SonoSteam®

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SonoSteam FORCE Technology
Teknologi der kun anvender damp-ultralyd, derfor ingen kemi.

Force Technology SonoSteam®

- SonoSteam is a division within Force Technology
- GTS institute
- An independent and self-owned company
- Profit goes to create new projects such as the SonoSteam project
- Force technology delivers highly specialized engineering knowledge into practical and value-creating solutions.
- Over 1600 employees

Content

SonoSteam – disinfection

- Disinfection, pros and cons
- SonoSteam disinfection, working principle
- Theoretical and practical knowledge
- Case studies and pilot scale experiments
- Full scale applications

Disinfection
The
Pros & Cons

The importance of cleaning and disinfection

- Prevent spread of infection
- Prevent recurrence of infection
- Keep control of contaminations level

…and is not that simple

- First you need to identify the problem
- What methods to apply
- What are the possible outcomes
- Benefits vs. drawbacks
- Sustainable solution?

Chemical disinfection -One of the most populær solutions

Chemical disinfection – wide application but not enough knowledge

- Difficulty with the correct use and concentrations
- Burden to the environment
- Expensive
- Excess water rinse requirements
- Risk of microbial adaptation

Microbial resistance

- Microbial resistance mechanism
  - Antibiotics resistance
  - Antimicrobials

Chemical disinfection induces antibiotic resistant

- mediated by changes in the cell membrane and their transport proteins (ex. the efflux pumps).

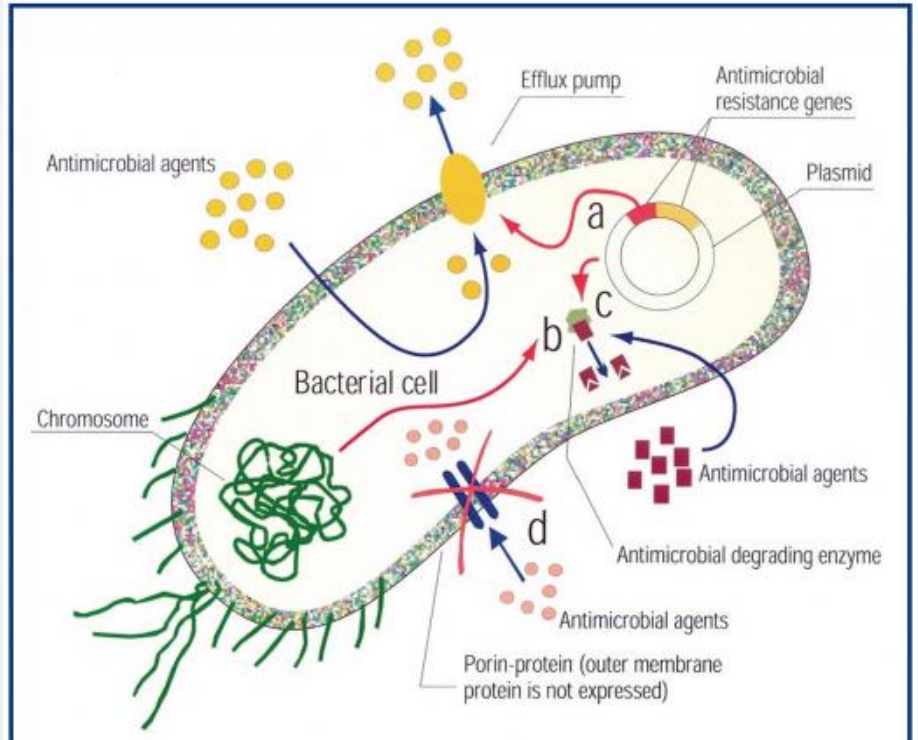
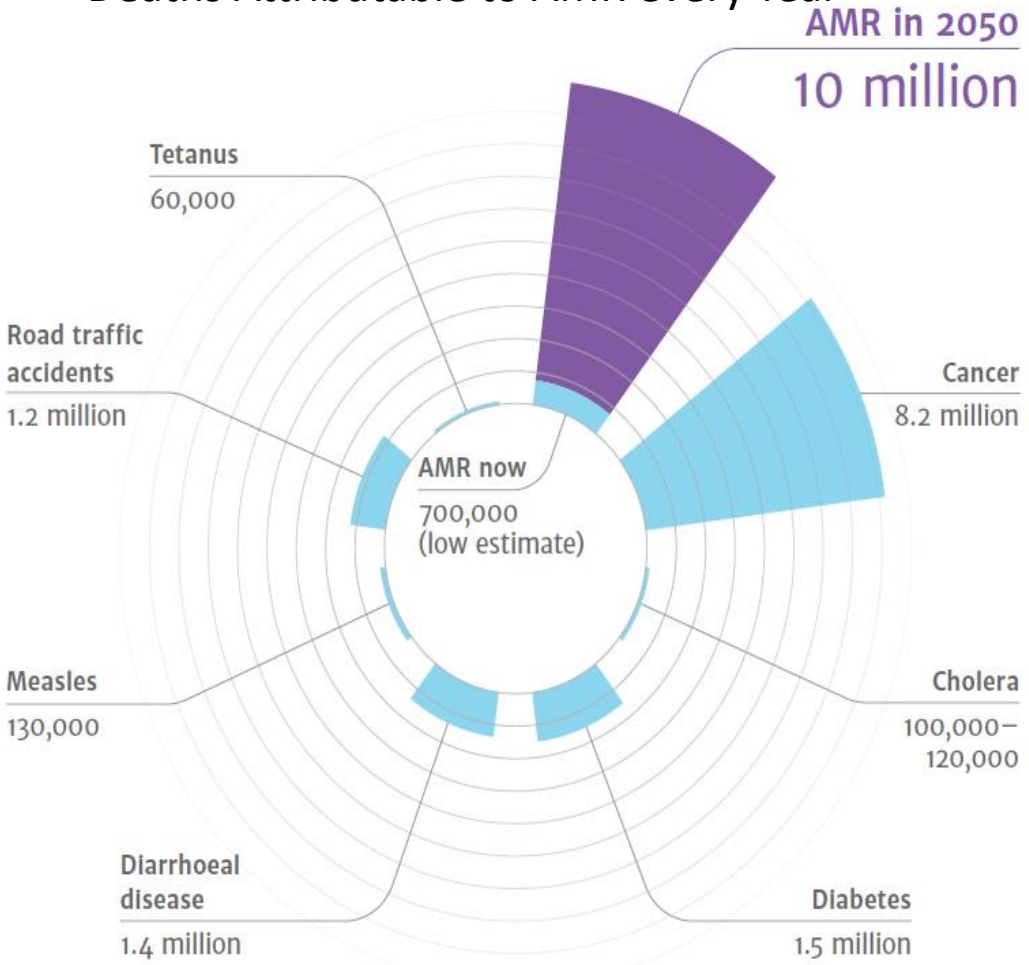


