UV-LED TECHNOLOGY AS A POTENTIAL DECONTAMINATION STRATEGY OF POULTRY MEAT WITH FOCUS ON *CAMPYLOBACTER JEJUNI*

Koenraad Van Hoorde

EURL Campylobacter 2024

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Sciensano connects health,
science and society

The Foodborne pathogens service supports food safety and public health policy via

i. fast detection of pathogens, their toxins and antimicrobial resistance;
ii. expert advise;
iii. future oriented innovative research

in the context of foodborne outbreak investigations, AMR monitoring, environmental surveillance and our national reference laboratory/center activities.

This way our service contributes to the One-Health approach of Sciensano.

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INTRODUCTION

●

OBJECTIVES

●

METHODOLOGY

●

RESULTS

●

CONCLUSIONS & FUTURE PERSPECTIVE

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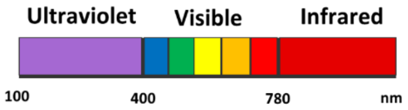
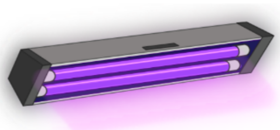
Introduction - UV light, an emerging technology ?

Downes and Blunt discovered the use of sunlight as disinfection strategy — 1877



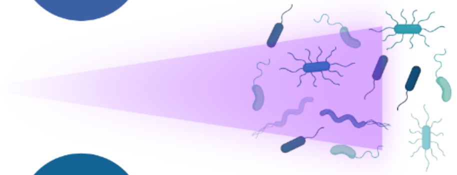
1900 — **Niels Finsen** creates first UV source

Bernard and Morgan found λ ~ 250 nm more effective — 1903



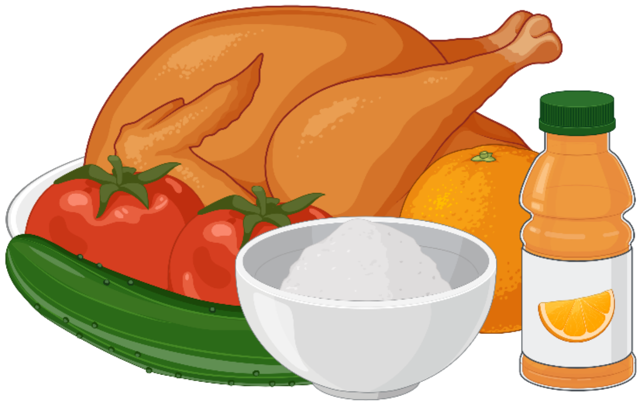
1904 — **Kuch** creates first quartz lamp

Henri, Helbronner and Recklinghausen install first commercial UV mercury lamp — 1910



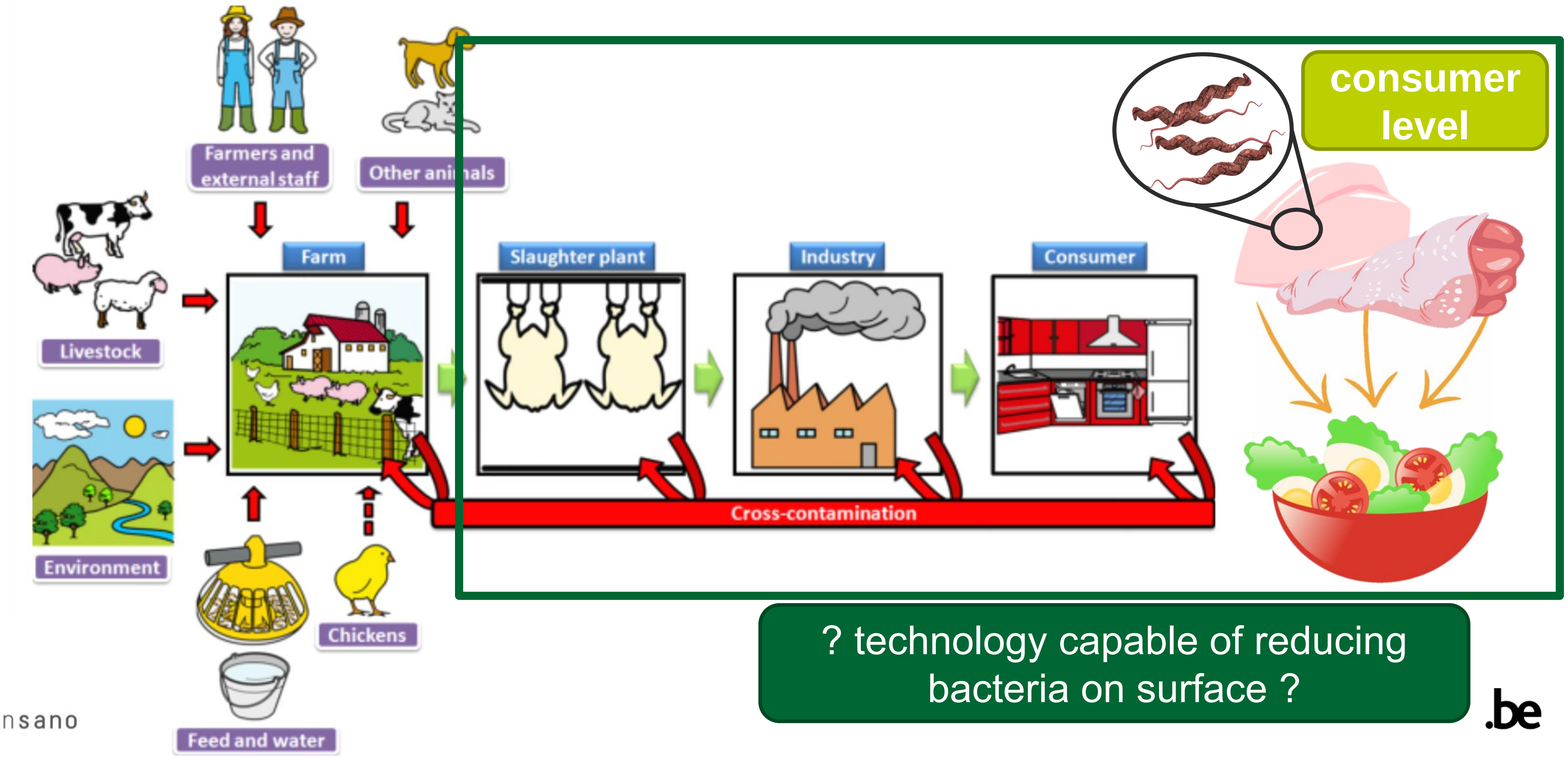
1949 — **Kelner** discovered photoreactivation

