Catalasa positivos,
- Microorganismos ocultos:
  - Anaerobios,
  - Anaerobios facultativos.



Ripollés Ávila C. 2018. Supervivencia de *listeria monocytogenes* sobre superficies de contacto con alimentos: un abordaje multidisciplinar de un problema complejo. PhD Thesis.. UAB

Problema con la detección de biofilms

- Empleo de detectores de actividad microbiana en superficies,
- Control de la concentración real de microorganismos en las superficies,
- Evolución a lo largo del tiempo,
- Interacción entre microorganismos,
- Competencia variable.

Food Control 99 (2019) 40–47

Contents lists available at ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

Evaluation of the microbiological contamination of food processing environments through implementing surface sensors in an iberian pork processing plant: An approach towards the control of *Listeria monocytogenes*

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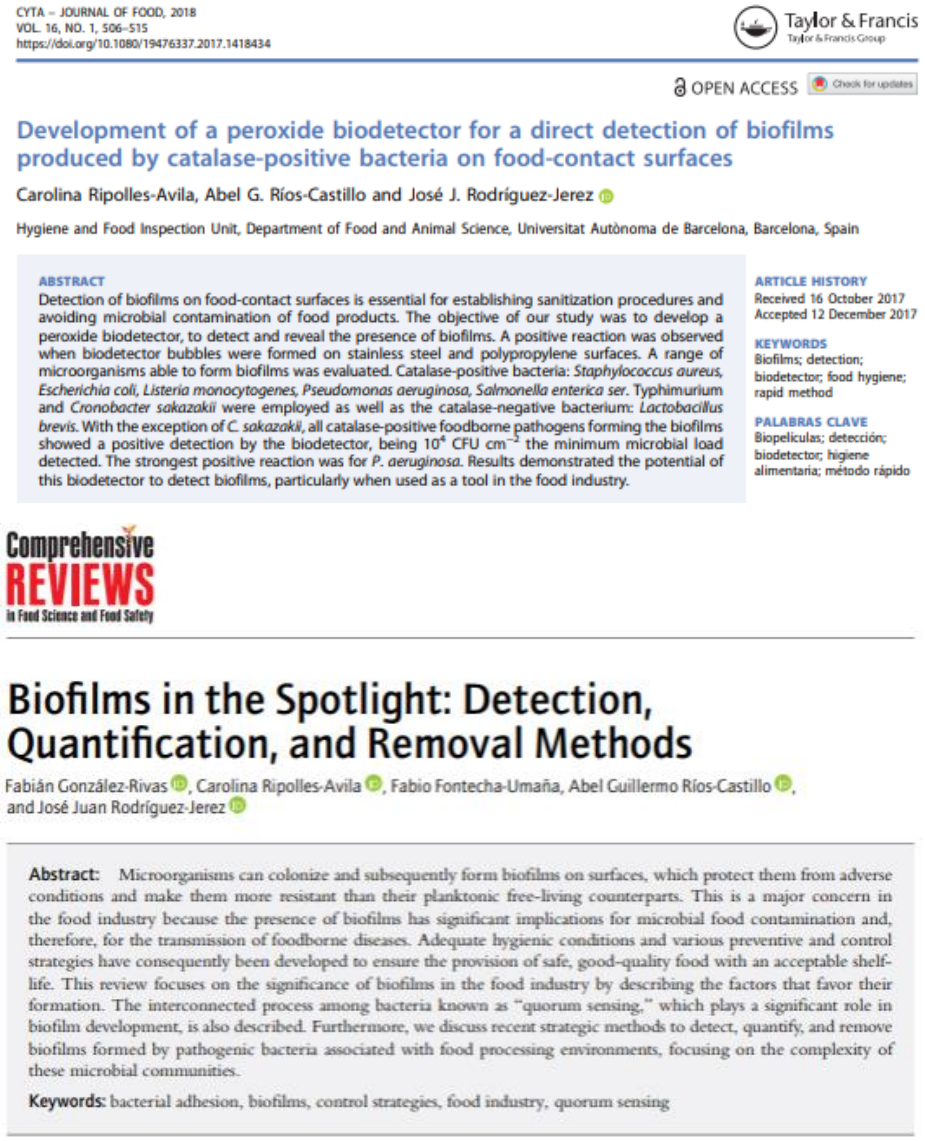


CYTA – JOURNAL OF FOOD, 2018
VOL. 16, NO. 1, 506–515
https://doi.org/10.1080/19476337.2017.1418434

Taylor & Francis

OPEN ACCESS

Development of a peroxide biodetector for a direct detection of biofilms produced by catalase-positive bacteria on food-contact surfaces

Carolina Ripolles-Avila, Abel G. Ríos-Castillo and José J. Rodríguez-Jerez

Hygiene and Food Inspection Unit, Department of Food and Animal Science, Universitat Autònoma de Barcelona, Barcelona, Spain

ABSTRACT

Detection of biofilms on food-contact surfaces is essential for establishing sanitization procedures and avoiding microbial contamination of food products. The objective of our study was to develop a peroxide biodetector, to detect and reveal the presence of biofilms. A positive reaction was observed when biodetector bubbles were formed on stainless steel and polypropylene surfaces. A range of microorganisms able to form biofilms was evaluated. Catalase-positive bacteria: *Staphylococcus aureus*, *Escherichia coli*, *Listeria monocytogenes*, *Pseudomonas aeruginosa*, *Salmonella enterica ser.* Typhimurium and *Cronobacter sakazakii* were employed as well as the catalase-negative bacterium: *Lactobacillus brevis*. With the exception of *C. sakazakii*, all catalase-positive foodborne pathogens forming the biofilms showed a positive detection by the biodetector, being 10^4 CFU cm^{-2} the minimum microbial load detected. The strongest positive reaction was for *P. aeruginosa*. Results demonstrated the potential of this biodetector to detect biofilms, particularly when used as a tool in the food industry.