Figure 1: Illustration of resistance/tolerance mechanisms of the bacterial cell. Examples: (a) efflux of antimicrobials across the cell membrane, (b) enzymatic degradation of antimicrobials, (d) changes in the outer membrane illustrated by reduced influx of antimicrobials through membrane proteins. Resistance mechanisms may be encoded by genes present on the chromosome as well as on plasmids (c)

Evolving enemy

Deaths Attributable to AMR every Year



Source: Tackling Drug-Resistant Infections Globally
UK Goverment, May 2016

WHO published list of antibiotic-resistant "priority pathogens"

- **To achieve this goal, the global action plan sets out strategic objectives:**
- to improve awareness and understanding of antimicrobial resistance;
- to strengthen knowledge through surveillance and research;
- to reduce the incidence of infection;
- to optimize the use of antimicrobial agents

Priority 1: CRITICAL

- *Acinetobacter baumannii*, carbapenem-resistant
- *Pseudomonas aeruginosa*, carbapenem-resistant
- *Enterobacteriaceae*, carbapenem-resistant, ESBL-producing

Priority 2: HIGH

- *Enterococcus faecium*, vancomycin-resistant
- *Staphylococcus aureus*, methicillin-resistant, vancomycin-intermediate and resistant
- *Helicobacter pylori*, clarithromycin-resistant
- *Campylobacter* spp., fluoroquinolone-resistant
- *Salmonellae*, fluoroquinolone-resistant
- *Neisseria gonorrhoeae*, cephalosporin-resistant, fluoroquinolone-resistant

Priority 3: MEDIUM

- *Streptococcus pneumoniae*, penicillin-non-susceptible
- *Haemophilus influenzae*, ampicillin-resistant
- *Shigella* spp., fluoroquinolone-resistant

SonoSteam- chemical free decontamination

- What is SonoSteam?
- How does it work?
- What can it be used for?
- Where is it applied?

