

# BIOVITAE<sup>®</sup>

SAFE DISINFECTION IN  
OCCUPIED SPACES

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# THE PROBLEM

ANTIMICROBIAL RESISTANCE (AMR) IS ONE OF THE TOP 10 GLOBAL PUBLIC HEALTH THREATS FACING HUMANITY.

## WHY:

- Misuse and overuse of antimicrobials in human, animal, and agricultural sectors
- Poor infection prevention and control (IPC)
- Environmental and sanitation factors (secondary contributors)

## CONSEQUENCES:

- **2019:** 1.27M direct deaths; 4.95M deaths associated with AMR
- **By 2050:** Up to 10M deaths annually
- **Economic impact:**
  - Up to £2.6–£2.8 trillion GDP loss per year by 2030
  - Up to 24M people pushed into extreme poverty

## ANTI MICROBIAL RESISTANCE

THE XXI CENTURY'S "SILENT PANDEMIC"



## GLOBAL

A failure to address the problem of antibiotic resistance could result in:



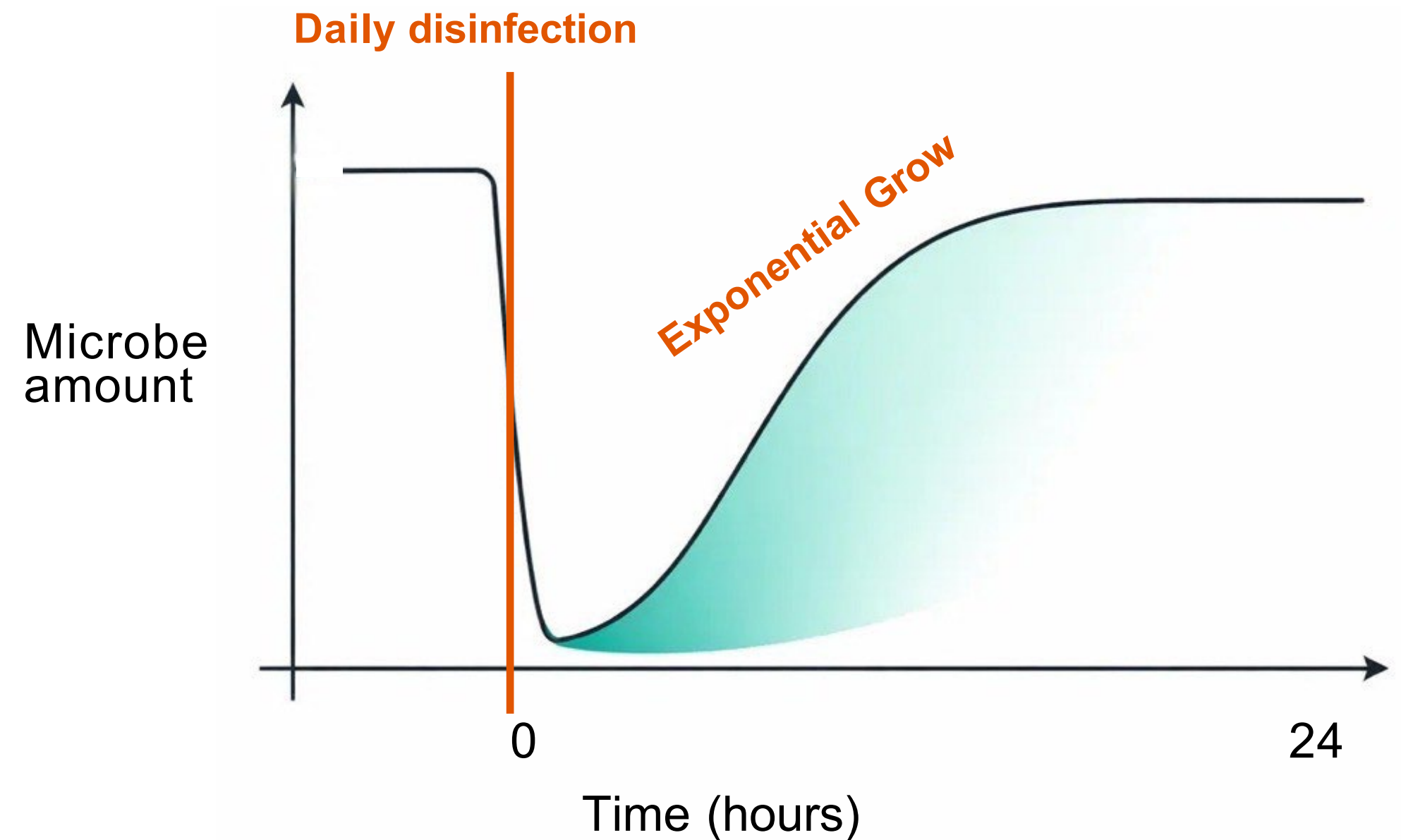
**10m**  
deaths  
by 2050

**Costing**  
**£66**  
trillion

## MANUAL CLEANING

Manual disinfection, done once per day, momentarily brings the microbe levels down. As soon as people use the room, microbe levels start to grow fast.

## TRADITIONAL DISINFECTION



# WHAT DOES “CONTINUOUS DISINFECTION” ACTUALLY MEAN?

## ALWAYS ACTIVE

Continuously reduces microbial load, not in intermittent cycles

## SAFE FOR HUMANS AND ANIMALS

Photobiologically safe for humans and animals, with no harmful emissions or chemical by-products.

## NON-INTERRUPTIVE

Designed to operate in occupied spaces. Non-interruptive: no need to evacuate rooms or suspend activities

## EFFECTIVE ON AIR AND SURFACES

Addresses both airborne and contact transmission while reducing the reliance on chemical disinfectants.

## OPERATOR-INDEPENDENT PERFORMANCE

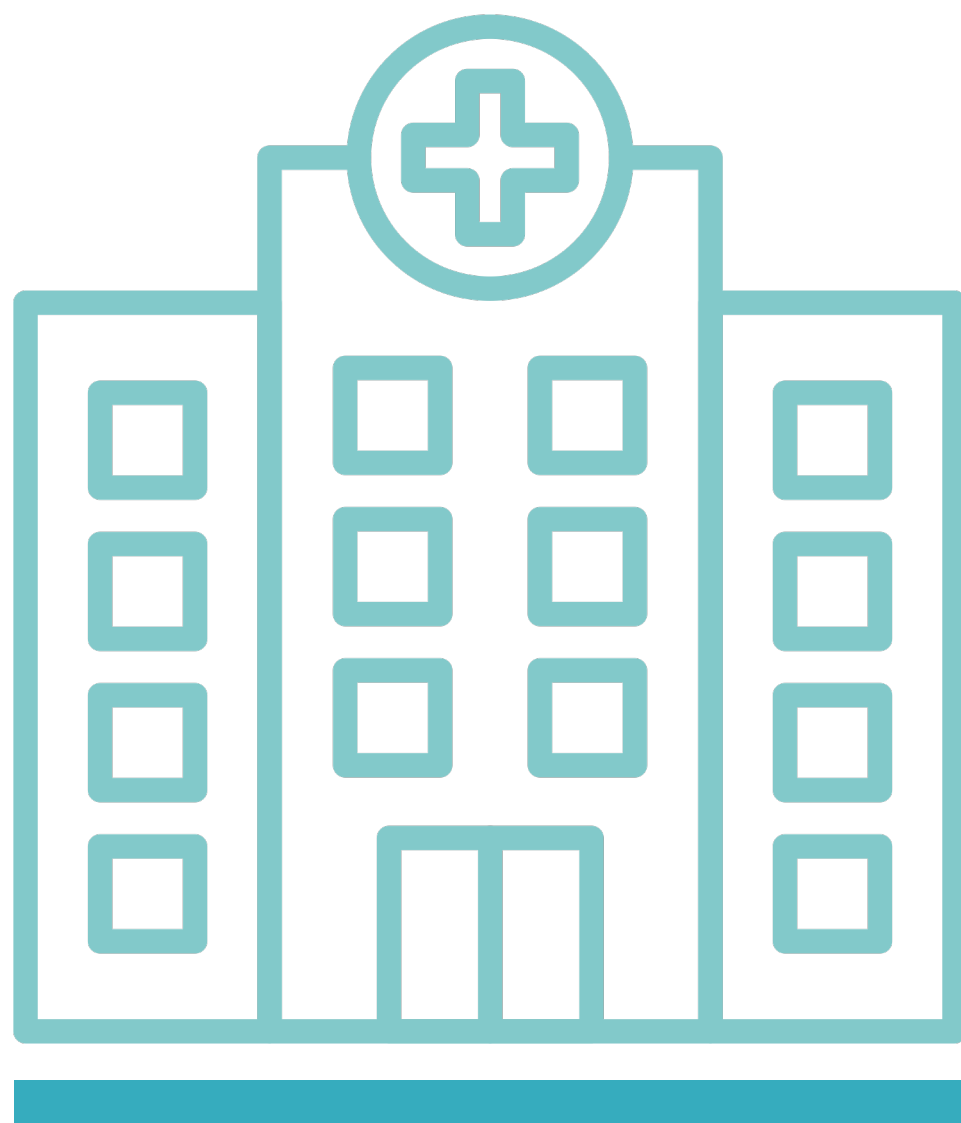
Not reliant on manual cleaning, timing, or compliance

## IS CLEANTECH

An always-active, all-in-one system integrating sanitisation and lighting, with zero emissions and no additional energy consumption

# WHERE CONTINUOUS DISINFECTION IS MOST NEEDED IN HOSPITALS

These are hospital environments where continuous disinfection provides the greatest value by maintaining protection during normal occupancy.



ICU



Isolation Wards



Operating Rooms



Dialysis Units



Waiting Areas & High-Traffic Zones



Bathrooms & Sanitary Areas



Cafeterias & Staff Common Areas

# BIOVITAE®

BIOVITAE®

## SANITIZES PROTECTS ILLUMINATES

Biovitae a sanitizing LED.