ARTICLE HISTORY
Received 16 October 2017
Accepted 12 December 2017

KEYWORDS
Biofilms; detection; biodetector; food hygiene; rapid method

PALABRAS CLAVE
Biopelículas; detección; biodetector; higiene alimentaria; método rápido

Comprehensive REVIEWS in Food Science and Food Safety

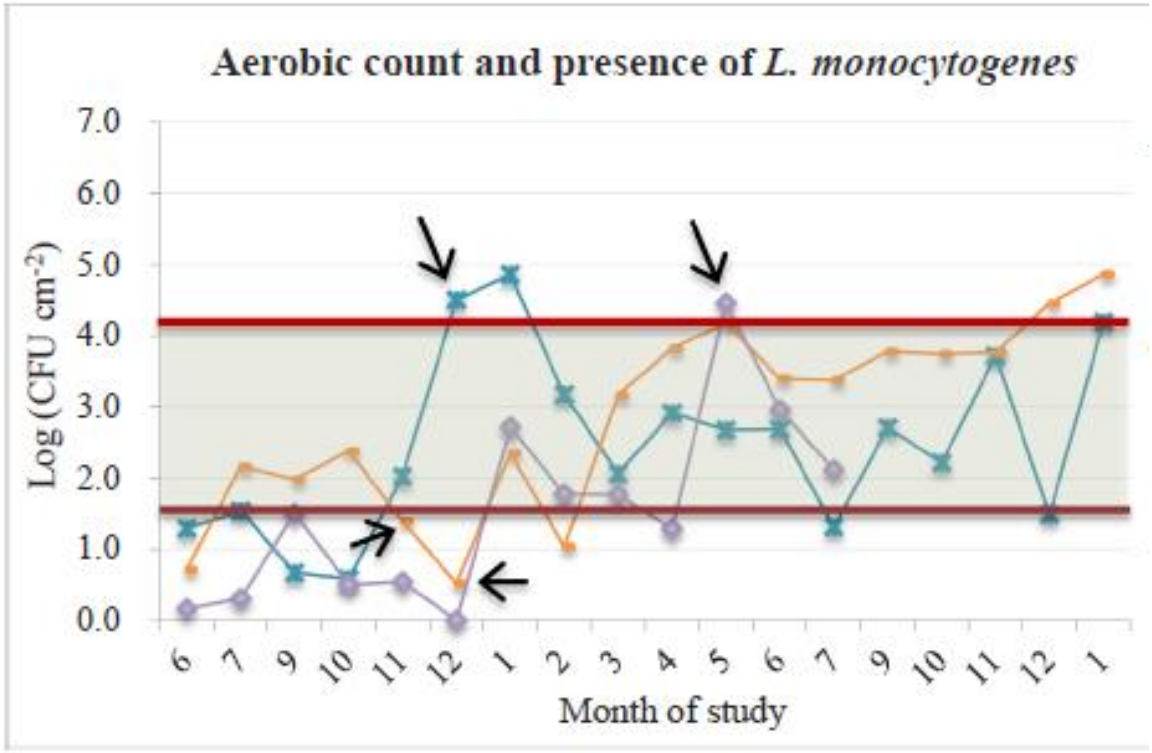
Biofilms in the Spotlight: Detection, Quantification, and Removal Methods

Fabián González-Rivas, Carolina Ripolles-Avila, Fabio Fontecha-Umaña, Abel Guillermo Ríos-Castillo, and José Juan Rodríguez-Jerez

Abstract: Microorganisms can colonize and subsequently form biofilms on surfaces, which protect them from adverse conditions and make them more resistant than their planktonic free-living counterparts. This is a major concern in the food industry because the presence of biofilms has significant implications for microbial food contamination and, therefore, for the transmission of foodborne diseases. Adequate hygienic conditions and various preventive and control strategies have consequently been developed to ensure the provision of safe, good-quality food with an acceptable shelf-life. This review focuses on the significance of biofilms in the food industry by describing the factors that favor their formation. The interconnected process among bacteria known as "quorum sensing," which plays a significant role in biofilm development, is also described. Furthermore, we discuss recent strategic methods to detect, quantify, and remove biofilms formed by pathogenic bacteria associated with food processing environments, focusing on the complexity of these microbial communities.