SonoSteam®

A green chemical free technology

Steam

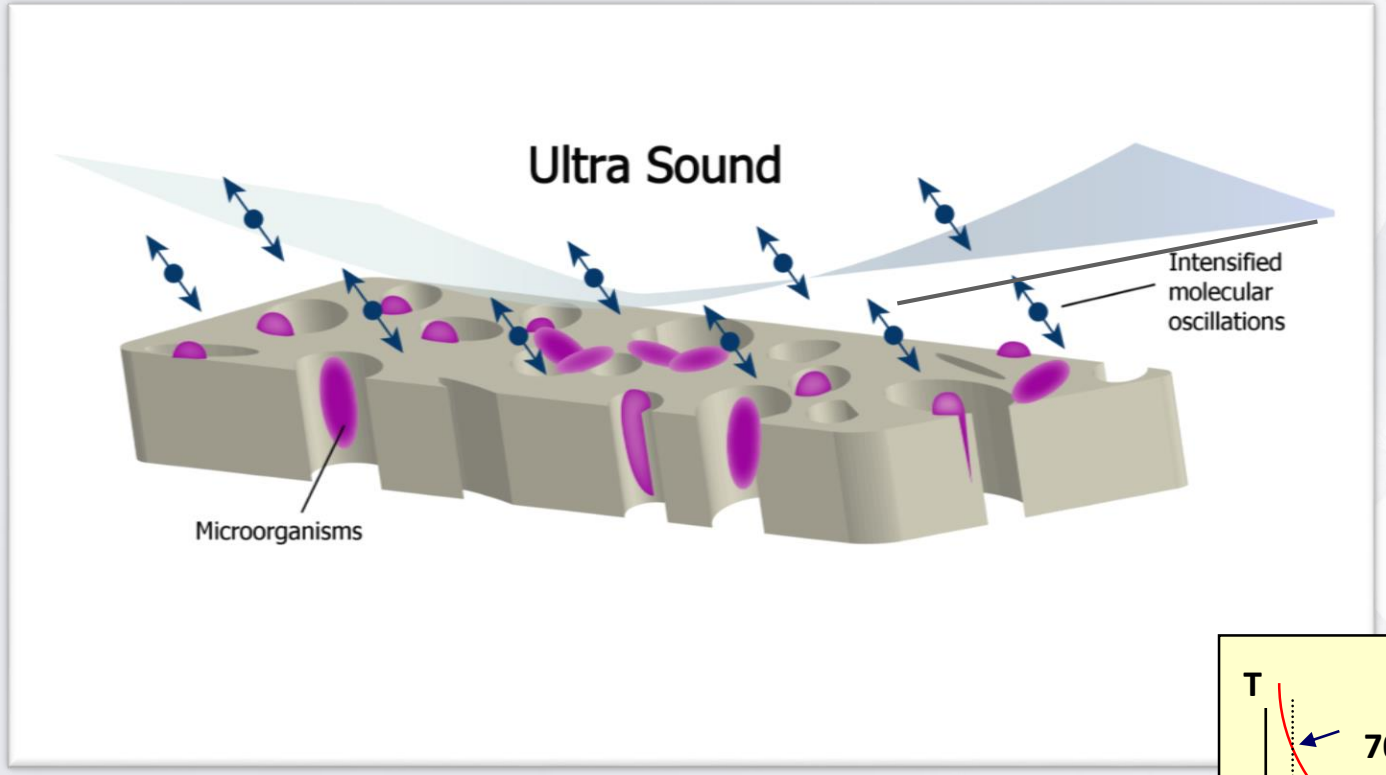
- Kills micro-organisms

Ultrasound

- Catalyze and optimize the process

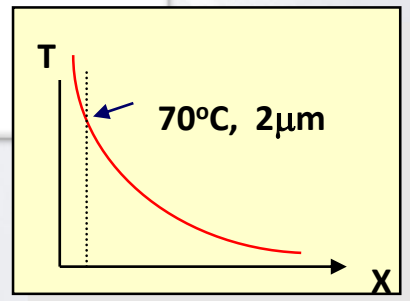
Principle of work for SonoSteam®

Situation with SonoSteam®



The Laminar Layer

- *Microscopic size of microbes are instantly heated and destructed.*
- *Heat barely penetrates the products (only few micrometers)*
- *Process is stopped before thermal changes can occur*



Video: Principle of work for SonoSteam®

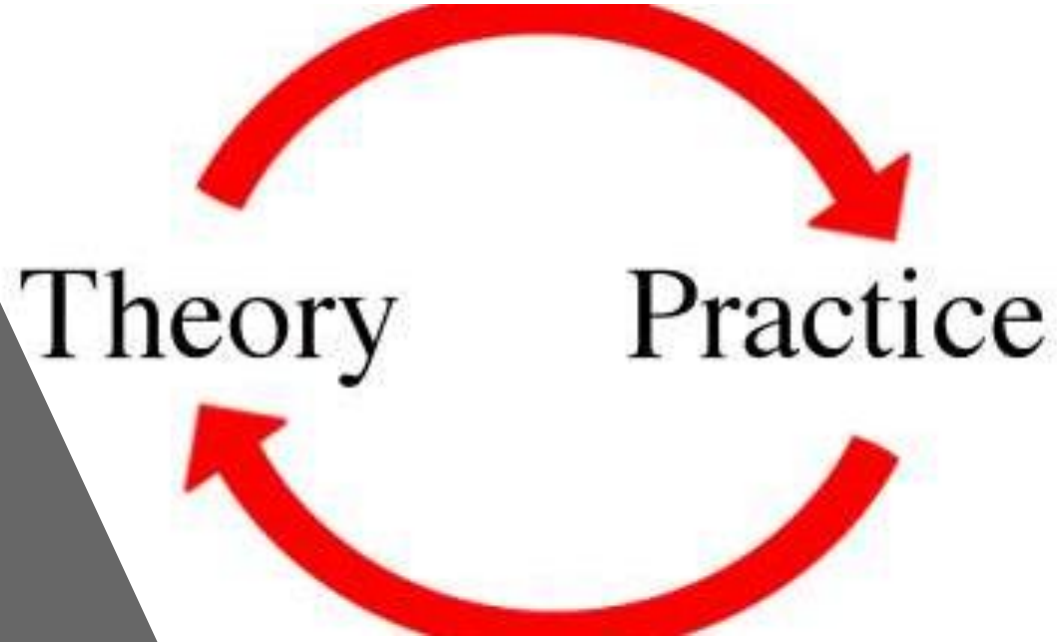
Destruction of a laminar boundary layer by ultrasound