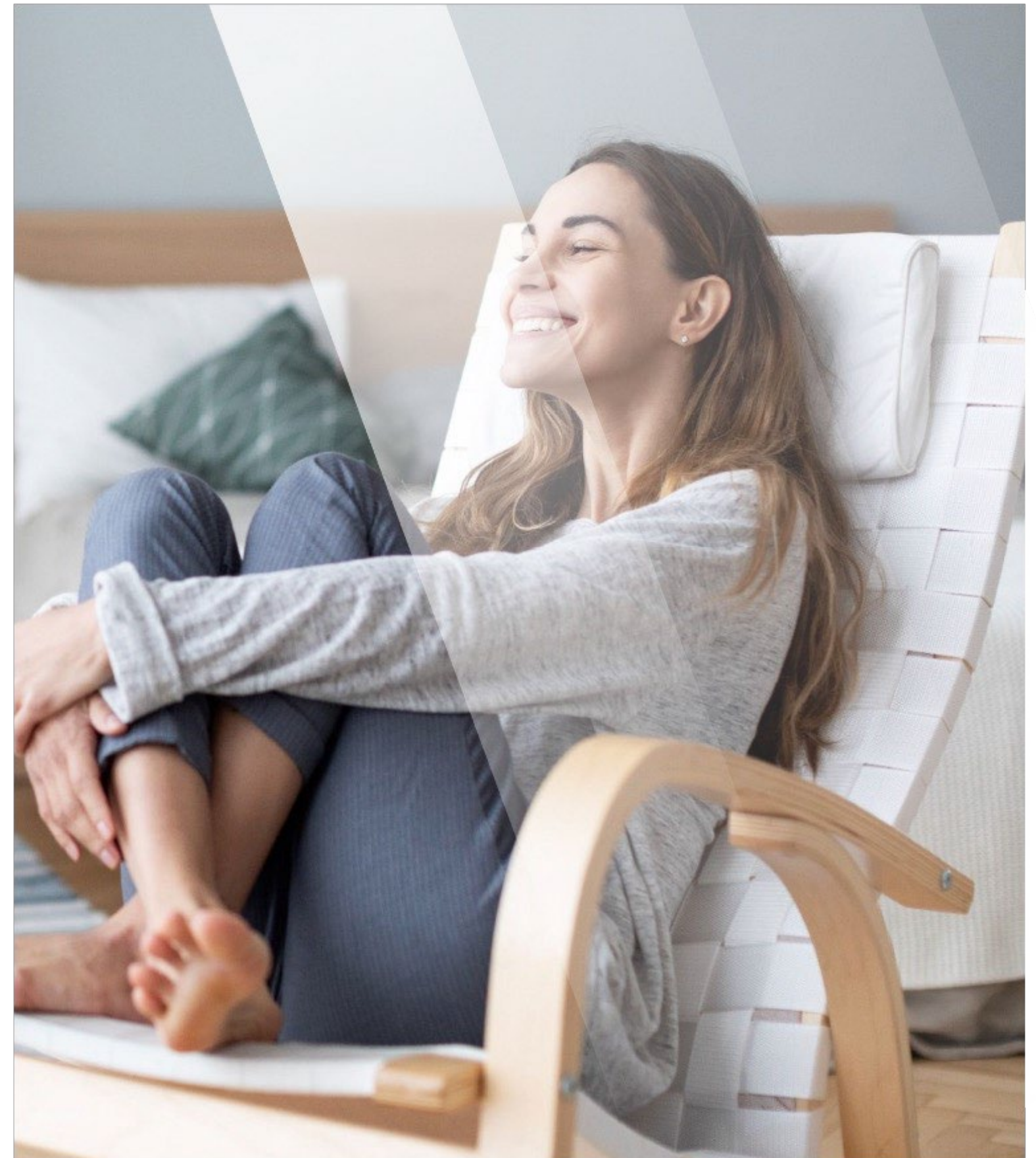
A patented technology, safe for people and animals, capable of eliminating bacteria and viruses and reducing the microbial load in indoor environments.

The Biovitae LED uses a combination of visible-spectrum wavelengths (without UV) and emits a natural white light that sanitizes air and surfaces without interrupting normal activities.



**Effective against viruses and bacteria**

\*Independent tests on the technology have shown, for SARS-CoV-2, a reduction of up to 99.8% in 60 minutes on surfaces. Independent tests on the technology against Staphylococcus aureus (MRSA, E. coli, P. aeruginosa and B. atrophaeus) have demonstrated up to 99.9% reduction within 2 hours on all types of surfaces.



# BIOVITAE<sup>®</sup>

## MICROBICIDAL LED LIGHT



Eliminates bacteria



Eliminates viruses,  
including SARS-COV-2



Penetrates and eliminates  
the biofilm



Reduces odors\*\*



Reduces the risk of  
allergies\*



UV free



For continuous use in  
the presence of people  
and animals



Natural white light



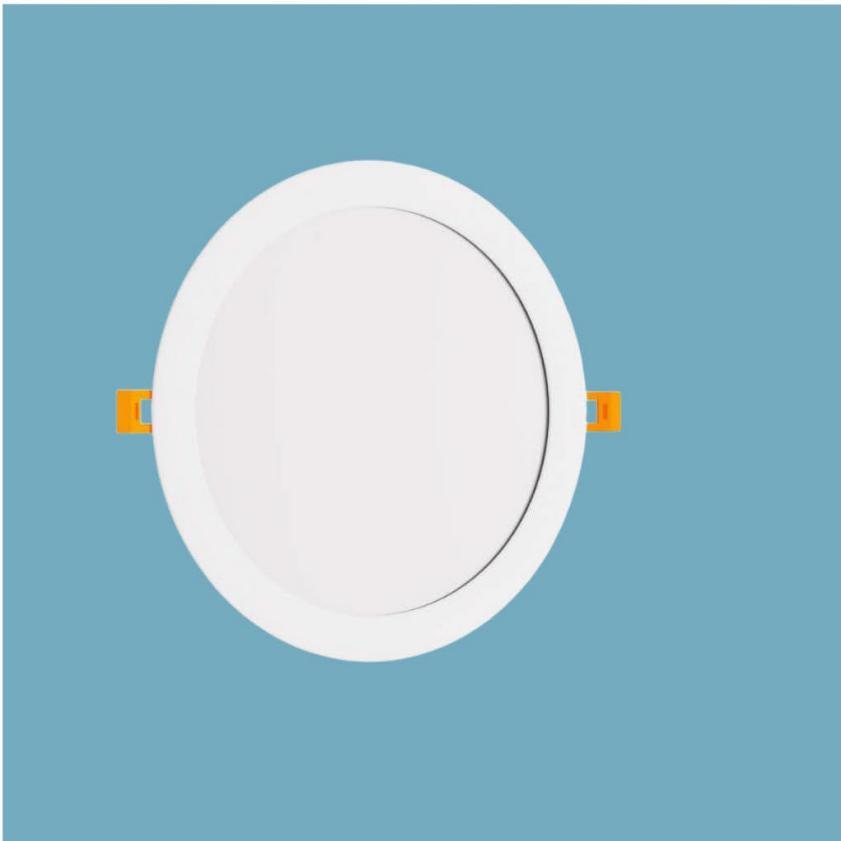
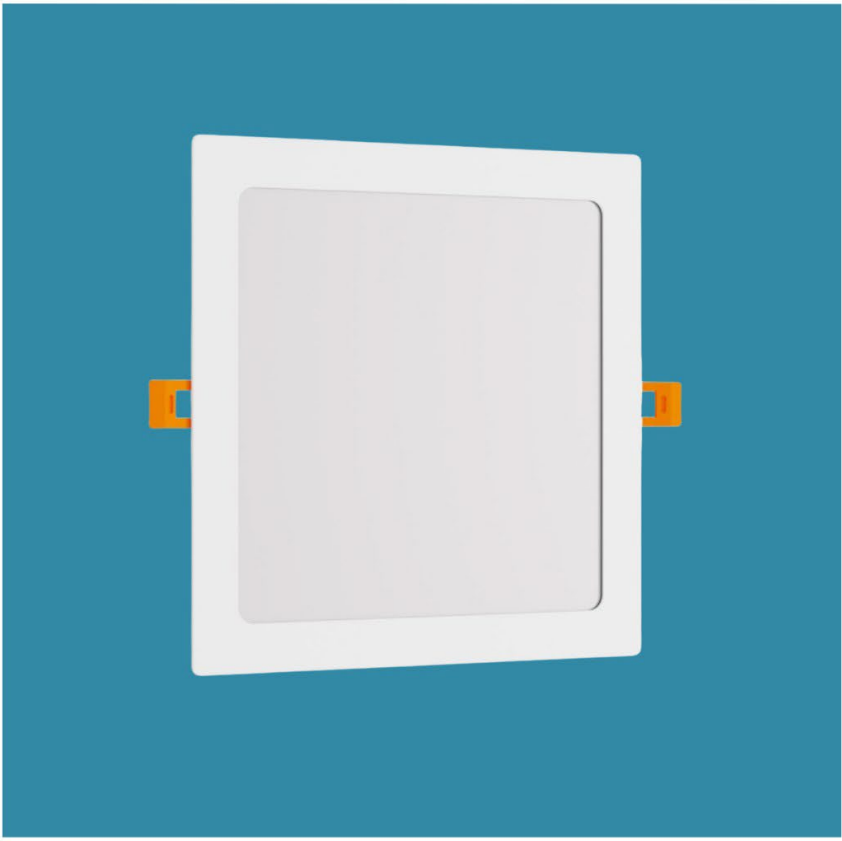
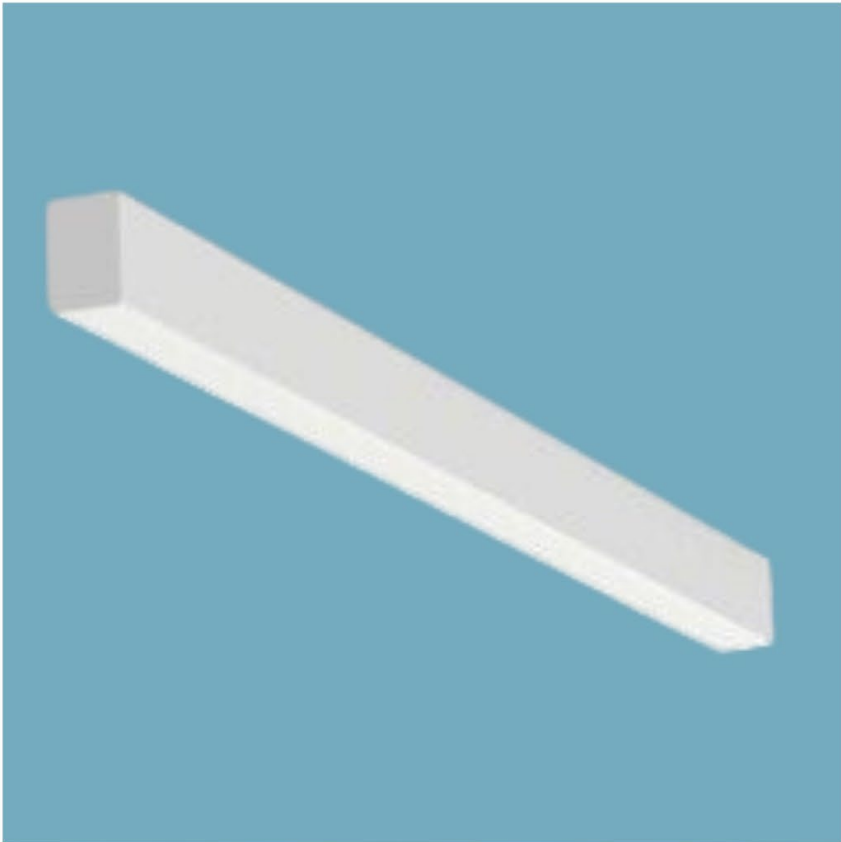
High energy efficiency