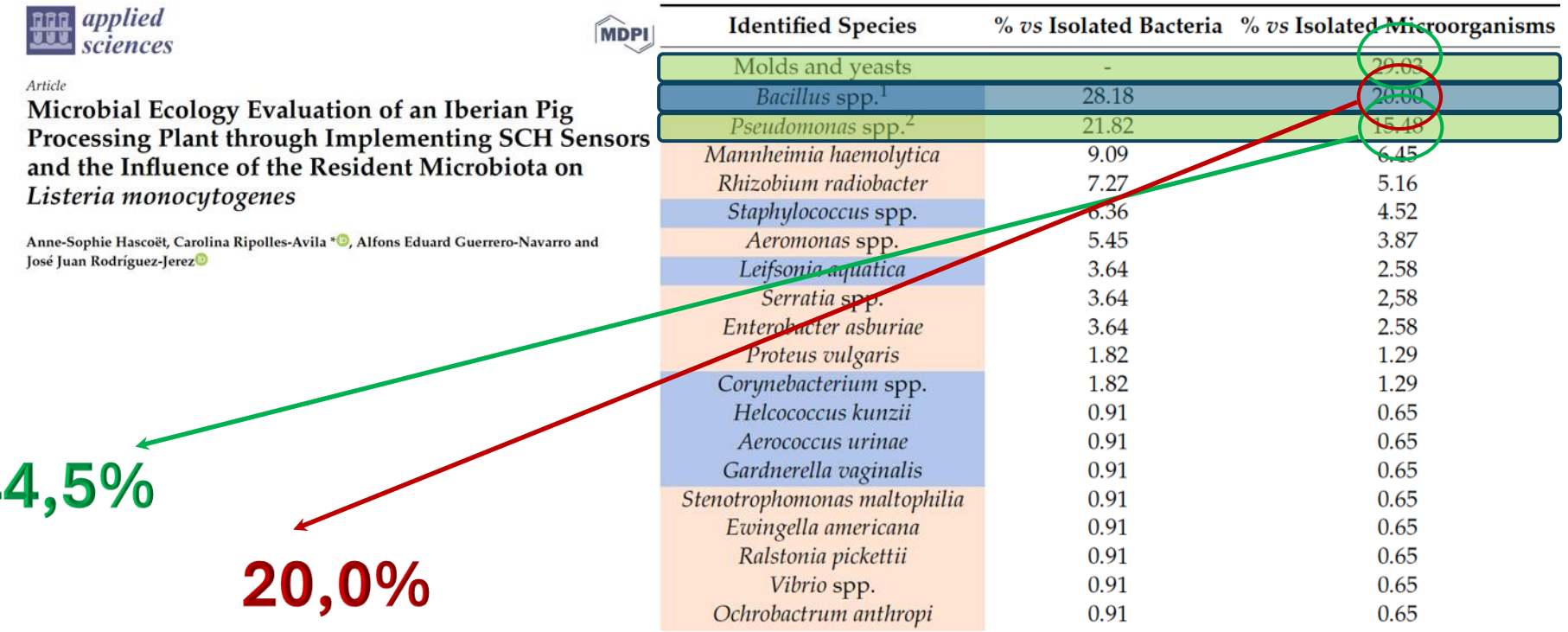
Keywords: bacterial adhesion, biofilms, control strategies, food industry, quorum sensing

Microorganismos competidores SCH – Control de superficies



Ripolles-Avila C., Hascoët A.S., Martínez-Suárez J.V., Capita R., Rodríguez-Jerez J.J. 2019. Evaluation of the microbiological contamination of food processing environments through implementing surface sensors in an iberian pork processing plant: An approach towards the control of Listeria monocytogenes". Food Control. 99:40-47.

Microbiota presente en superficies con *Listeria monocytogenes*



applied sciences

Article

Microbial Ecology Evaluation of an Iberian Pig Processing Plant through Implementing SCH Sensors and the Influence of the Resident Microbiota on *Listeria monocytogenes*

Anne-Sophie Hascoët, Carolina Ripolles-Avila *, Alfons Eduard Guerrero-Navarro and José Juan Rodríguez-Jerez