Beukers and Berends discovered UV mechanism of action — 1960



<> consumer safety
<> potential for off-flavours
<> nutrient degradation

INTRODUCTION – *CAMPYLOBACTER* PROBLEM



? technology capable of reducing bacteria on surface ?

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Introduction - Application of UV-LED technology

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Article | Open access | Published: 10 June 2023

Investigation of differences in susceptibility of *Campylobacter jejuni* strains to UV light-emitting diode (UV-LED) technology

Arturo B. Soro, Daniel Ekhlas, Maitiú Marmion, Amalia G. M. Scannell, Paul Whyte, Declan J. Bolton, Catherine M. Burgess & Brijesh K. Tiwari

Scientific Reports **13**, Article number: 9459 (2023) | Cite this article

ELSEVIER

Food Microbiology

Volume 116, December 2023, 104365

The efficiency of UV light-emitting diodes (UV-LED) in decontaminating *Campylobacter* and *Salmonella* and natural microbiota in chicken breast, compared to a UV pilot-plant scale device

Arturo B. Soro [a b c], Daniel Ekhlas [b c], Sajad Shokri [d], Ming Ming Yem [d], Rui Chao Li [d], Soukaina Barroug [d], Shay Hannon [b], Paul Whyte [c], Declan J. Bolton [b], Catherine M. Burgess [b], Paula Bourke [d], Brijesh K. Tiwari [b]

conclusions:

- larger # of strains
- food matrix
- culturability ?
- antibiotic resistance ?
- protein profile ?

Objectives

this study aimed at further assessing the effectiveness of UV-LED technology to inactivate ***C. jejuni*** on **chicken meat** via the investigation of the impact of UV light on the **bacterial culturability** and on the **susceptibility to antibiotics**