Active on microorganisms that cause allergies through pollen or dust  
\*\*Of bacterial origin



# OUR PRODUCTS

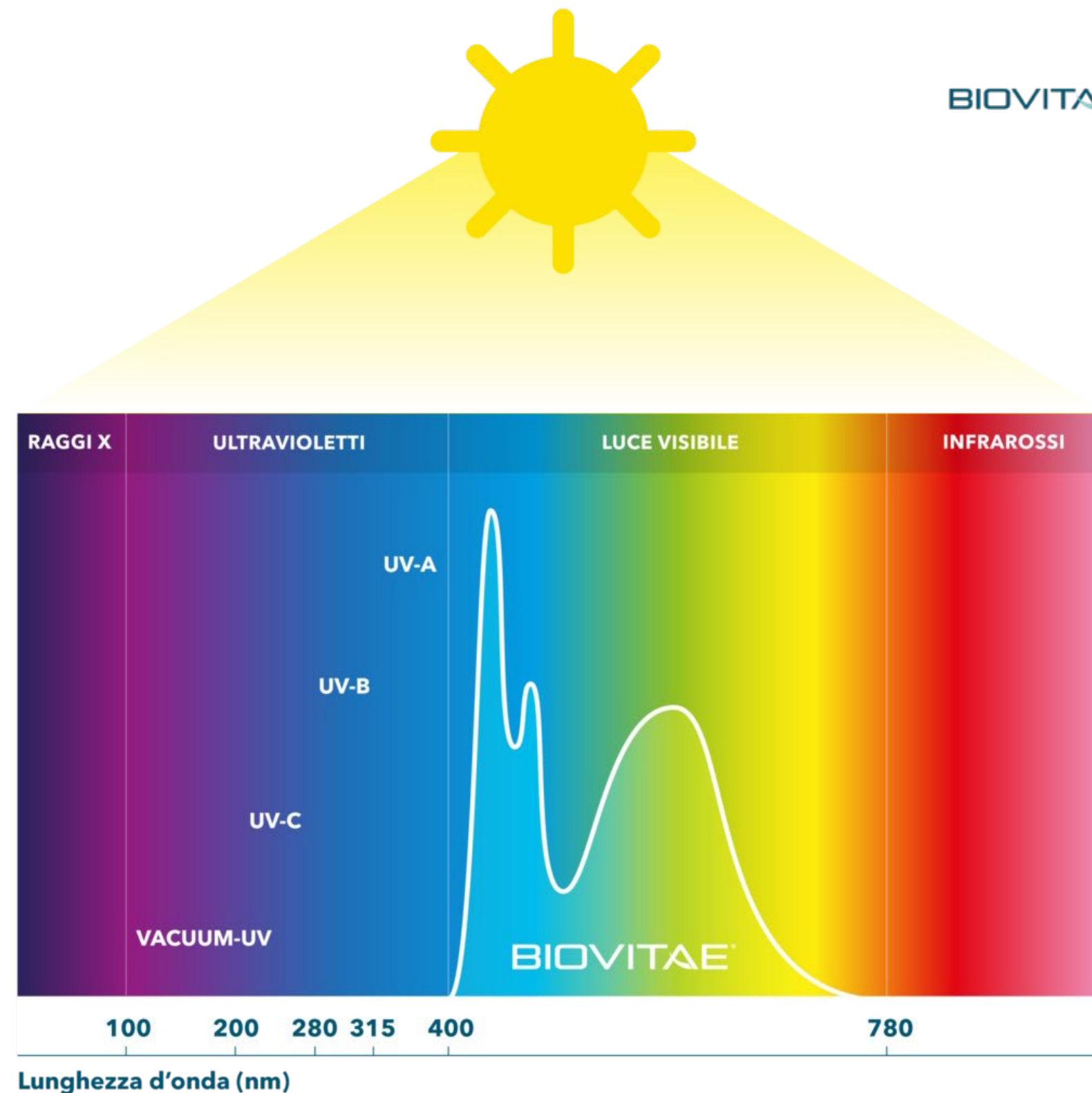
BIOVITAE™



Biovitae is a 1:1 replacement to conventional LED lighting



BIOVITAE's microbicidal technology operates at the diode level and can therefore be integrated by replacing standard LEDs with BIOVITAE LEDs.



The microbicidal action is activated by the photodynamic effect of a patented (non-UV) combination of wavelengths in the 400–420 nm range (Soret band), which causes oxidative damage to microbial cell membranes, leading to their death.

# SPECTROSCOPY OF MICROORGANISMS

## Targeting Intrinsic Absorption Pathways of Microorganisms

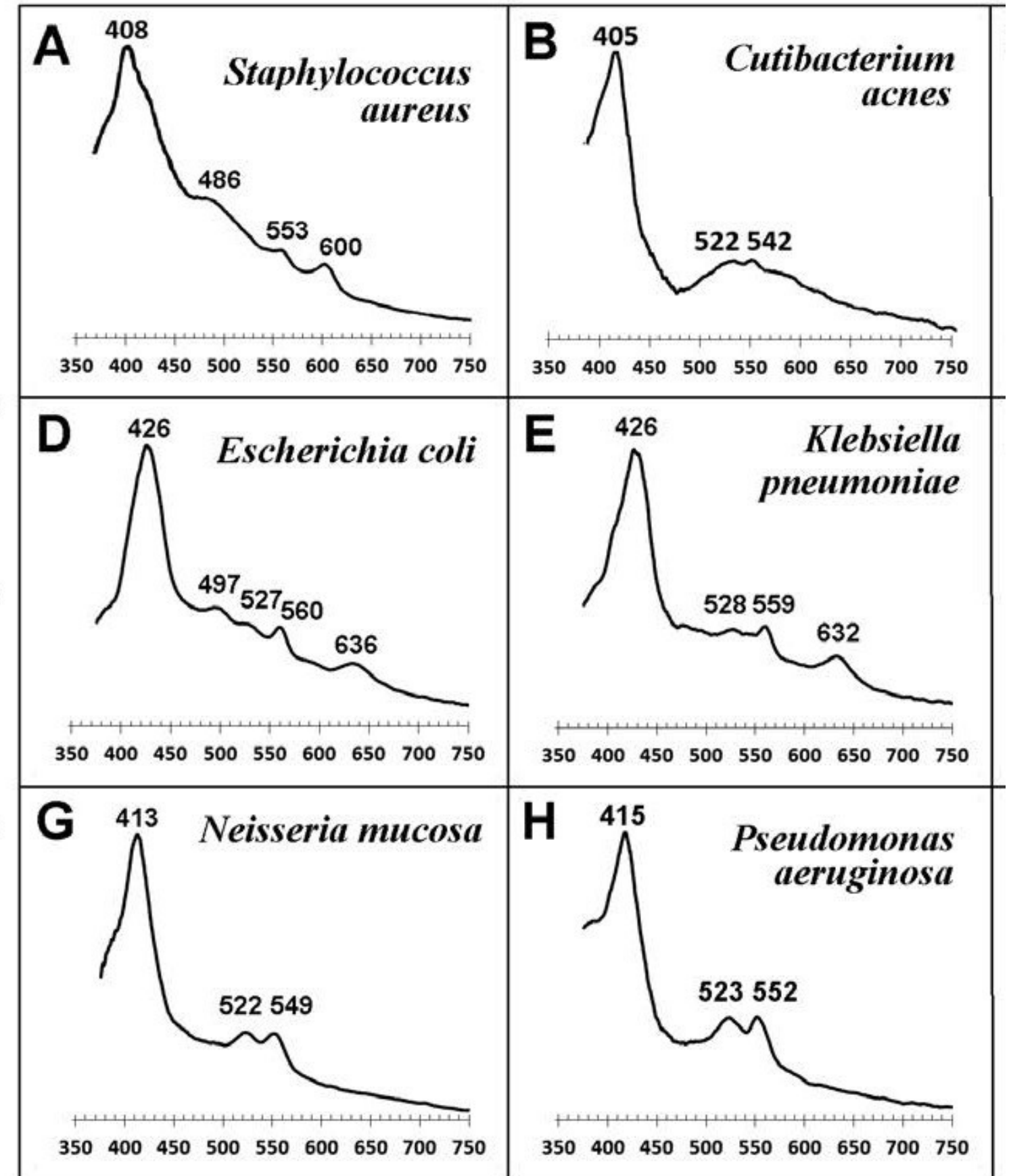
Microorganisms exhibit **peak sensitivity in the blue light spectrum ( $\approx 380\text{--}480\text{ nm}$ )**

- This aligns with absorption bands (Soret band) of **endogenous chromophores**:
  - Porphyrins
  - Flavins

Upon illumination:

**Light** → **Chromophore excitation** → **ROS generation** → **Microbial inactivation**

Absorbance spectra of microbes. (Harris.et al) **BIOVITAE**



Absorbance (arbitrary units)

wavelength

# SPECTROSCOPY OF MICROORGANISMS

The goal is to match the spectrum of the light source, to the absorption of the bacteria, in order to eradicate it effectively.