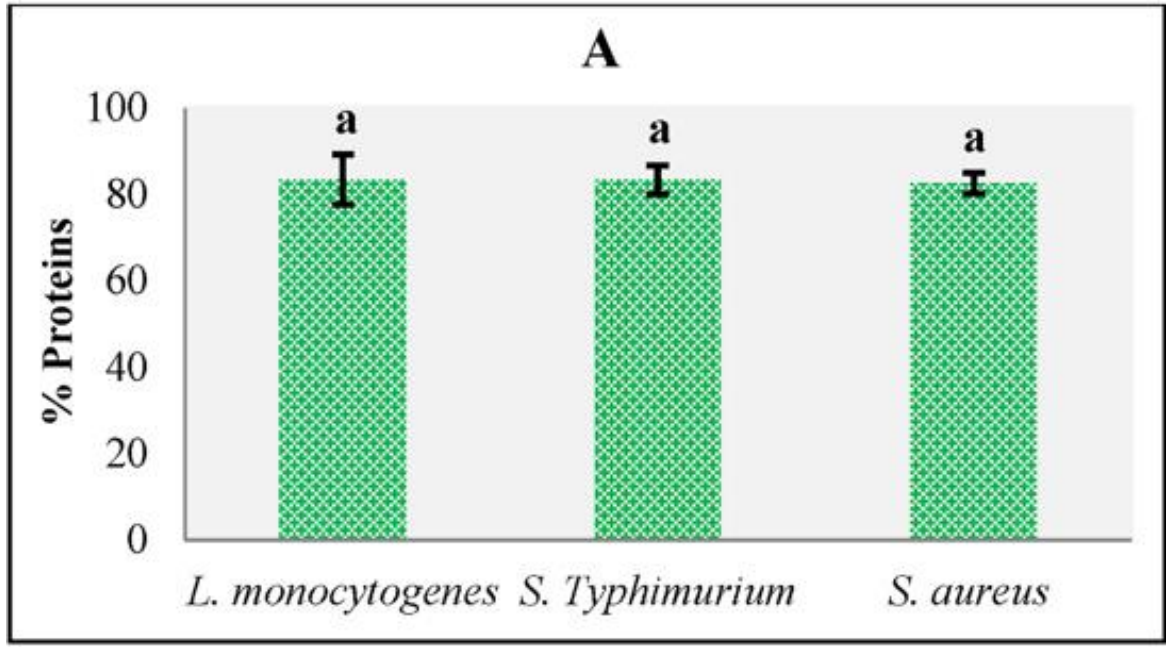
MDPI

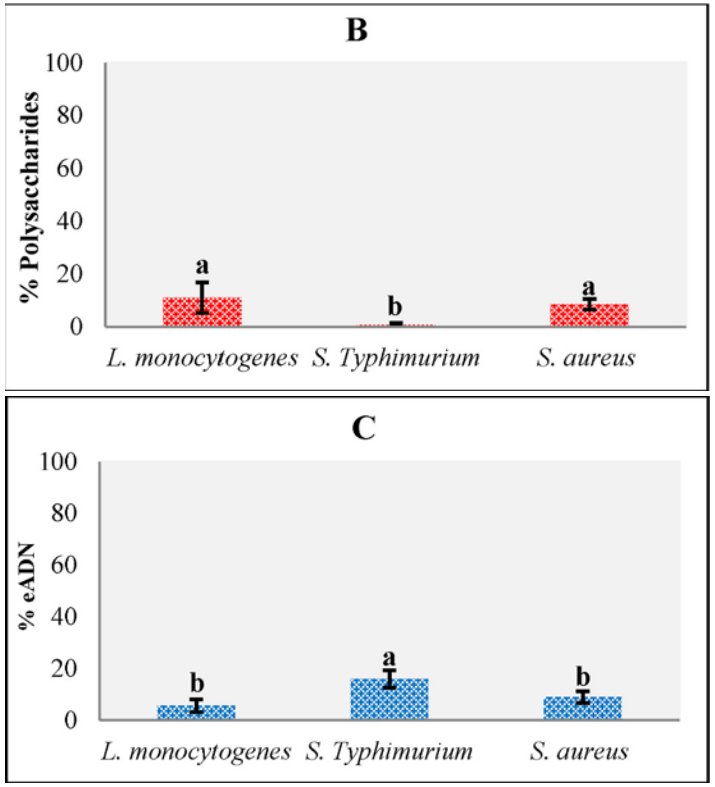
Identified Species	% *vs* Isolated Bacteria	% *vs* Isolated Microorganisms
Molds and yeasts	-	29.03
Bacillus spp.[1]	28.18	20.00
Pseudomonas spp.[2]	21.82	15.48
Mannheimia haemolytica	9.09	6.45
Rhizobium radiobacter	7.27	5.16
Staphylococcus spp.	6.36	4.52
Aeromonas spp.	5.45	3.87
Leifsonia aquatica	3.64	2.58
Serratia spp.	3.64	2,58
Enterobacter asburiae	3.64	2.58
Proteus vulgaris	1.82	1.29
Corynebacterium spp.	1.82	1.29
Helcococcus kunzii	0.91	0.65
Aerococcus urinae	0.91	0.65
Gardnerella vaginalis	0.91	0.65
Stenotrophomonas maltophilia	0.91	0.65
Ewingella americana	0.91	0.65
Ralstonia pickettii	0.91	0.65
Vibrio spp.	0.91	0.65
Ochrobactrum anthropi	0.91	0.65