METHODOLOGY – SELECTED *CAMPYLOBACTER JEJUNI* STRAINS

25
C. jejuni
strains

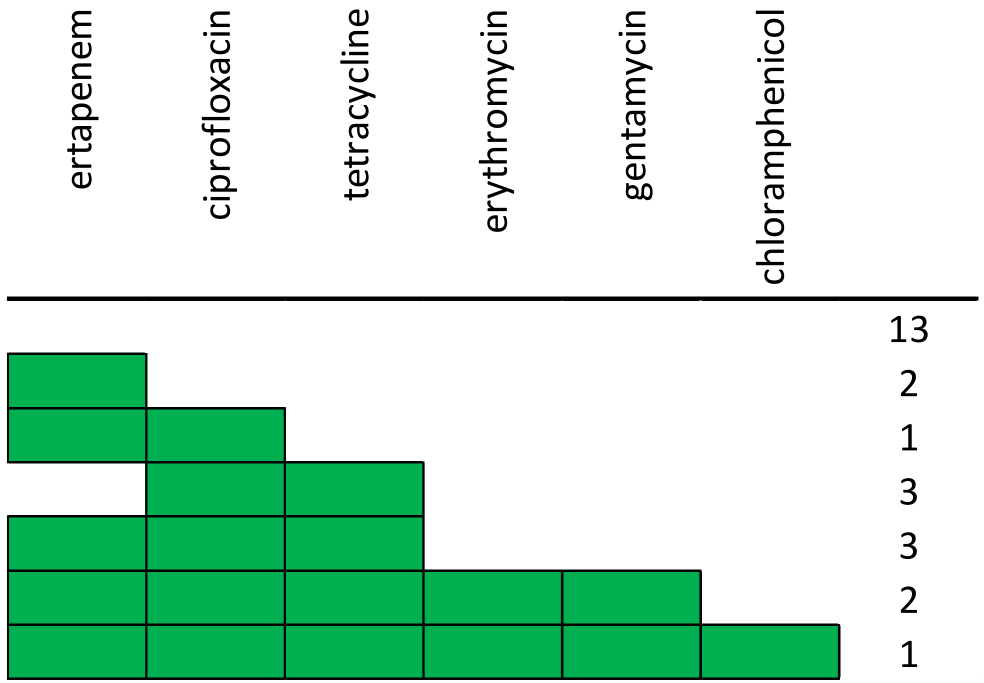
origin

human (fbo): 5

chicken:17

calf: 3

antimicrobial resistance properties



METHODOLOGY - UV TREATMENT + *C. JEJUNI* ENUMERATION

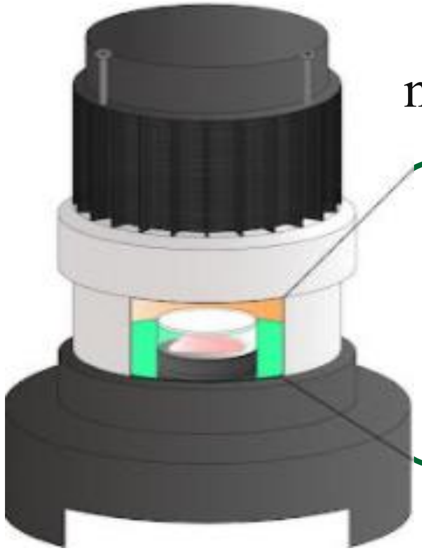
25 strains *C. jejuni*

\+

4-5 Log CFU/g

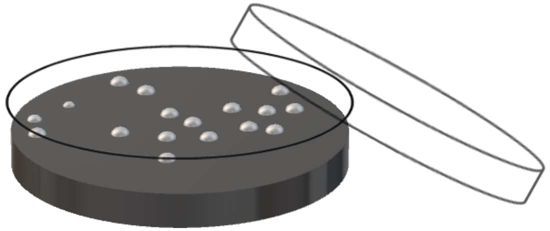
chicken meat

\+



control
non-treated samples

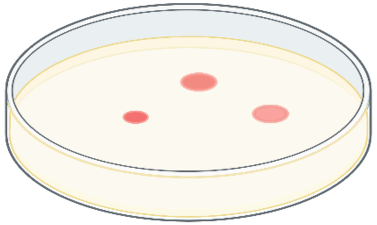
UV-LED
λ: **280** nm
Time: **6** min



mCCDA

ISO 10272-2:2017
48 hours
42°C
microaerophilic

enumeration



CFA

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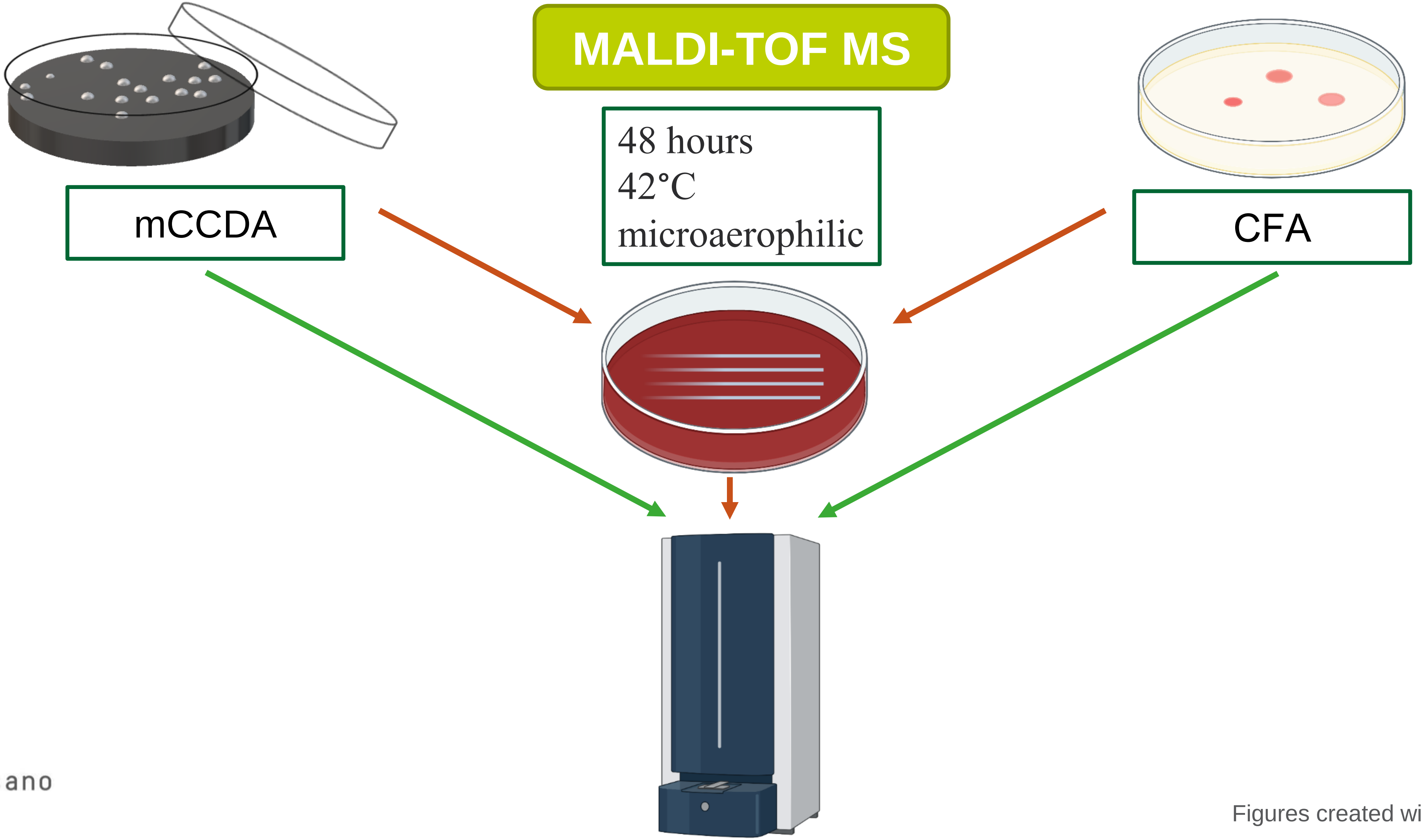
METHODOLOGY – MALDI-TOF MS