## *Absorption Spectra of E.Coli – One example*

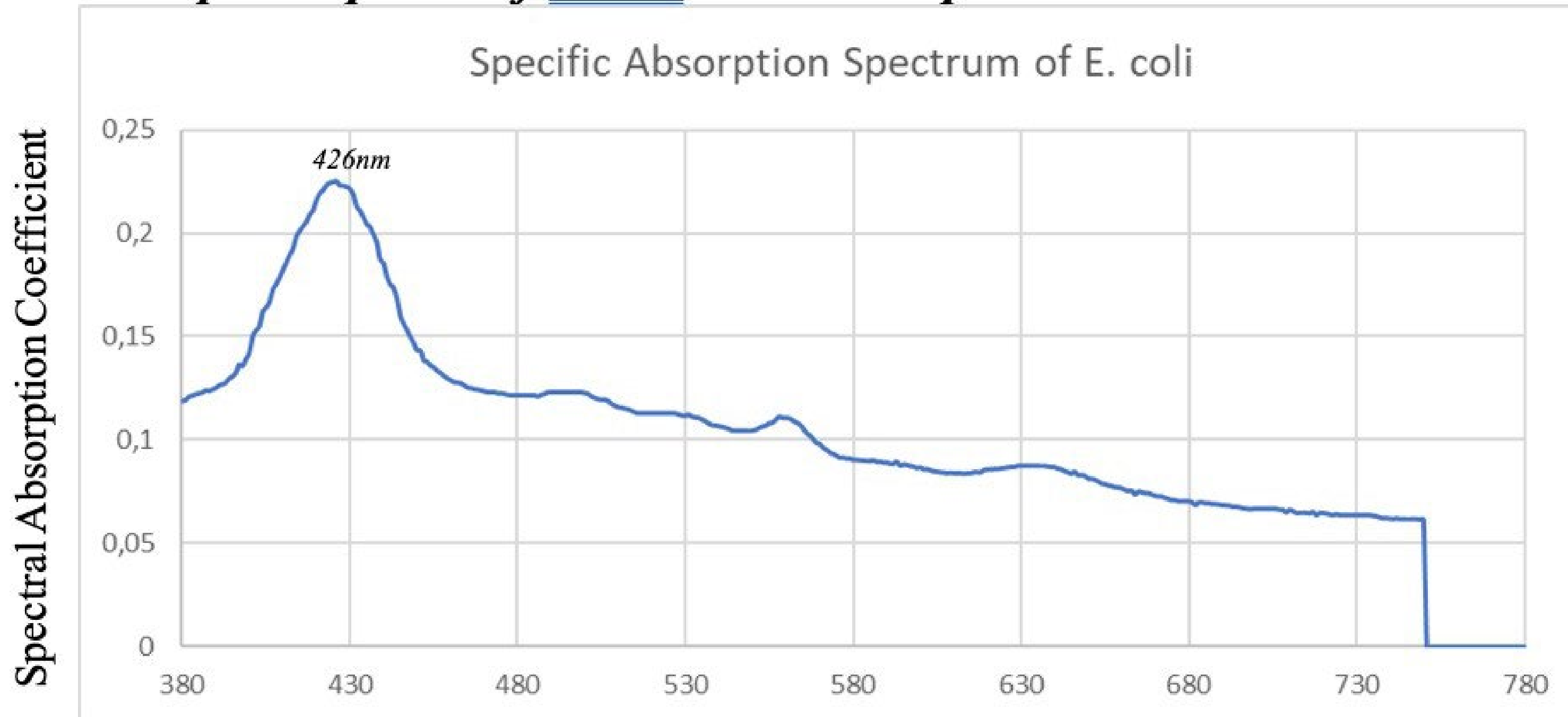


Fig. 1.A: Specific Absorption Spectrum of *E. coli*

# SPECTROSCOPY OF MICROORGANISMS

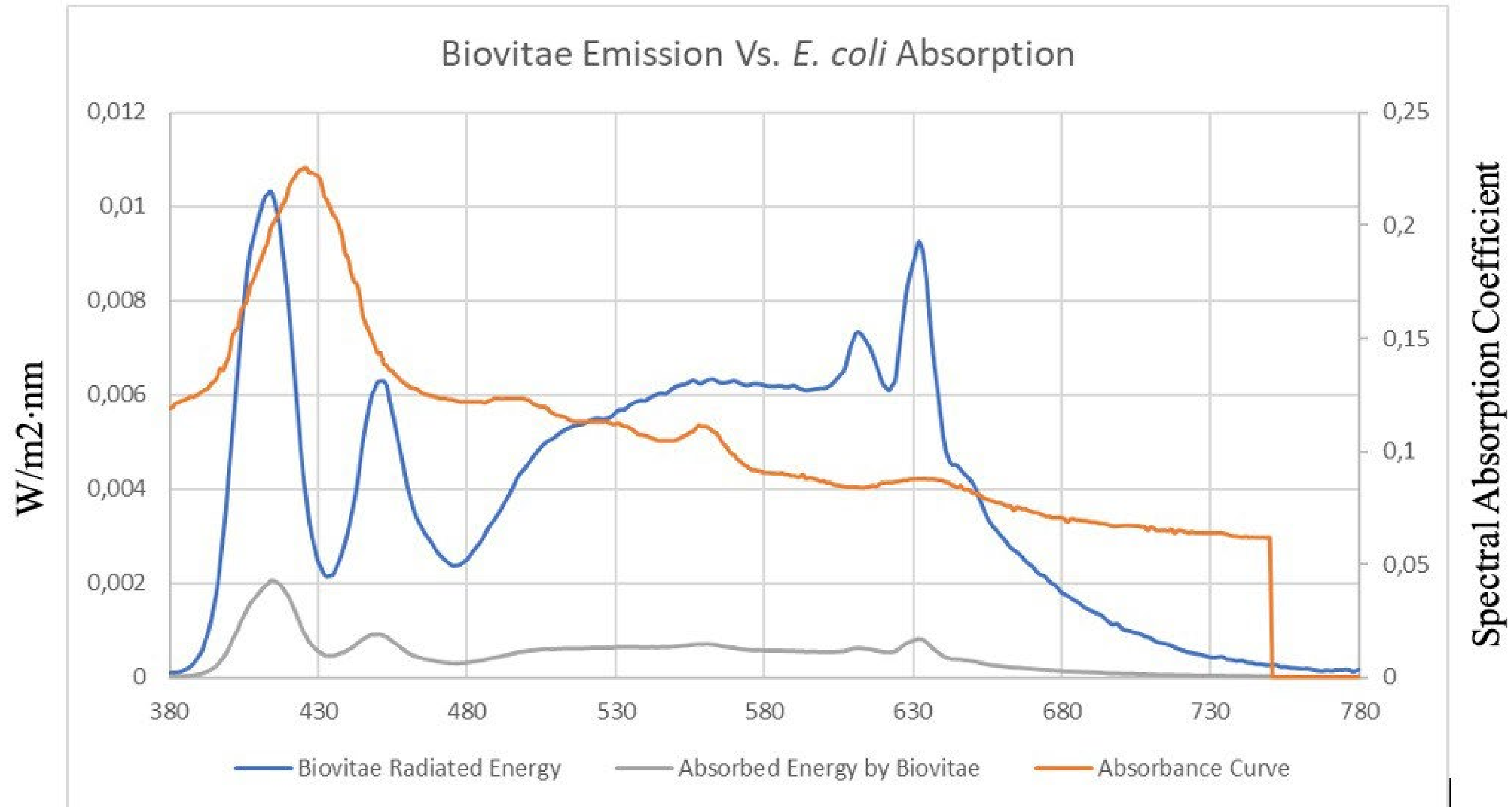


Fig. 2A: Biovitae Vs. *E. coli* Absorption

# SPECTROSCOPY OF MICROORGANISMS

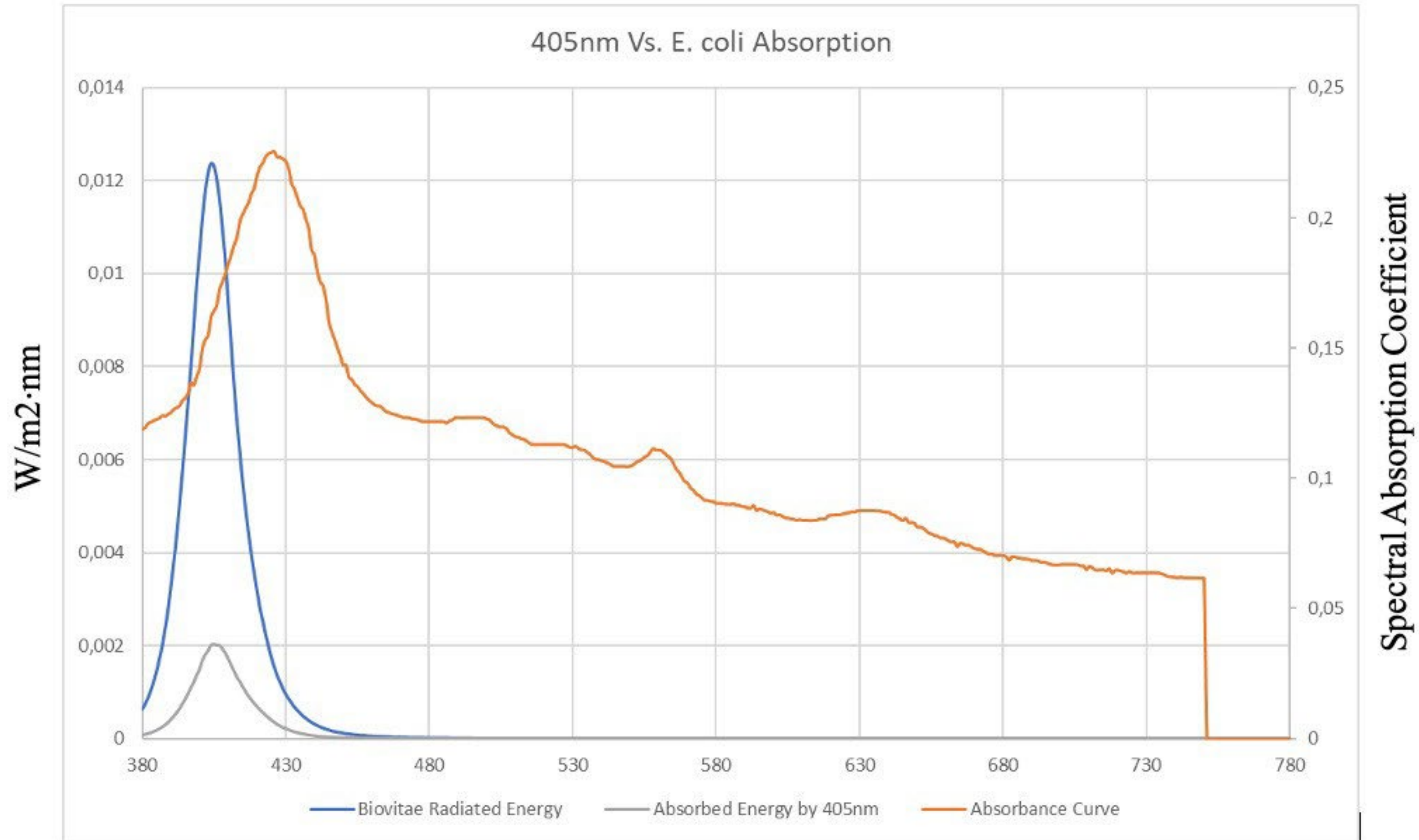


Fig. 3A: 405nm Vs. *E. coli* Absorption

Fig. 4A: Differences in *E. coli* Absorption Between 405nm and Biovitae

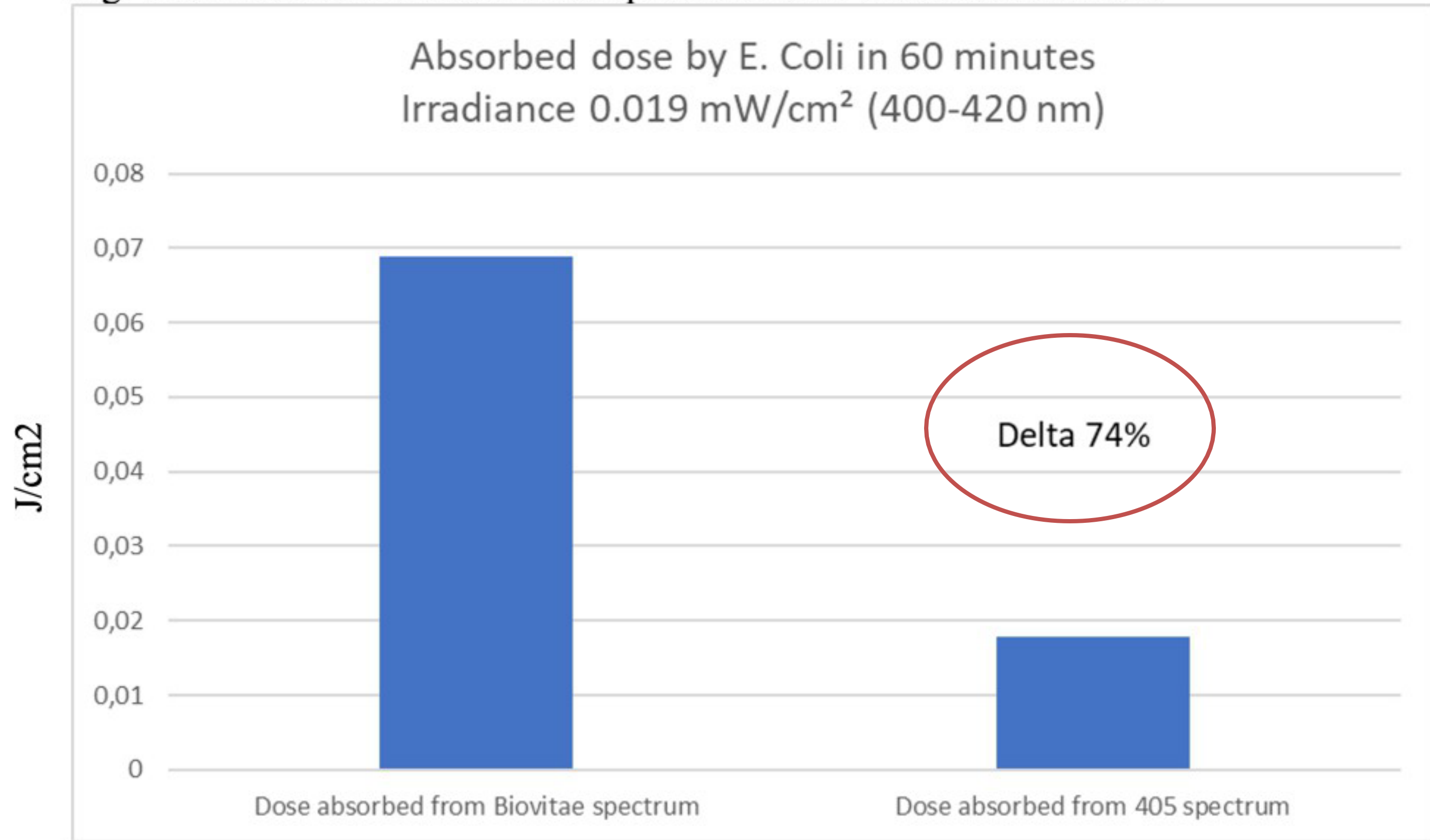
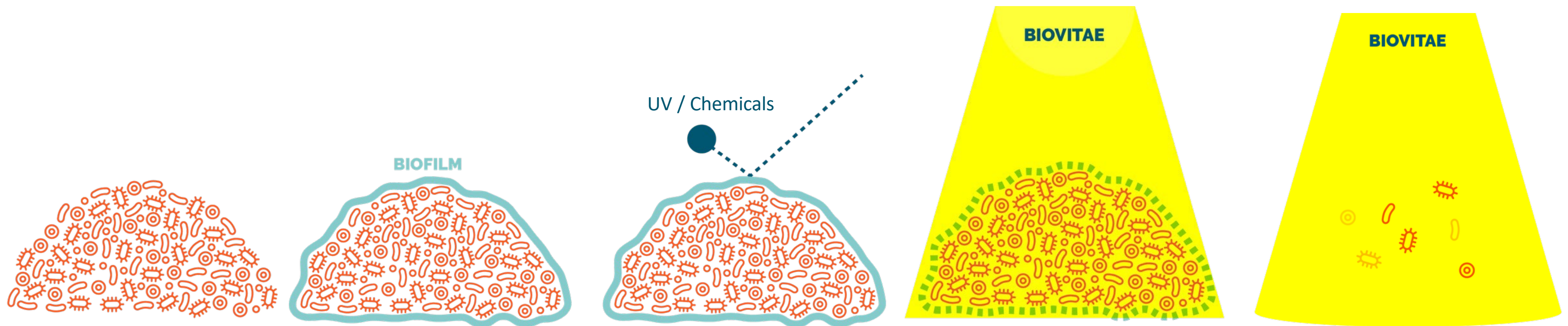
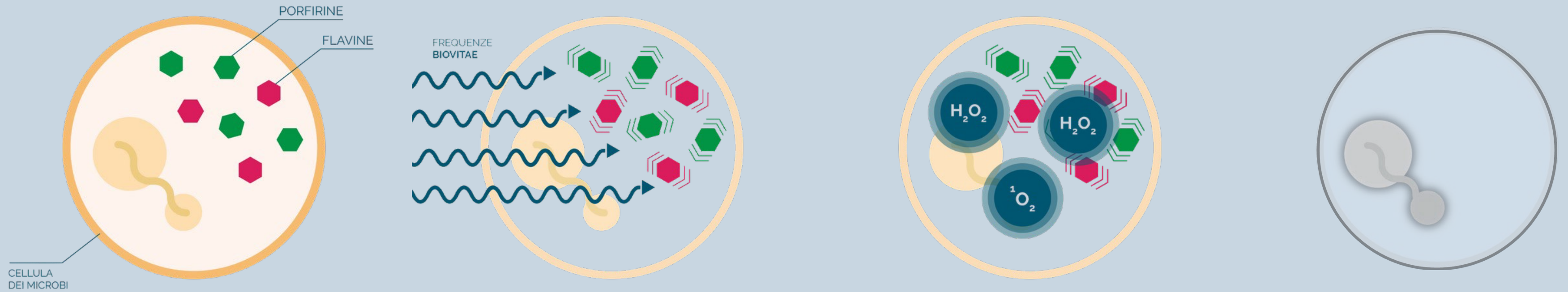