44,5%

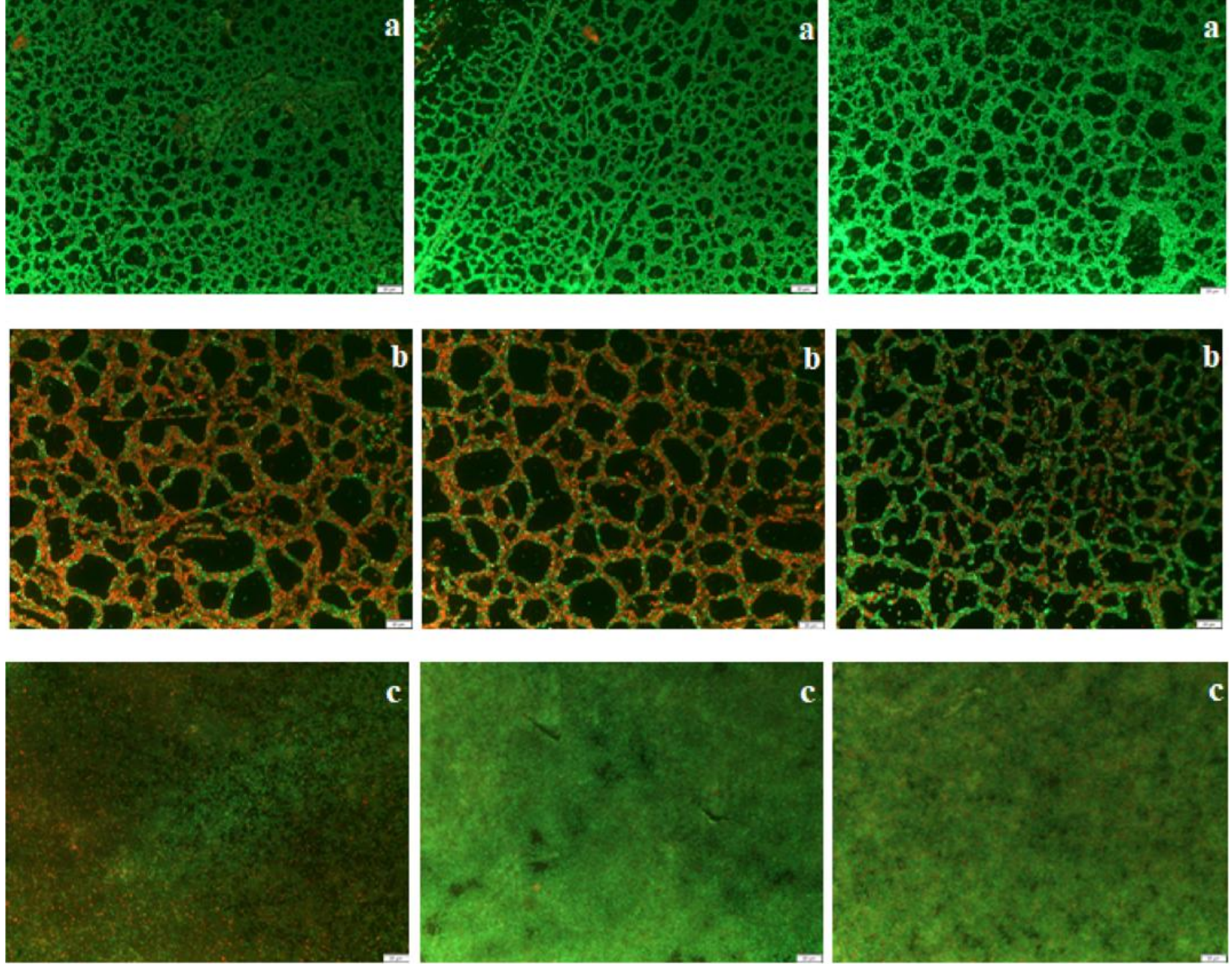
20,0%

Microorganismos competidores, Composición de la matriz del biofilm





Cervantes-Huamán B.R.H., Ripolles-Avila C., Mazaheri T., Rodríguez-Jerez J.J. Pathogenic mono-species biofilm formation on stainless Steel surfaces: Quantitative, qualitative, and compositional study. LWT - Food Science and Technology 159 (2022) 