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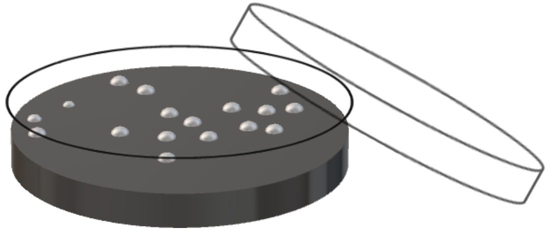
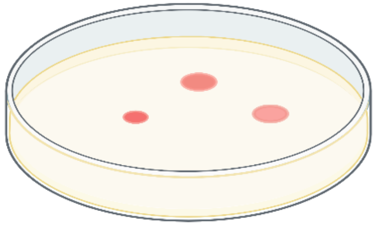
Methodology – antibiotic resistance (MIC)



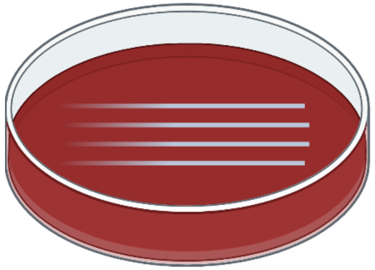
mCCDA

MIC

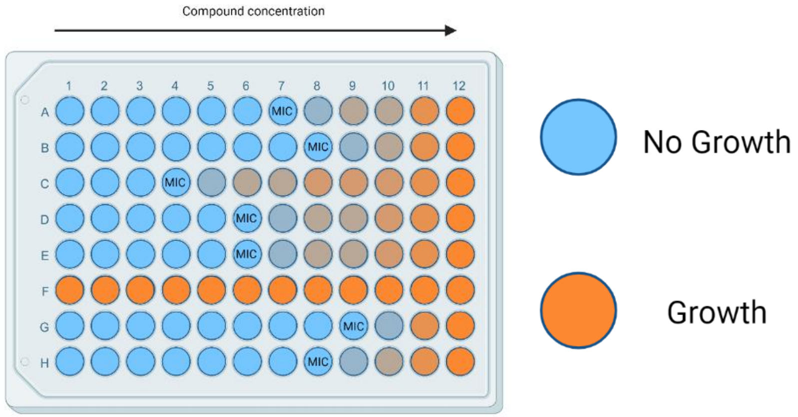
48 hours
42°C
microaerophilic



CFA



ISO 20776-1:2019
EUCAST



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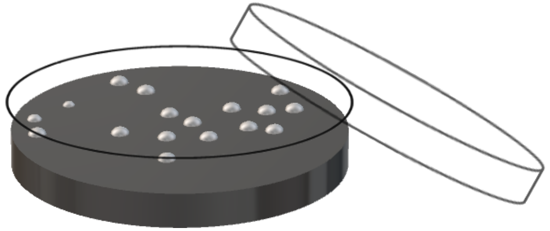
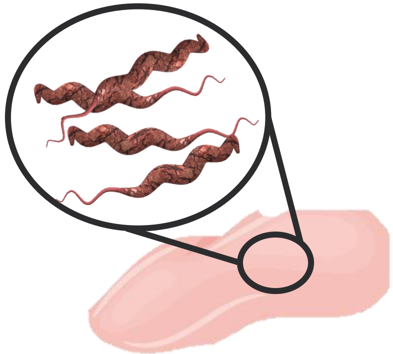
Results – Enumeration mCCDA vs CFA