Fig. 5A: Energy Transferred in 60 Minutes to the Bacterium by Biovitae and 405nm (Irradiance Level Measured for Both Sources: 0.019 mW/cm<sup>2</sup>)

# MECHANISM OF ACTION: Photodynamic Inactivation

BIOVITAE®



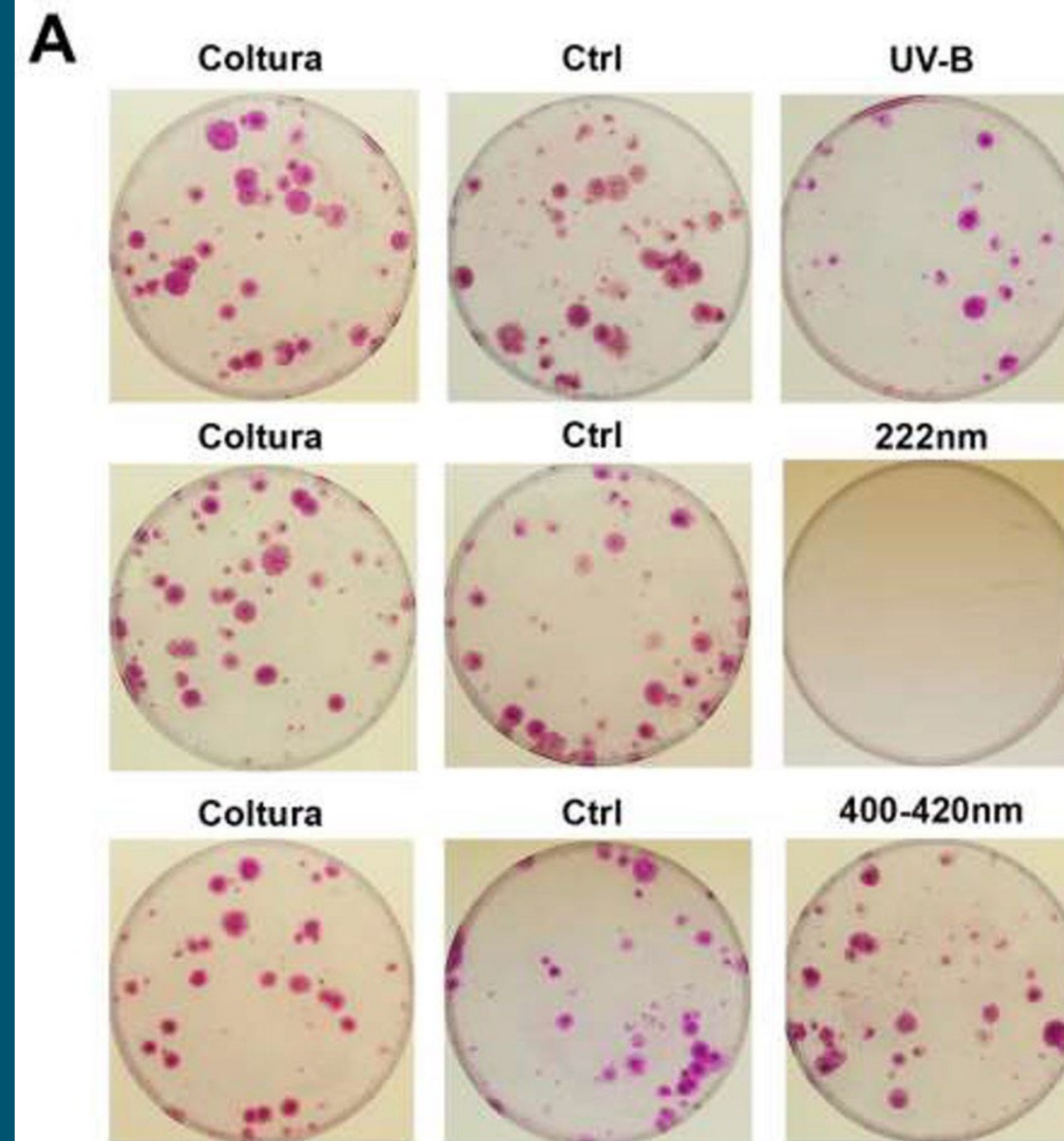
# SAFETY TESTING

## Photobiological Safety (IEC 62471)

- Independently tested in accordance with IEC 62471 / IEC TR 62778
- Classified within Risk Group 0 / Risk Group 1 depending on configuration
- Designed for continuous exposure in occupied environments
- No requirement for room evacuation or restricted access