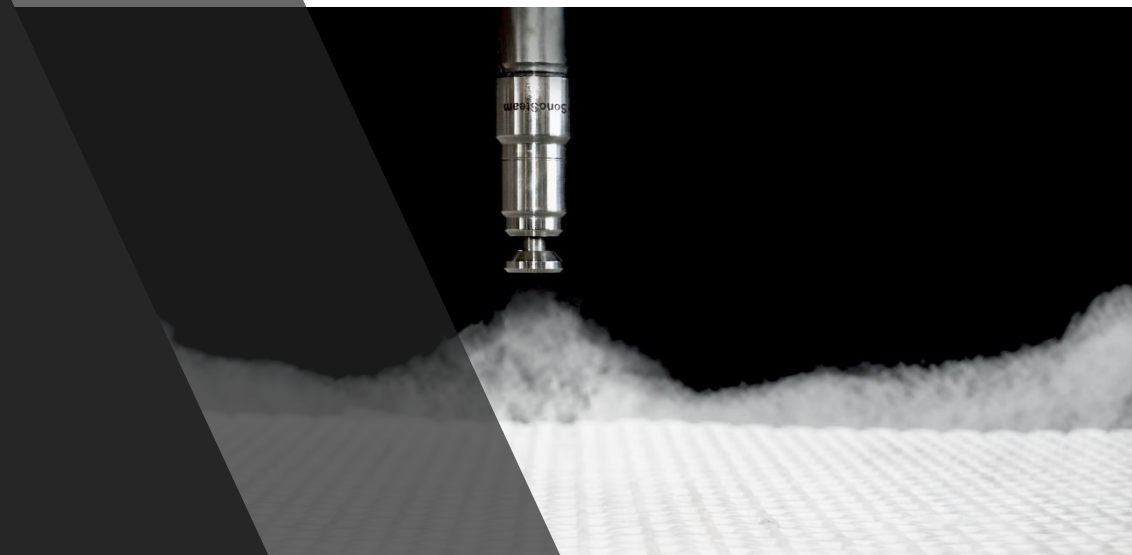
SonoSteam benefits:

- Catalyze and optimize the process
- No chemicals
- No post wash
- No adaptive resistance of microorganisms
- Effective against bacteria, viruses, fungi and yeast
- Few seconds of treatment
- More than 7 log reduction in just 1.0 seconds

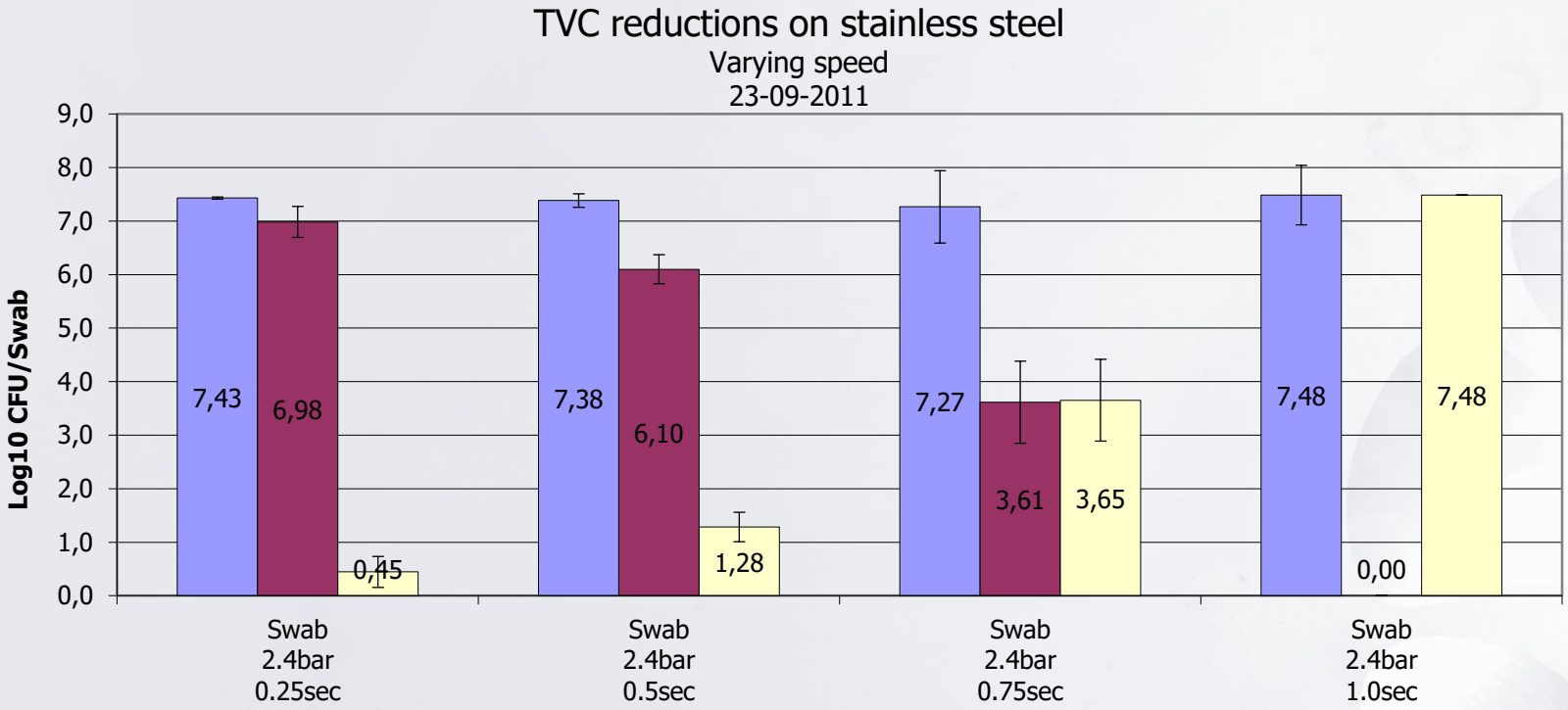
Decontamination by the use of steam and ultrasound