113211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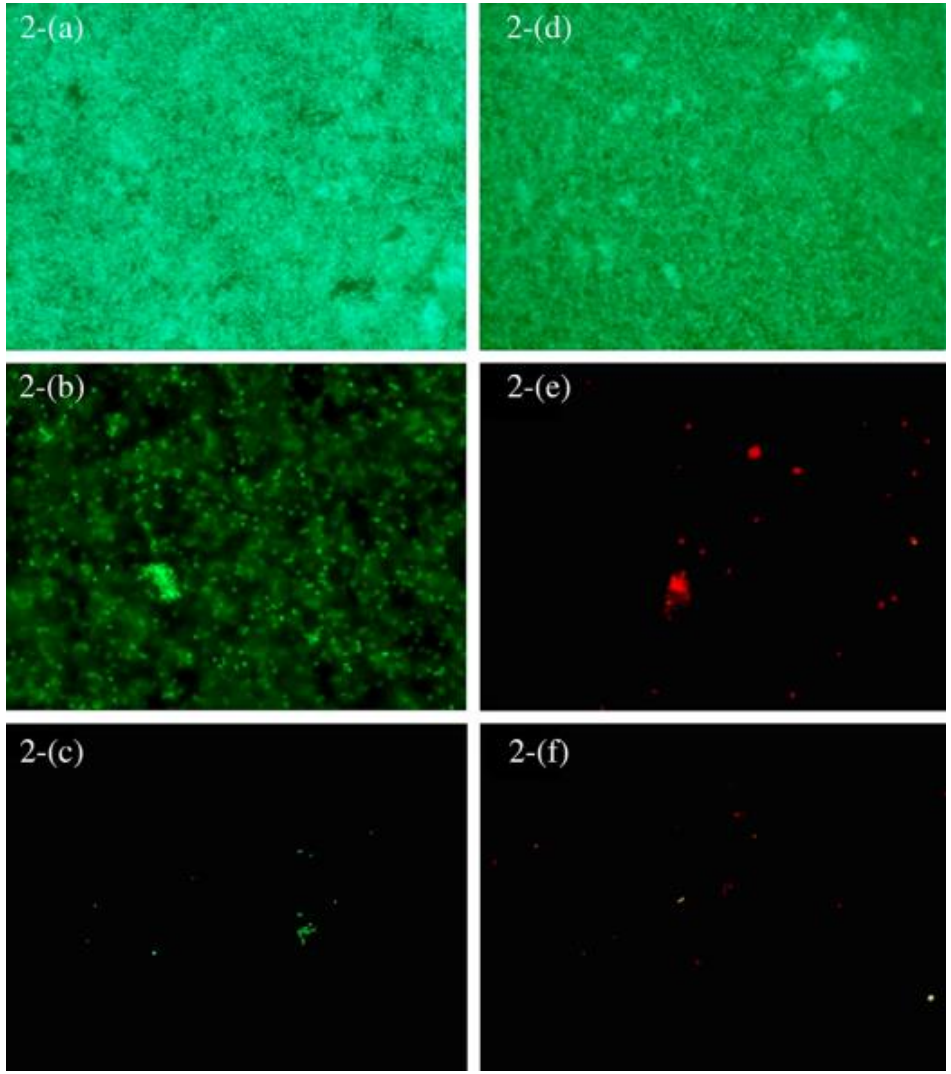
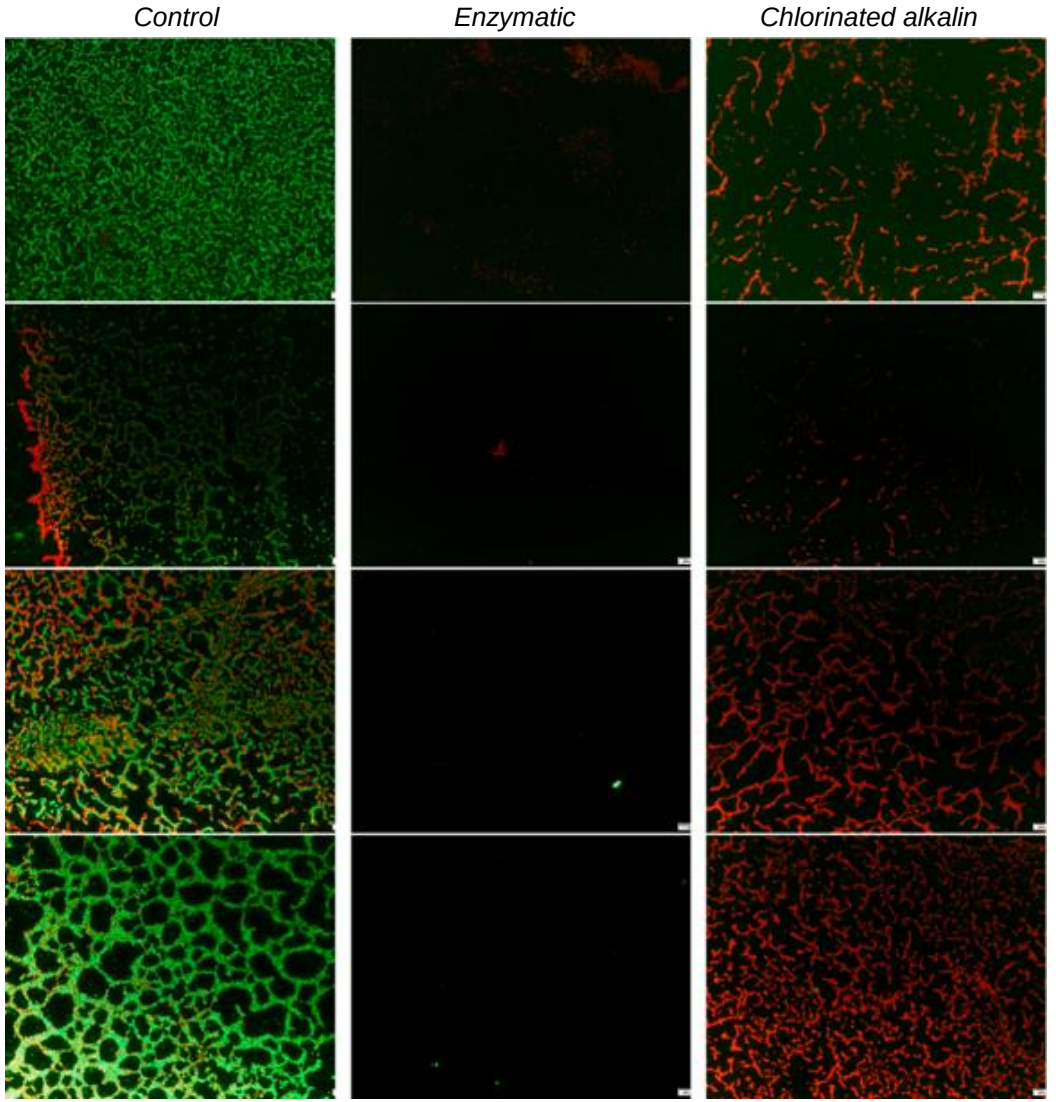
Limpieza enzimática



Carolina Ripolles-Avila; Abel G. Ríos-Castillo; Fabio Fontecha-Umaña; José J. Rodríguez-Jerez. Removal of Salmonella enterica serovar Typhimurium and Cronobacter sakazakii biofilms from food contact surfaces through enzymatic catalysis. Journal of Food Safety. 2019. e12755