## Live Cell Testing

- Evaluated on mammalian (human-relevant) cell lines under continuous exposure
- No significant cytotoxic effects observed at operational irradiance levels
- Confirms selective antimicrobial action without damage to host cells
- Supports safe deployment in clinical and high-occupancy settings



# SCIENTIFIC VALIDATION

BIOVITAE



## TESTS

## PUBLICATIONS

## UNDER REVIEW

### Bacteria (in vivo/vitro)

- *E. coli* MG1655 (ATCC 700926)
- *E. coli*, ATCC25922
- *S. typhi* (Ty21a-ATCC 33459)
- *Klebsiella* spp.,
- *Enterobacter* spp.,
- *Pseudomonas* spp.,
- *S. aureus*,
- *S. microti*,
- *S. agalactiae*
- *M. tuberculosis*
- *E. coli* (ESBL/ Carbapenems)
- *S. aureus* Methicillin (MRSA)
- *P. aeruginosa* Fluoroquinolones
- *A. baumannii*. Fluoroquinolones
- *Klebsiella* spp (ESBL/ Carbapenems)

### Virus (in vitro)

- SARS-CoV-2
- Vaccinia (Monkeypox)
- Chikungunya
- Yellow Fever
- H1N1



Rapid inactivation of SARS-CoV-2 with LED irradiation of visible spectrum wavelengths

Riccardo De Santis<sup>a</sup>, Vincenzo Luca<sup>a,b</sup>, Jonas Näslund<sup>c</sup>, Rosina K. Ehmann<sup>f</sup>, Marta De Angelis<sup>d</sup>, Eva Lundmark<sup>e</sup>, Lucia Nencioni<sup>d</sup>, Giovanni Faggioni<sup>a</sup>, Silvia Fillo<sup>a</sup>, Donatella Amatore<sup>a</sup>, Elisa Regalbuto<sup>a</sup>, Filippo Molinari<sup>a</sup>, Giancarlo Petralito<sup>a</sup>, Roman Wölfel<sup>f</sup>, Paola Stefanelli<sup>c</sup>, Gianni Rezza<sup>c</sup>, Anna Teresa Palamara<sup>d</sup>, Markus Antwerpen<sup>f</sup>, Mats Forsman<sup>e</sup>, Florigio Lista<sup>a,\*</sup>



Improving the Microbiological Safety of Raw Meat Through Visible Blue-Violet Light Irradiation

Anna Angela Barba<sup>1</sup> and Gaetano Lamberti<sup>2,\*</sup>

Applied Microbiology and Biotechnology (2026) 110:34  
<https://doi.org/10.1007/s00253-026-13709-0>

RESEARCH

Photodynamic inactivation of *Mycobacterium tuberculosis* by broad-spectrum visible light

Cartesio D'Agostini<sup>1,2</sup>, Carla Prezioso<sup>3,4</sup>, Paola Checconi<sup>3,4</sup>, Valeria Camicia<sup>1</sup>, Marco Pelliccioni<sup>1</sup>, Lolde Di Traglia<sup>1</sup>, Marilena Minieri<sup>2,5</sup>, Jacopo M. Legramante<sup>6,7</sup>, Enrico Garaci<sup>8</sup>, Dolores Limongi<sup>3,4</sup>

**Multiwavelength Antimicrobial Blue Light (aBL) systems for advanced environmental decontamination across liquid, solid, and built surfaces**

School of Chemical Engineering, University of Birmingham, Birmingham B15 2TT, UK  
Department of Microbiology, University Nigeria, Nsukka 410105, Nigeria

Nnabueze Darlington Nnaji<sup>1,2,†</sup>, Christian Kosisochukwu Anumudu<sup>1,†</sup>, Damion Forbes<sup>1</sup>, Elroy Castelino<sup>1</sup>, Taghi Miri<sup>1\*</sup> and Helen Onyeaka<sup>1,\*</sup>

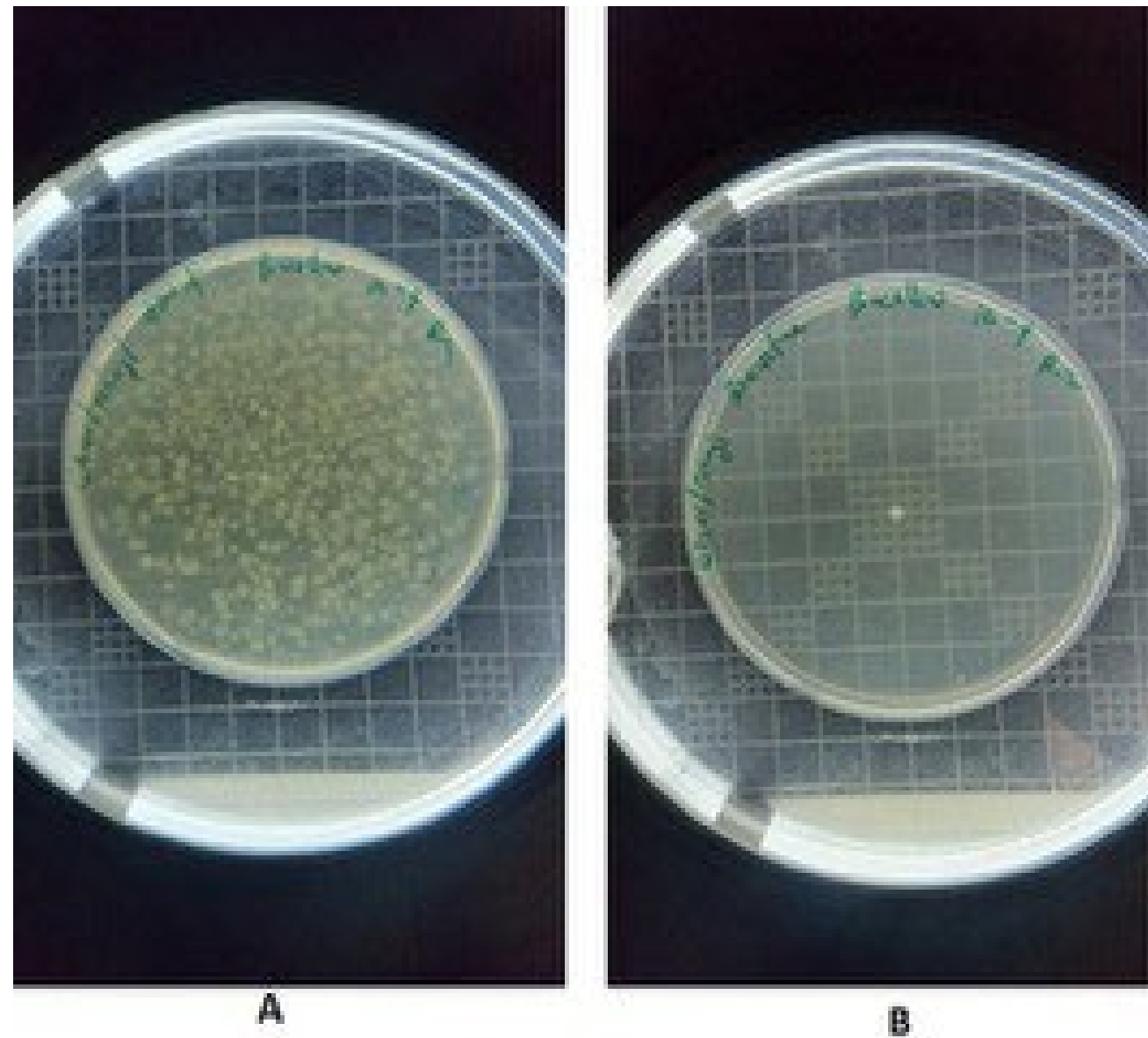
**Safety evaluation of antimicrobial white light (aWL) with multifrequency polychromatic emission in primary human skin cells and reconstructed 3D skin models.**

Valeria Bartolucci, Alessio Capone, and Elena Dellambra.