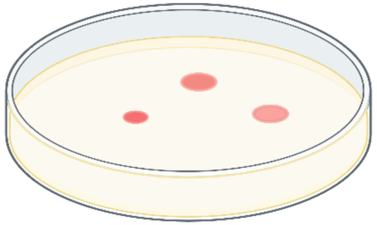
enumeration



mCCDA



25 strains *C. jejuni*



CFA

$\overline{x}$ = 4.51 log CFU/g

≠

$\overline{x}$ = 5.26 log CFU/g

$\Delta\overline{x}$ = 0.75 log CFU/g

counts on mCCDA and CFA to take into account separately

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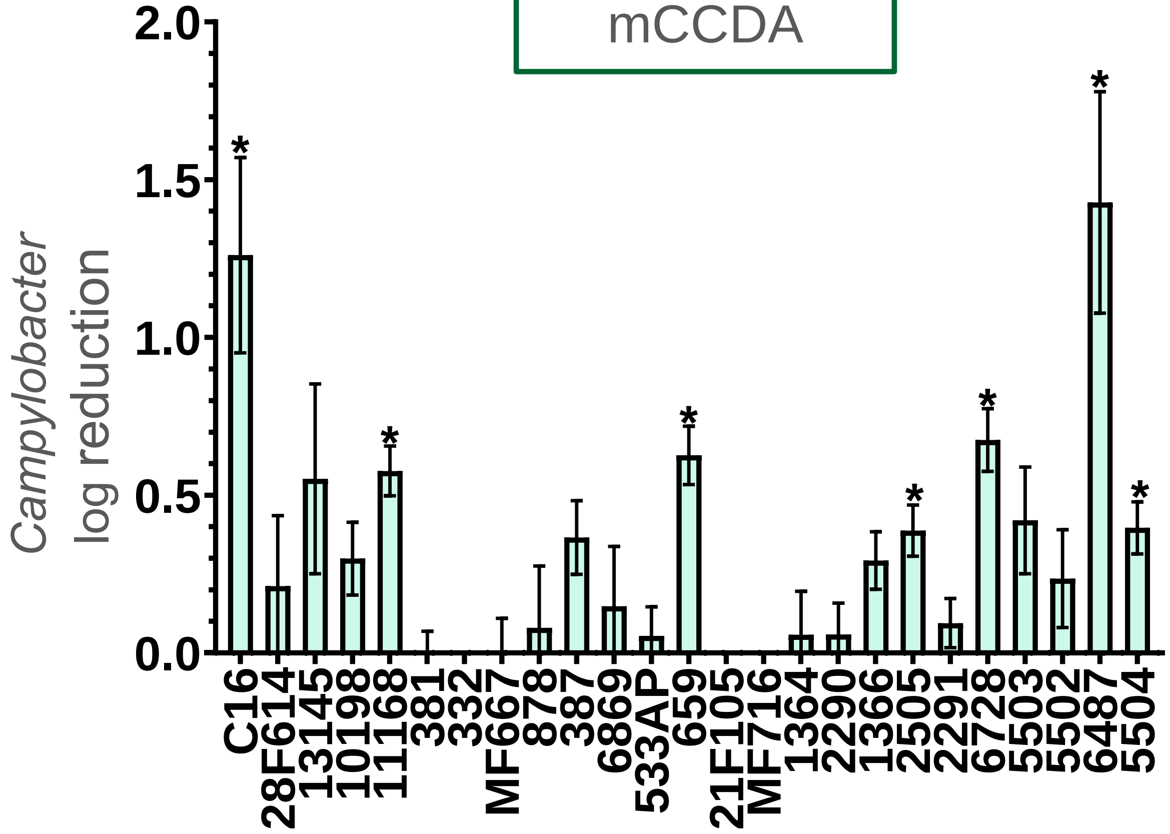
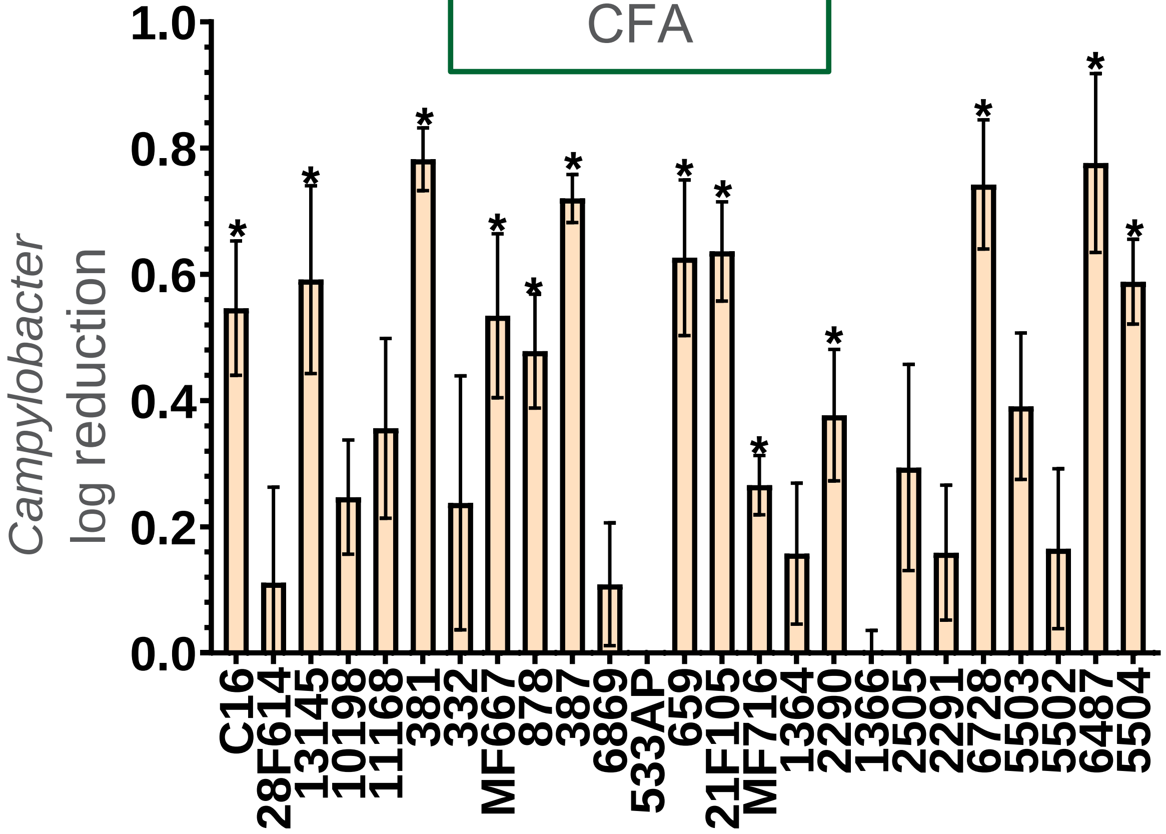
RESULTS - ENUMERATION NON-TREATED VS UV-LED TREATED