Theoretical and practical knowledge





Example: Stainless steel

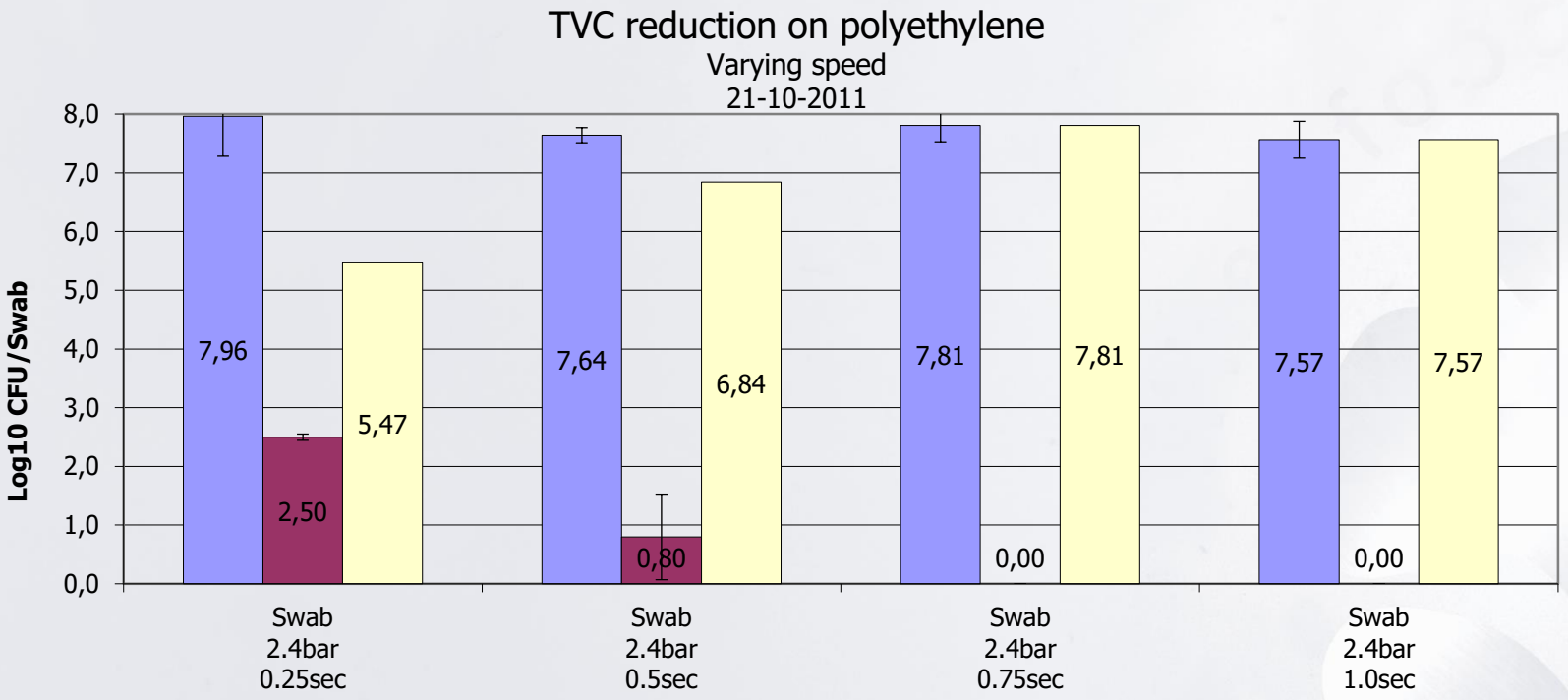


Methods & Results:

- Artificially contaminated stainless steel plates with TVC levels of approx. log 7.0.
- Reduction was correlated to treatment speed. Temp. was constant at 90C
- 100% TVC reduction was achieved at 1.0 sec. of treatment.