Laboratory of Molecular and Cell Biology, Istituto Dermatologico dell'Immacolata, IDI-IRCCS, Rome (Italy)

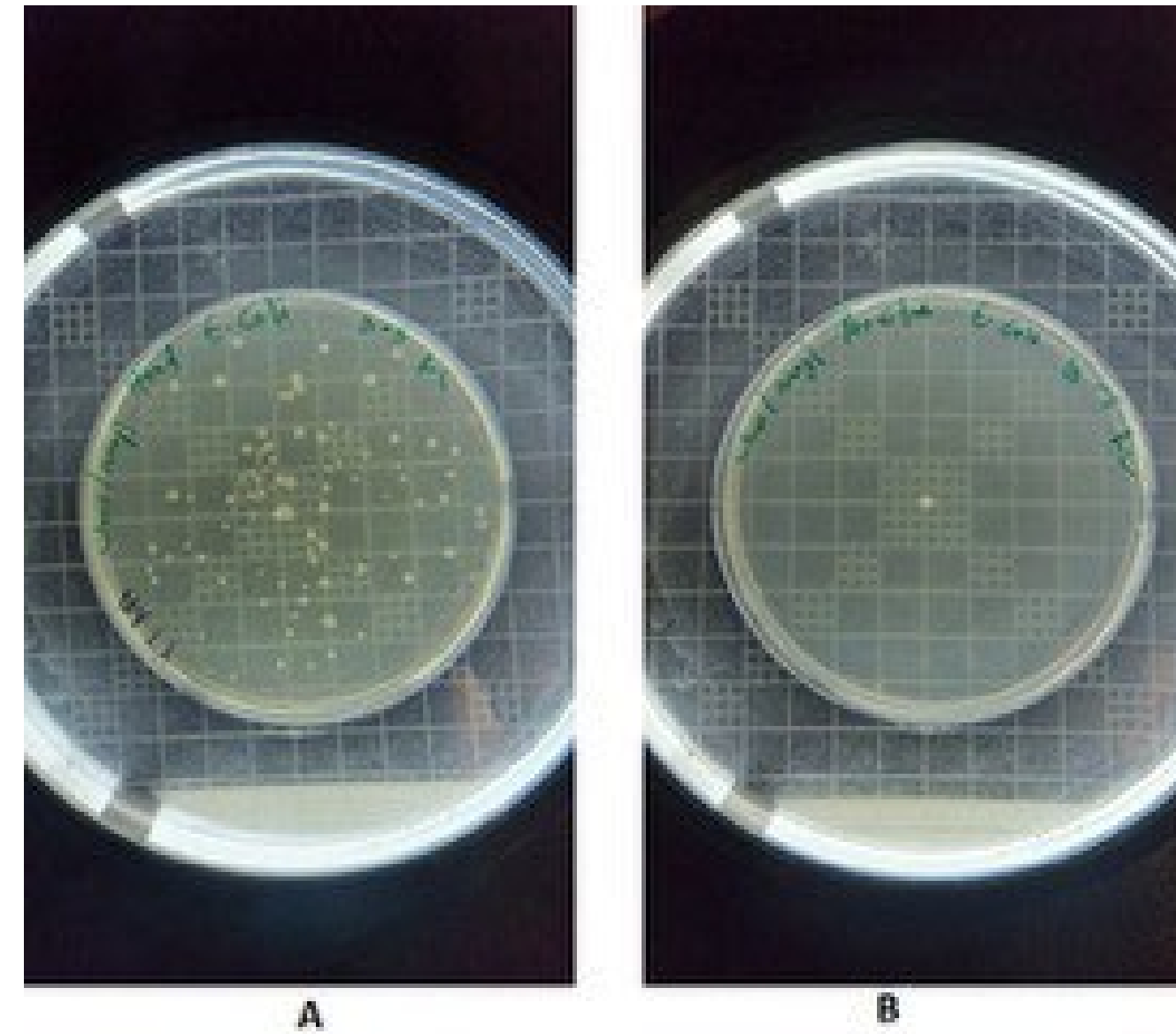
# EXAMPLE: TESTING BY UNIVERSITY OF BIRMINGHAM

## Bacillus cereus



**Fig A** - B. cereus following treatment with fluorescent light  
**Fig B** - B. cereus following treatment with Biovitae

## Escherichia coli

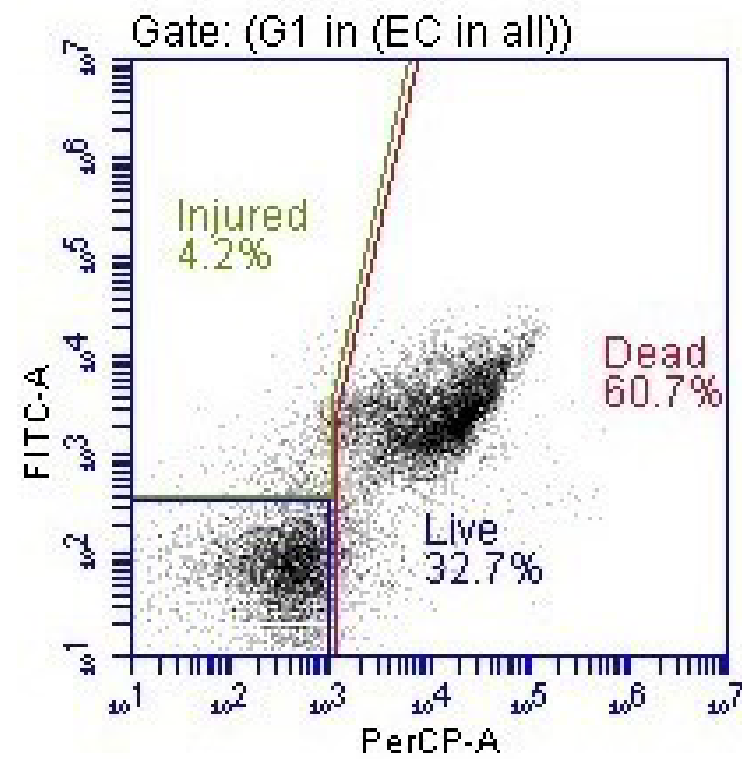


**Fig A –E.** Coli following treatment with fluorescent light  
**Fig B –E.** Coli following treatment with Biovitae

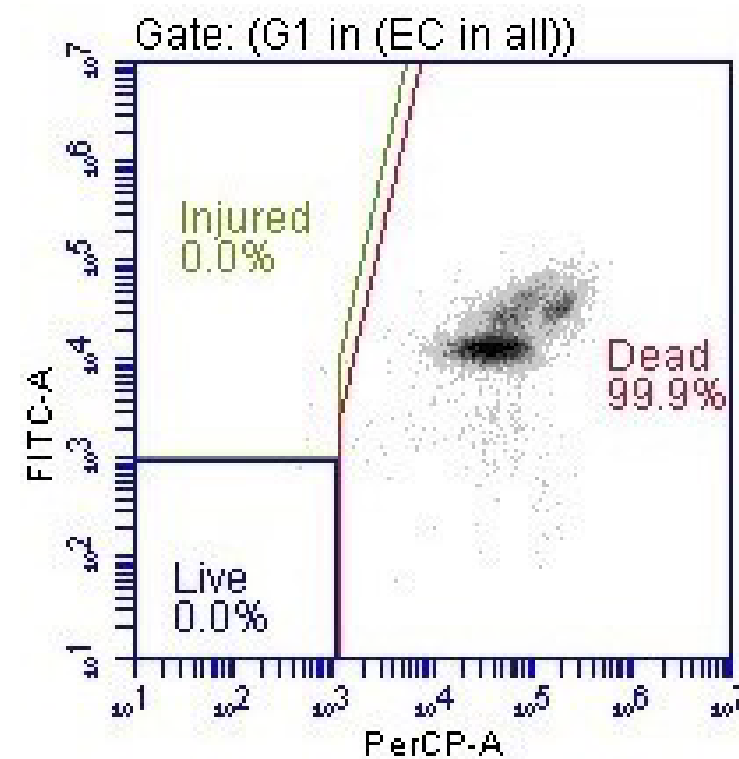


# FLOW CYTOMETRY ANALYSIS

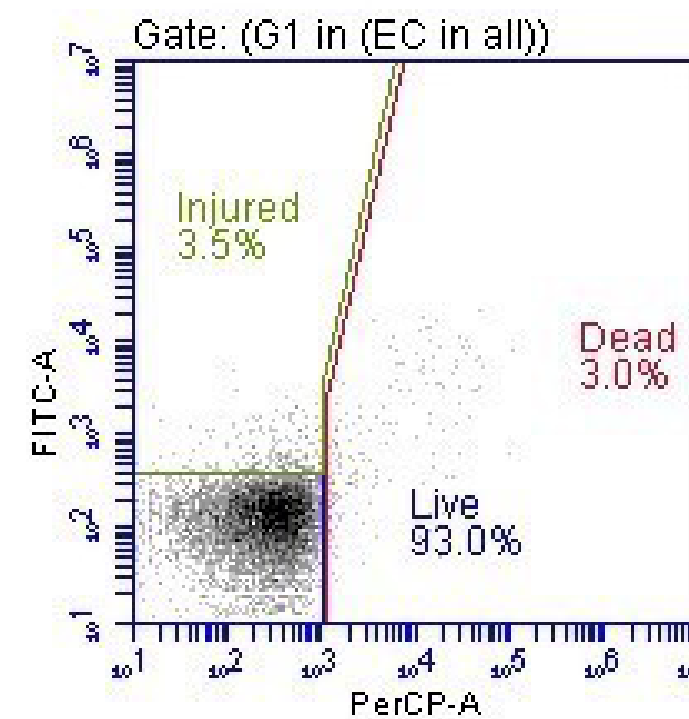
Flow cytometry was employed to evaluate the impact of Biovitae light on bacterial populations, specifically *Escherichia coli* and *Bacillus cereus*, by distinguishing live, injured, and dead cells. This analysis provides critical insights into the microbiocidal mechanism of Biovitae and its potential to counteract the development of antibiotic-resistant bacteria.