7 out of 25 (28%)
[0.4-1.4 Log CFU/g]



13 out of 25 (52%)
[0.3-0.8 Log CFU/g]

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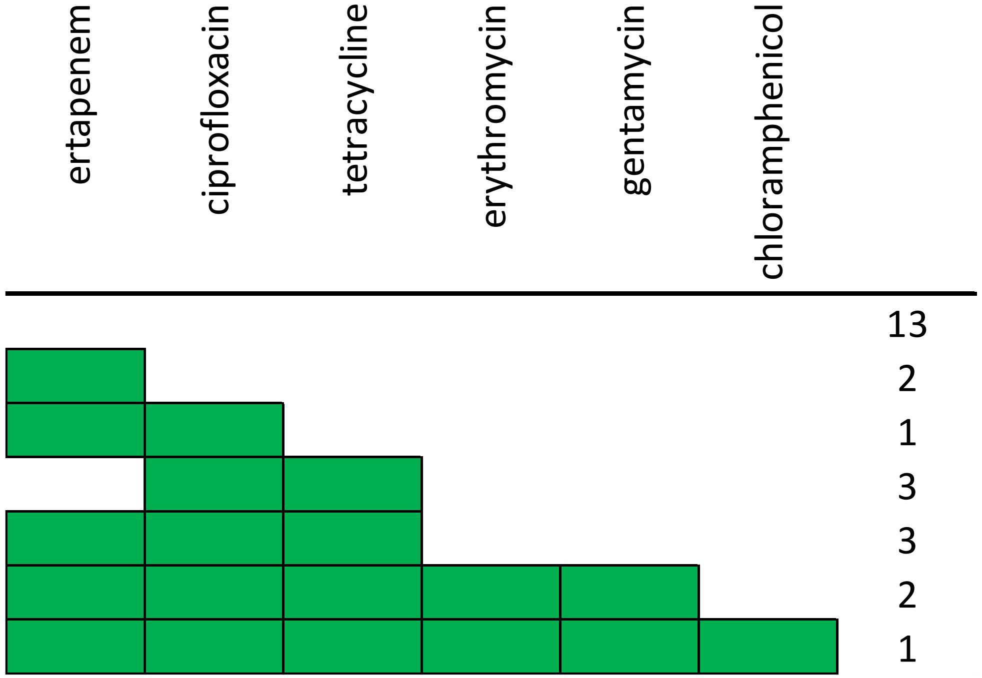
Results - Antibiotic resistance - Non-treated vs UV-LED