Control
Treated
Difference

Polyethylene



Control
Treated
Difference

Methods & Results:

- Artificially contaminated polyethylene plastic plates with TVC levels of approx. log 8.0.

- 100% TVC reduction was achieved at 0.75 sec. of treatment.

Case studies

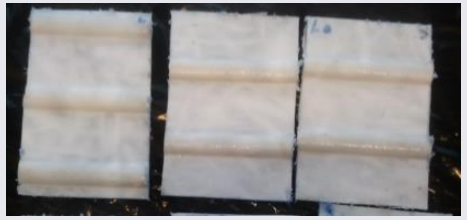
Food trays

TVC reductions on naturally contaminated food boxes

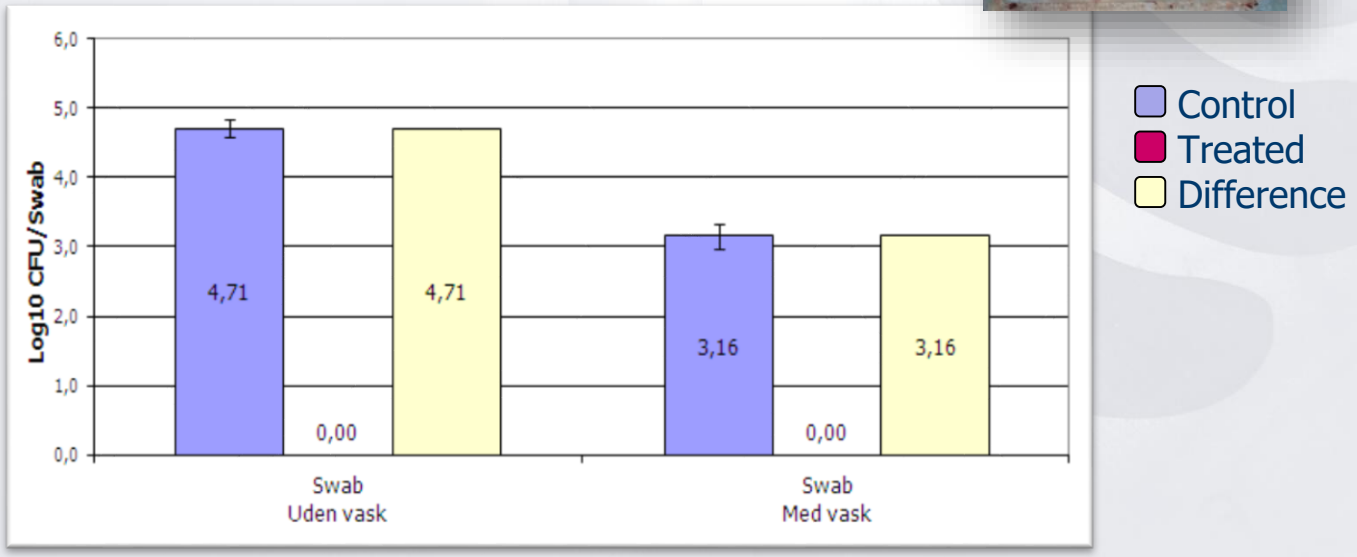
Methods & Results:

- Disinfection of food boxes – samples from an industrial food box.
- Investigated with and without prior rinse under cold water.

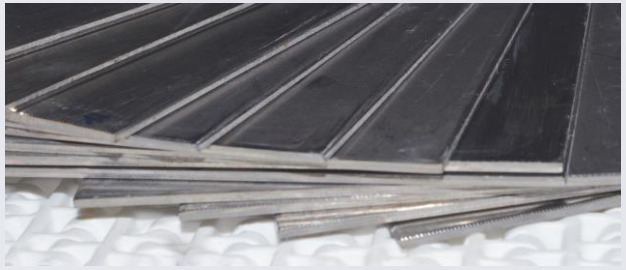
- 100% reduction was achieved at 1.0 Sec
  - from initial levels of 4.7 log.
- Independent on rinsing.