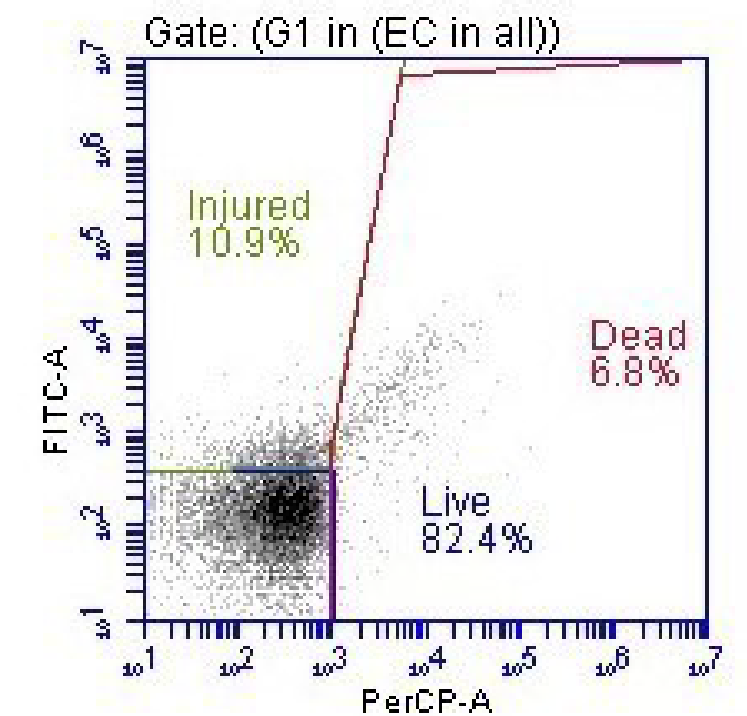
*E. coli* broth culture following 3 hour Biovitae treatment



*E. coli* broth culture following 6 hour Biovitae treatment



(a) *E. coli* broth culture following 3-hour Fluorescent treatment



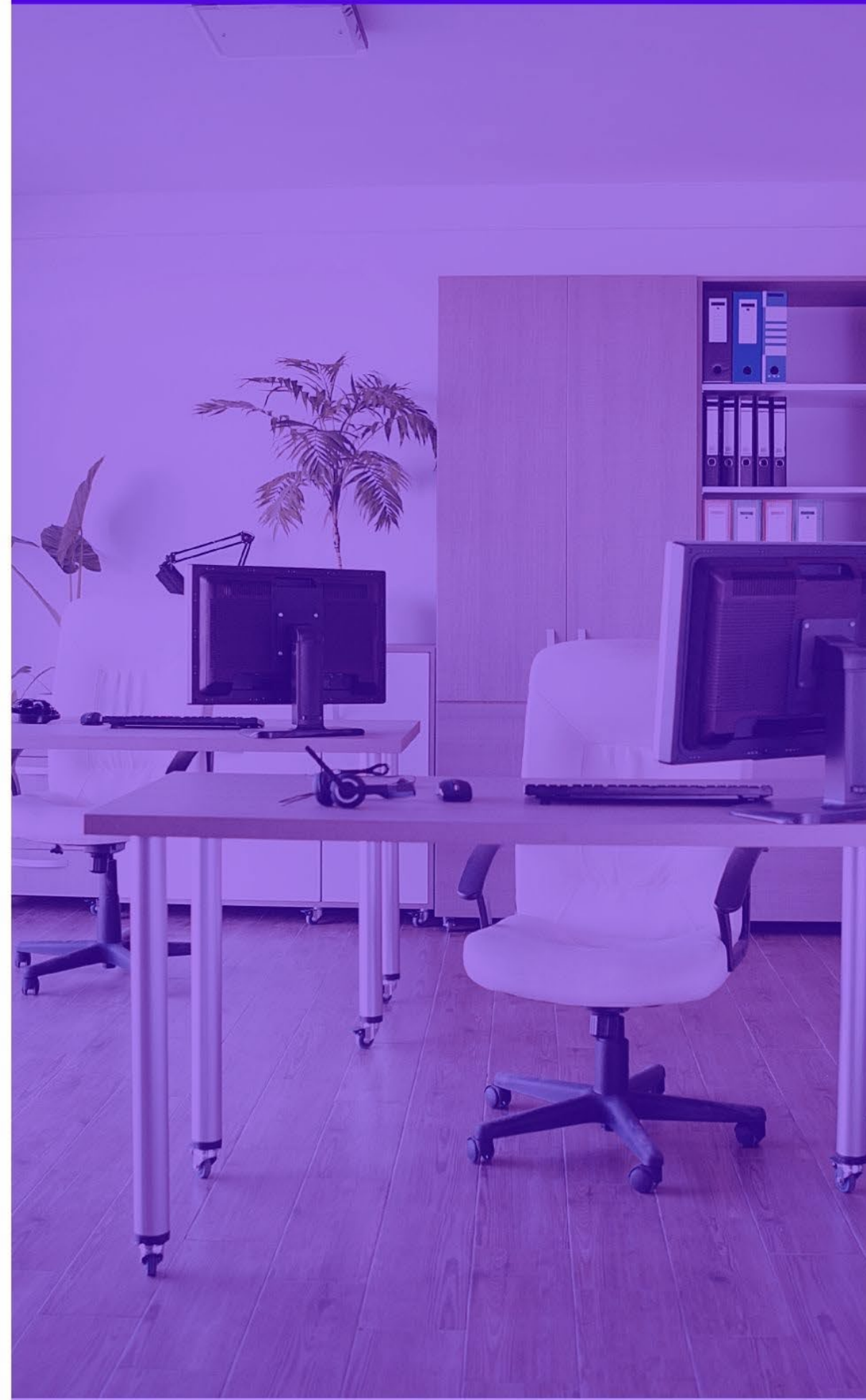
(b) *E. coli* broth culture following 6-hour Fluorescent treatment



# CHEMICALS



# UV-C



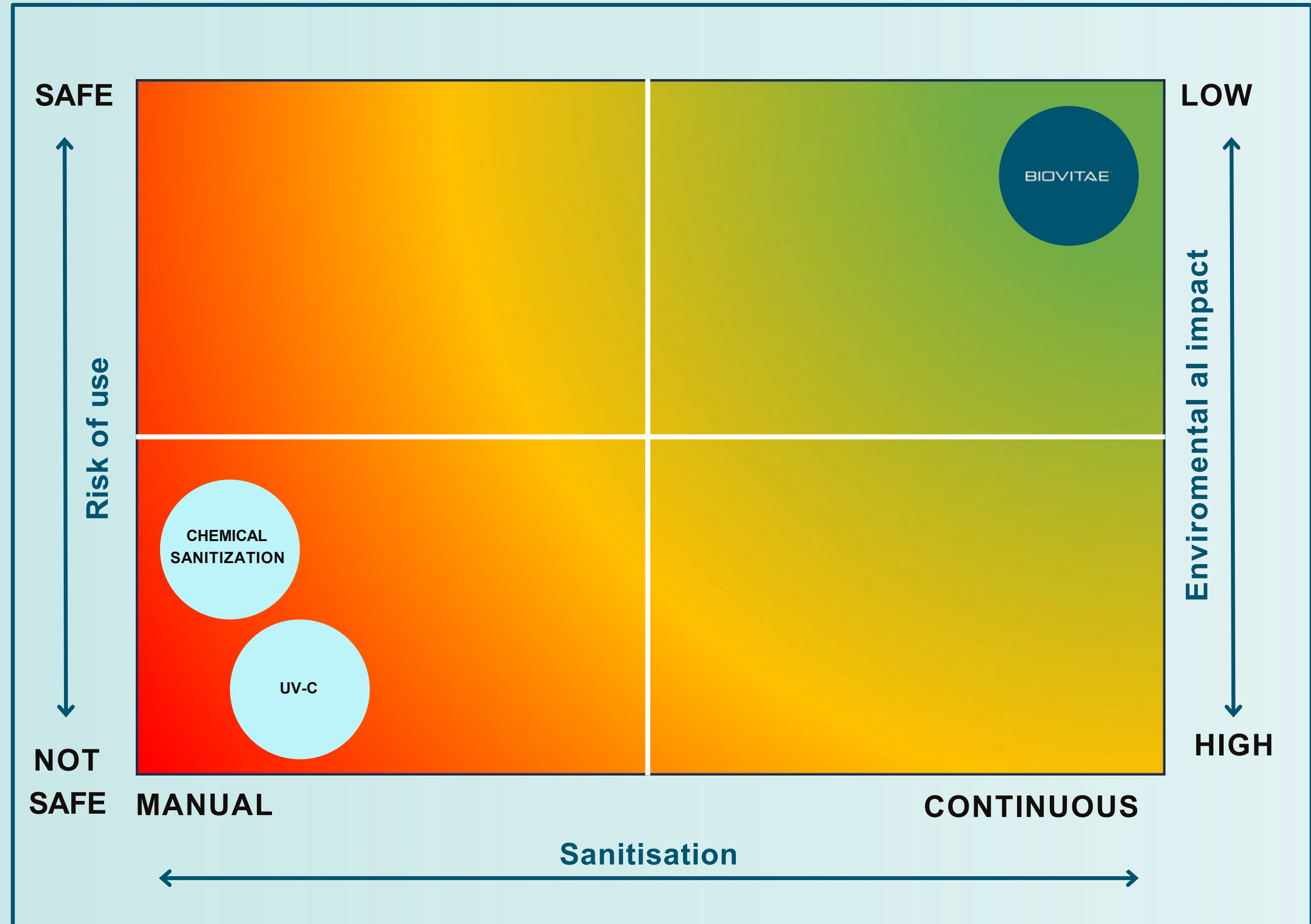
# CONTINUOUS SANITIZATION



# BIOVITAE

# TECHNOLOGY COMPARISON MATRIX

Biovitae is currently the only sanitisation system that guarantees a high and continuous level of sanitisation, is extremely safe to use, and has a minimal impact on the environment.



# INTELLECTUAL PROPERTY

USA

ITALY

INDIA

EPO

KOREA

AUSTRALIA

JAPAN

BRAZIL

TAIWAN

**20+** Granted and pending patents

# AWARDS



Best Innovation 2019



Best Innovation 2020



Best Innovation 2021



Best Innovation 2023



Best Innovation 2020

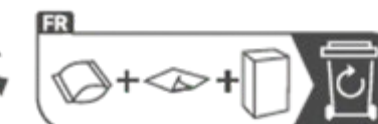


Best Startup 2023

# BIOVITAE<sup>®</sup> CERTIFICATIONS



Safe for people and animals





IDI (Dermopathic Institute of the Immaculate)  
Rome, Italy



Corte dei conti Polyclinic  
Rome, Italy



Emergency Room- Leonardo da Vinci Airport  
Rome, Italy



Dublin City University –  
Dublin, Ireland



Elementary School St. Walburg–  
St. Walburg, Germany



Prefecture—  
La Spezia, Italy



Headquarters of a Pharmaceutical Company -  
Rome, Italy



Lazio Innova Hub –  
Rome, Italy



La Granda Plant –  
Genola, Italy



Headquarters of a Pharmaceutical Company -  
Rome, Italy



Pig farm –  
Ireland



Torricelle Dairy –De Vivo Agriculture Plant -  
Salerno, Campania



Montevergine Hospital – Cardiological Operating Room  
Campania, Italy



Campus Biomedico University  
Rome, Italy



Moscato Scientific High School  
Italy



University of Camerino–  
Camerino, Italy



Preschool "Il Calore delle Coccole"–  
Ottati, Italy



La Cooperativa- Refrigeration Project –  
Cortina D'Ampezzo Italy



COOP  
Bologna, Italy



Flagship Lavazza Shop—  
London, UK



Sampdoria Football Club—  
Genoa, Italy



Bus  
Germany



Automotive Industry—  
Ongoing



Rail Transport -  
Ongoing

# REFERENCE



Haier – Sanitised Dishwasher project 2026



Poste Italiane – POLIS Project Italy

REFERENCE

Questions?

# BIOVITAE®



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