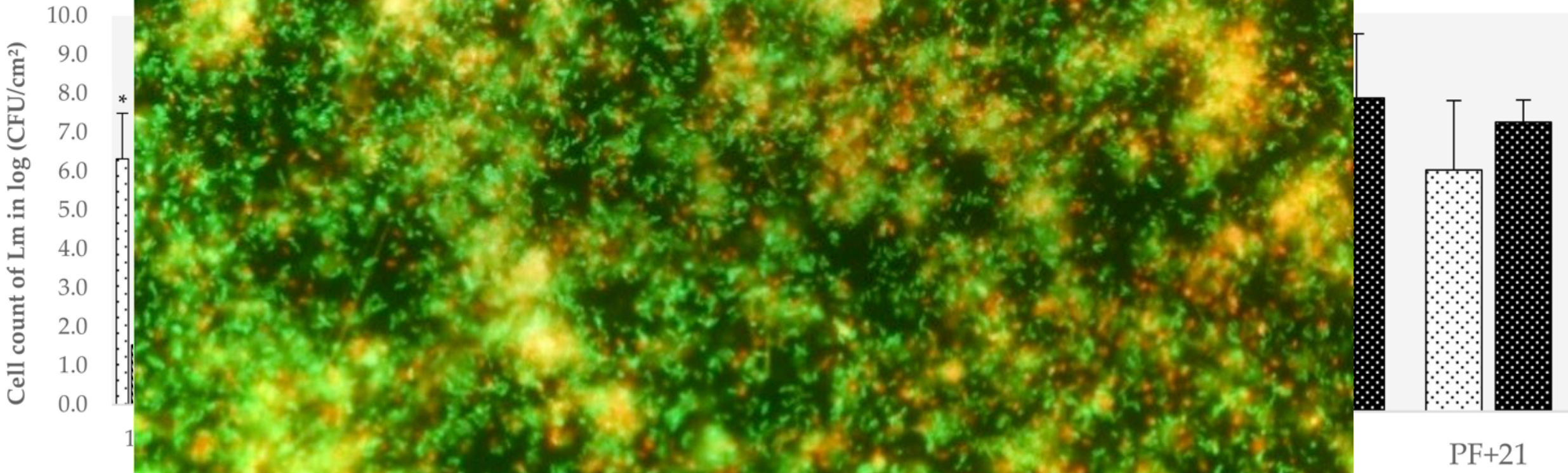
C. Ripolles-Avila, M. Ramos-Rubio, A.S. Hascoët, M. Castillo, J.J. Rodríguez-Jerez. New approach for the removal of mature biofilms formed by wild strains of Listeria monocytogenes isolated from food contact surfaces in an Iberian pig processing plant. International Journal of Food Microbiology 323 (2020) 108595

biomo

Article

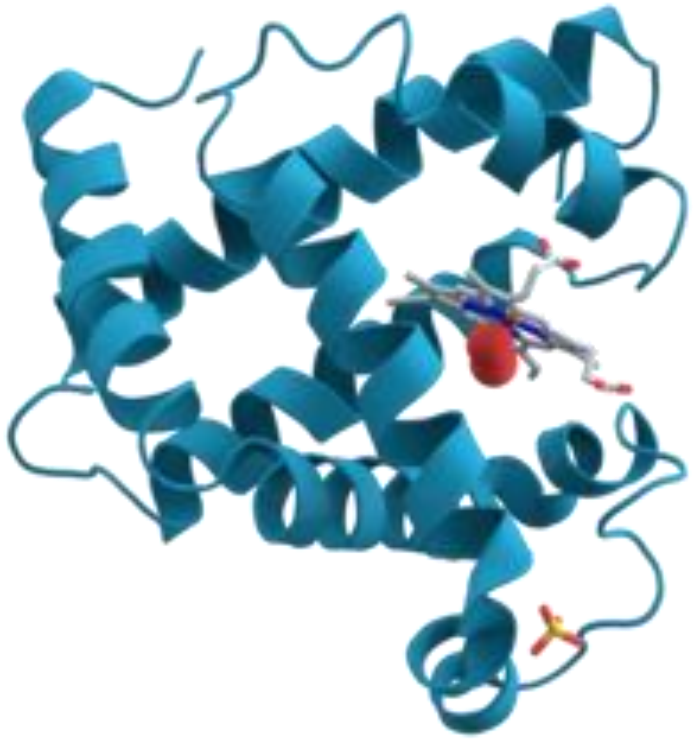
In Vitro Pr
Adhesion
monocytog

Anne-Sophie Hasc
and José Juan Rod



Inhibición de la formación de biofilm

- El crecimiento de algunos microorganismos desplaza la presencia del patógeno,
- El desplazamiento se debe al crecimiento de una bacteria, no necesariamente mortalidad.
- Algunas proteínas tienen varias acciones anti-Listeria:
  - Agregación,
  - Efecto *quorum sensing*
  - Efecto *quorum quenching*
- La purificación y producción de estas proteínas controlará la presencia de patógenos