Easily cleaned with brush and water after the treatment

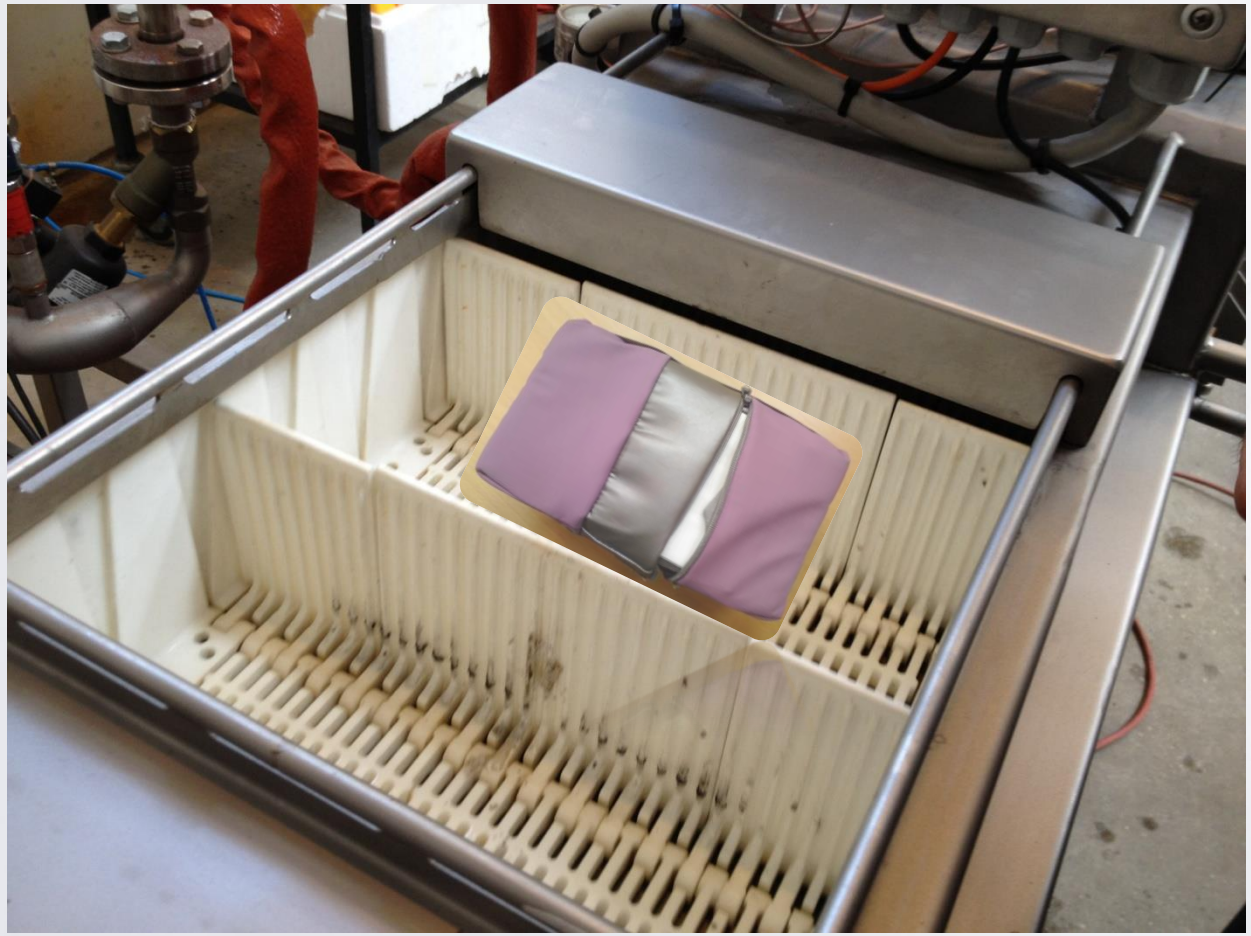



STERILCENTRALEN



Disinfection of mattress covers

Example of a pilot scale study

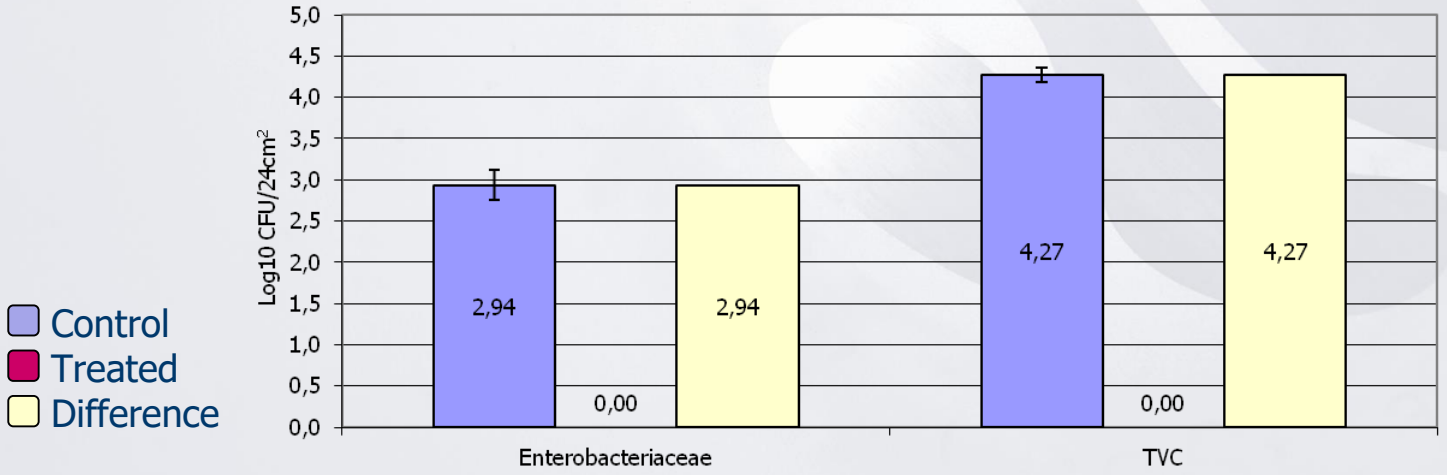


Disinfection of mattress covers

Methods & Results:

- Artificially contaminated mattress cover with Enterobacteriaceae and TVC levels of 2.9log and 4.3log.

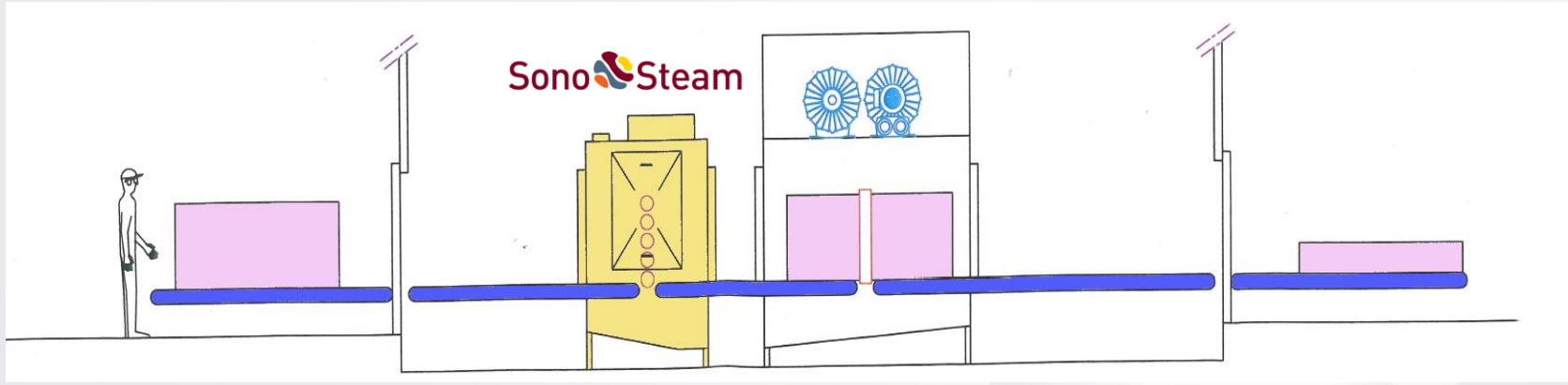
- 100% reduction at 2.0 sec. of treatment.
- No penetration of condense water through the mattress cover



Full scale applications

Hospital Mattress disinfection

Disinfection of mattress cover



Disinfection at Hospitals

Installations:

- Hvidovre Hospital (2014)
- Viborg Hospital (2017)

From pilot scale to full scale application

Mattress disinfection

Fully automated:

- Integrated PLC system
- Integrated conveyor system

Sustainable:

- No Chemicals
- Low energy consumption: 1.5kg steam/mattress
- Low running cost: 0.007 euro/mattress

Fast and Effective:

- 20 seconds/mattress ~90 mattresses/hour
- More than 5 log reduction (full scale)
- Reduced to below <2.5 CFU (critical limit)

Video

SonoSteam Mattress disinfection

Sampling Methods

- Whole area swabs 400cm2 (whole surface evaluation)
- Contact plates (low detection limit)
- ATP tests (cleaning effect)

Microbial analysis

- E. coli
- MRSA
- VRE
- ESBL
- Streptococcus
- Clostridium difficile
- Enterococcus
- Staphylococcus

Third Phase Results – Hospital mattress disinfection

MATTRESS # MICROBIAL WHOLE SURFACE SWAB	SAMPLED AREA [CM2]	TVC LEVELS BEFORE TREATMENT [CFU/SWAB]	TVC LEVELS AFTER TREATMENT [CFU/SWAB] 400CM2	TVC LEVELS AFTER TREATMENT [CFU/CM2] <2.5 CFU CRITICAL DETECTION LIMIT REQUIREMENT*	% OF TOTAL REDUCTION
STAPHYLOCOCCUS	400	70795	3.47	<2.5	99
ENTEROCOCCUS	400	708	0	<2.5	100
E. COLI	400	49	0	<2.5	100
STREPTOCOCCUS	400	89	<1.48	<2.5	98
MRSA	400	76	0	<2.5	100
CLOSTRIDIUM DIFFICILE	400	51	1	<2.5	97
TVC	400	223872	9	<2.5	99

Examples of SonoSteam equipment´s

Hospital mattress and bed disinfection

www.SonoSteam.com

Thank you

Food product, eggs, cheese, meat

Whole chicken carcasses

Box and tray disinfection