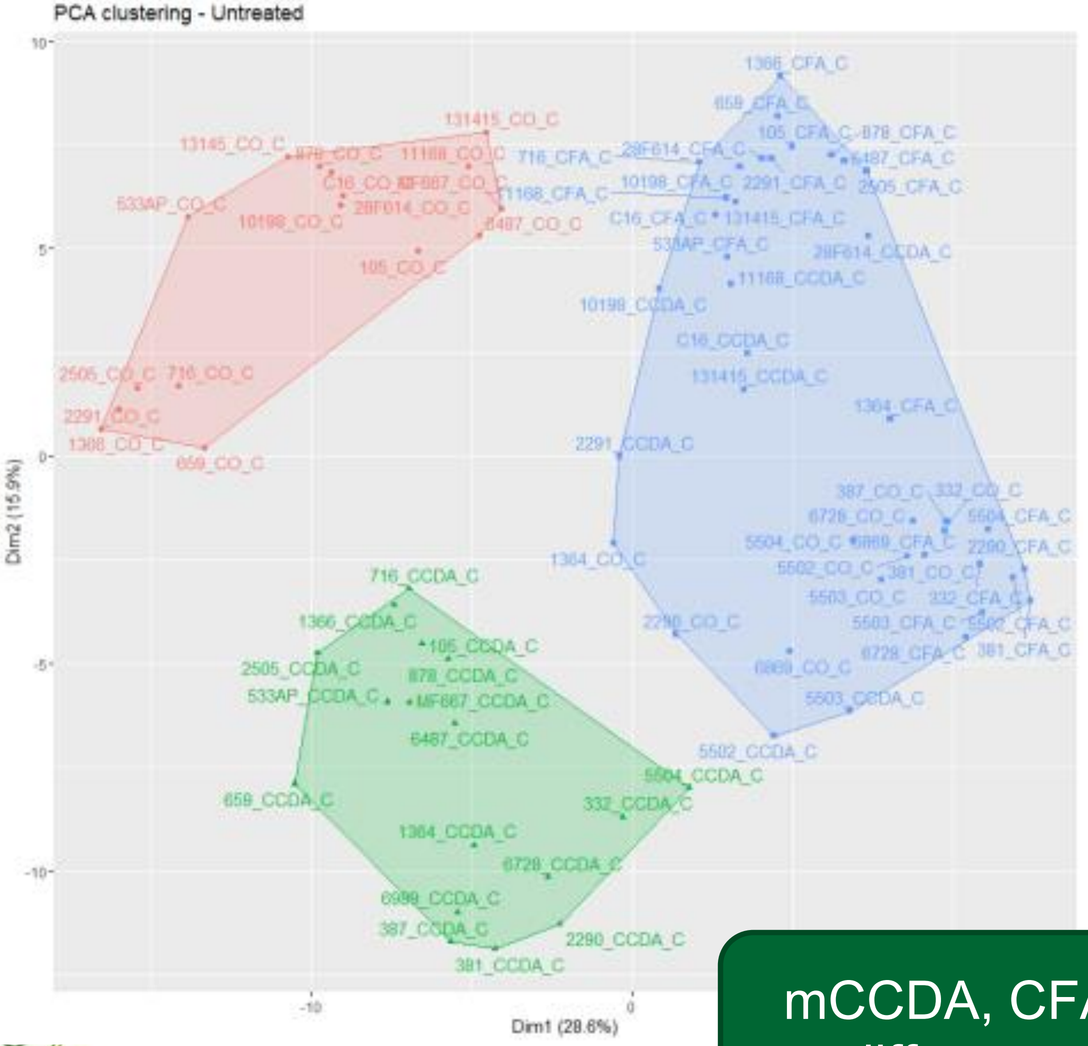
antimicrobial resistance properties
non-treated = UV-LED treated