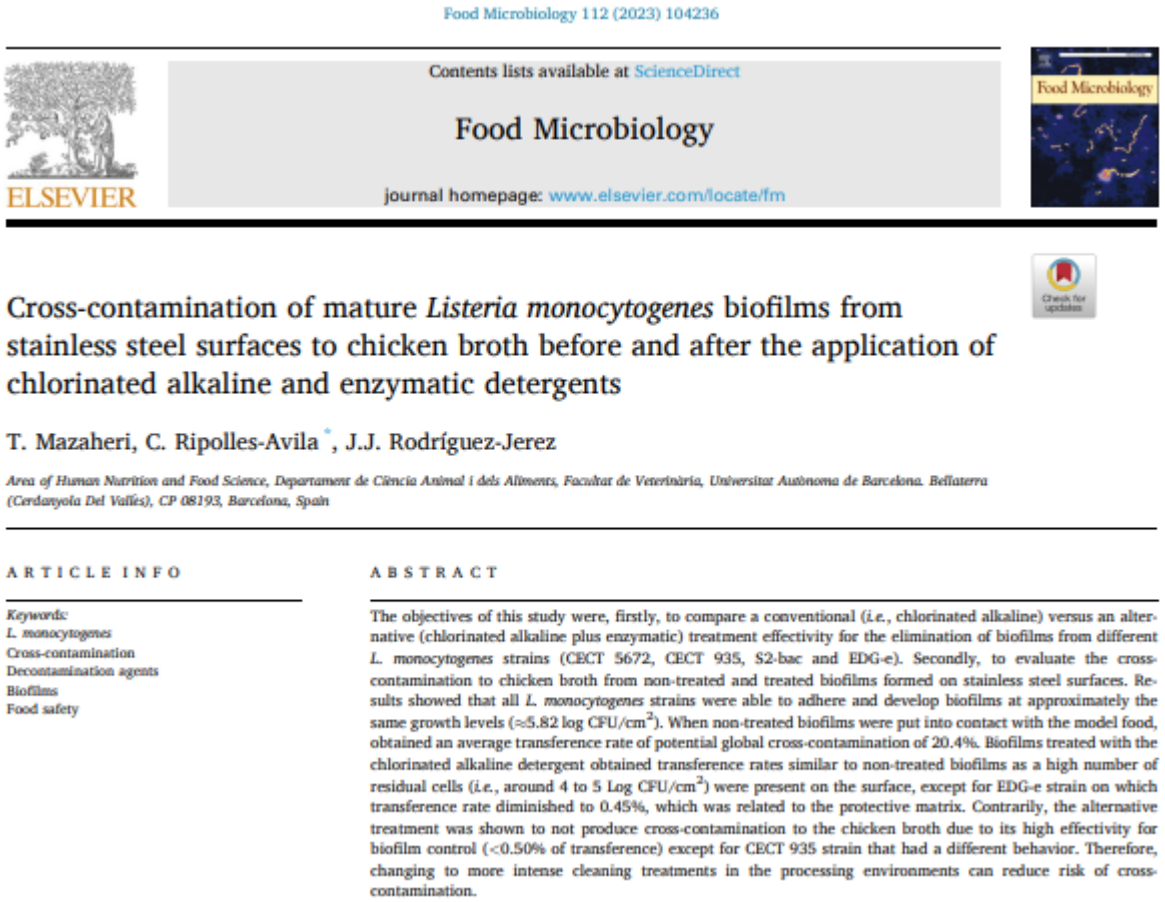


¿Límites críticos? Aproximación sobre probabilidad de detección de un peligro

- FSO (Food Safety Objetive):
  - Máxima frecuencia y/o concentración de un peligro en un alimento en el momento del consumo, que proporciona un nivel apropiado de protección de la salud (“appropriate level of (health) protection” -ALOP-).
  - Se fija con criterios de las autoridades sanitarias.

- PO (Performance Objectives):
  - La máxima frecuencia o concentración de un peligro en un alimento, en una etapa específica de la cadena alimentaria, antes del consumo, que prove o contribuye a que el FSO o ALOP sea applicable.
- Complejidad en el proceso de toma de decisions.
- ¿Cuánto aceptar en una superficie?

- Depende de la tasa de transferencia.



Food Microbiology 112 (2023) 104236

Contents lists available at ScienceDirect

Food Microbiology

journal homepage: www.elsevier.com/locate/fm

Cross-contamination of mature *Listeria monocytogenes* biofilms from stainless steel surfaces to chicken broth before and after the application of chlorinated alkaline and enzymatic detergents

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ARTICLE INFO

Keywords:
L. monocytogenes
Cross-contamination
Decontamination agents
Biofilms
Food safety

ABSTRACT

The objectives of this study were, firstly, to compare a conventional (*i.e.*, chlorinated alkaline) versus an alternative (chlorinated alkaline plus enzymatic) treatment effectivity for the elimination of biofilms from different *L. monocytogenes* strains (CECT 5672, CECT 935, S2-bac and EDG-e). Secondly, to evaluate the cross-contamination to chicken broth from non-treated and treated biofilms formed on stainless steel surfaces. Results showed that all *L. monocytogenes* strains were able to adhere and develop biofilms at approximately the same growth levels (≈5.82 log CFU/cm^2). When non-treated biofilms were put into contact with the model food, obtained an average transference rate of potential global cross-contamination of 20.4%. Biofilms treated with the chlorinated alkaline detergent obtained transference rates similar to non-treated biofilms as a high number of residual cells (*i.e.*, around 4 to 5 Log CFU/cm^2) were present on the surface, except for EDG-e strain on which transference rate diminished to 0.45%, which was related to the protective matrix. Contrarily, the alternative treatment was shown to not produce cross-contamination to the chicken broth due to its high effectivity for biofilm control (<0.50% of transference) except for CECT 935 strain that had a different behavior. Therefore, changing to more intense cleaning treatments in the processing environments can reduce risk of cross-contamination.

MUCHAS GRACIAS

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