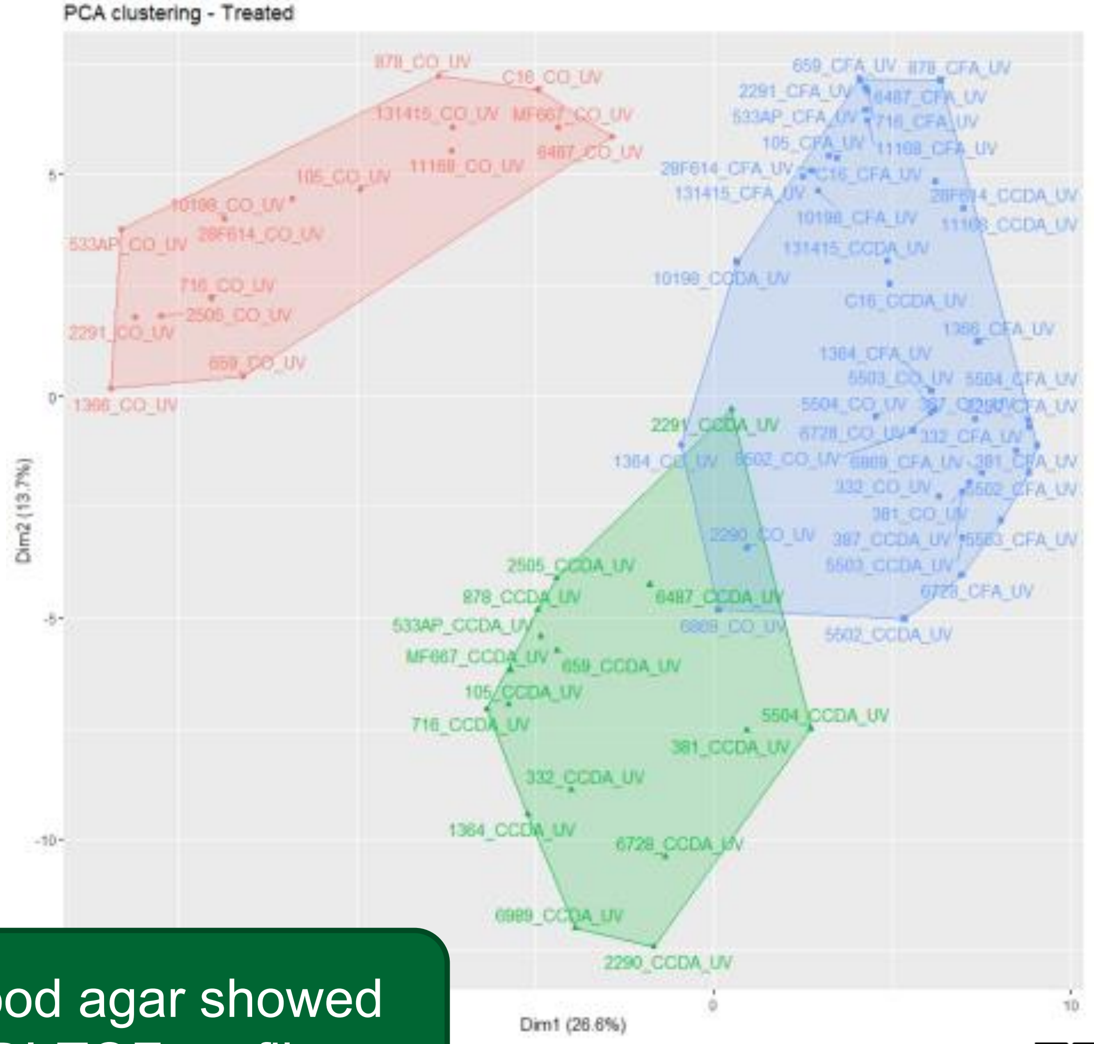


UV-LED did not affect MIC
of tested resistant *campylobacters* strains

UV-LED did not induce bacterial resistance
to any of the studied antibiotics

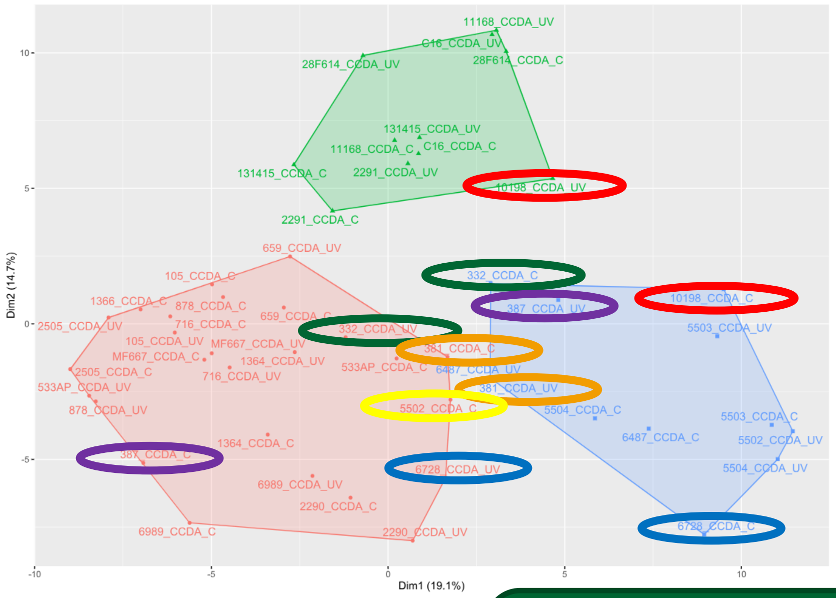
Results- MALDI-TOF mCCDA vs CFA vs blood agar

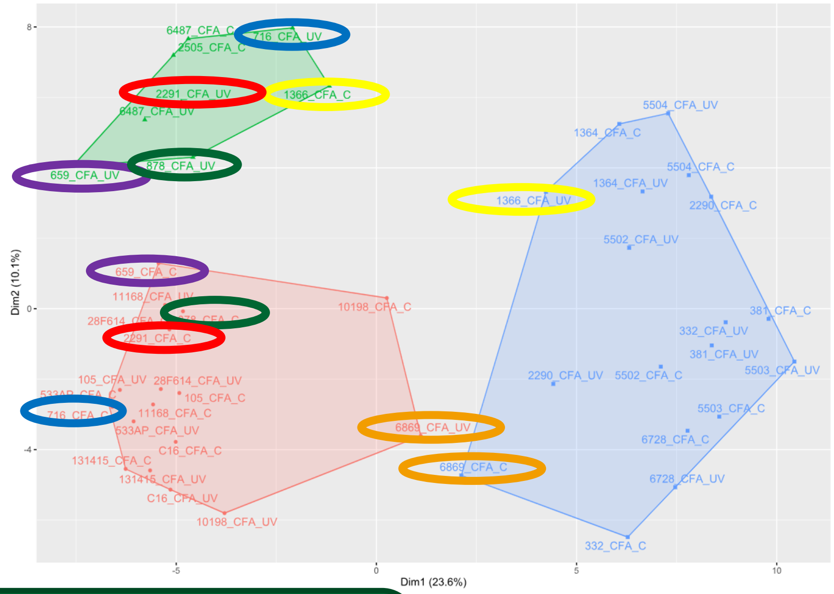




mCCDA, CFA and blood agar showed differences in MALDI-TOF profile

RESULTS- MALDI-TOF BLOOD AGAR





validated method
but no original colonies

6 strains
non-treated ≠ UV-LED

only 2 strains
non-treated ≠ UV-LED

different strains
for the different media

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Conclusions

important differences in counts on mCCDA and CFA ~ 1 log

following UV-LED treatment
different behaviour/observations on mCCDA and CFA

importance of post-treatment conditions

no impact on AMR profile

for some strains impact on MALDI-TOF MS profile
yet dependent on culture conditions

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Contact

Van Hoorde K.• koenraad.vanhoorde@sciensano.be
Arturo B. Soro • arturoblazsor@hotmail.com

Sciensano • Rue Juliette Wytsmanstraat 14 • 1050 Brussels • Belgium
T +32 2 642 51 11 • T Press +32 2 642 54 20 • info@sciensano.be • www.sciensano.be