

## Les apprêts probiotiques

*Ou comment la biologie peut résoudre des problèmes d'allergènes sans traitement chimique ?*

*Ir. Patrice Vandendaele*



# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- Dust Mites
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- Conclusions



# The Devan Group

## PROTECTING and MODIFYING TEXTILE SURFACES

New and innovative properties and functionalities focusing on

## Sustainable Entrepreneurship



# The company

Established in 1977

## Figures 2010

Volume : 3.500 T

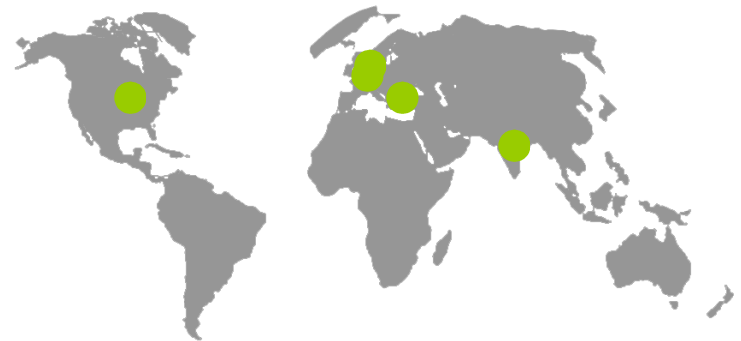
Turnover: 12.000.000€ (Consolidated)

Export: 75% (worldwide)

Staff : 43 people

## Offices

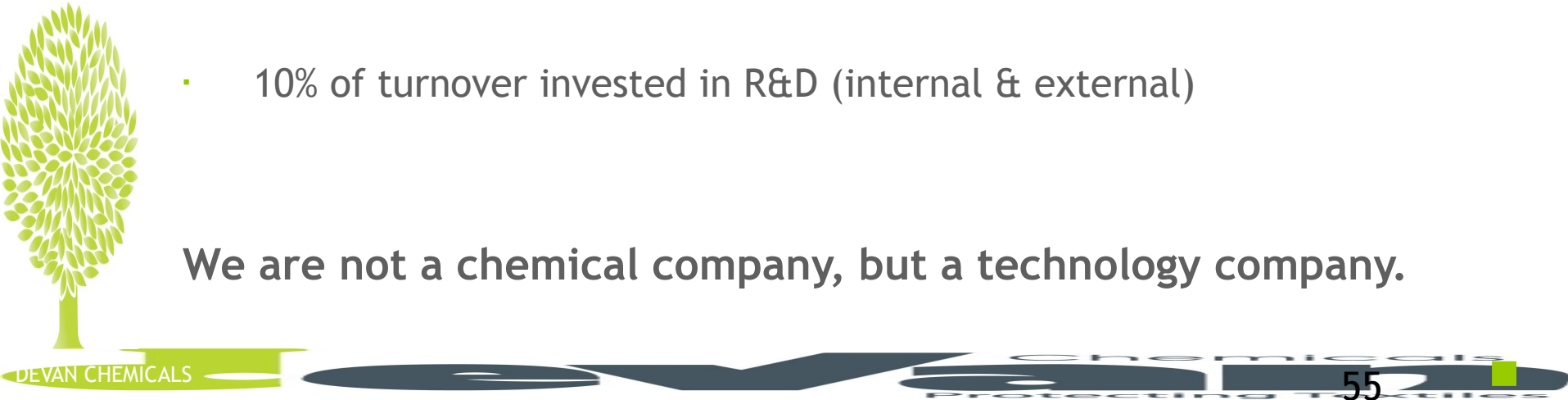
- Head Office Ronse - Belgium
- Derby - UK
- Porto - Portugal
- Charlotte (NC) - USA
- New Delhi - India
- Izmir, Istanbul - Turkey



# The team

- Highly qualified, technically driven company
- 10% PhD
- 60% Graduates in appropriate disciplines
  - Chemistry
  - Textile technology
  - Marketing
  - Finance and administration
- 20 % of staff work in R&D
- 10% of turnover invested in R&D (internal & external)

We are not a chemical company, but a technology company.



# Sustainability Strategy: 1990

Since 1990, Ecology has been the DNA of Devan

- 1995: Halogen-free flame retardants (**Eco-flam™**)
- 1999: Non migrating antimicrobial (**ægis™**)
- 2001: Masterbatch for inherent performance properties (**@2spin™**)
- 2002: Non-chlorine wool shrink-resist (**Dylan™**)
- 2005: Environmentally more acceptable insect resist (**insecta™**)
- 2008: Reactive capsules (no need of binders) (**Thermic™**)



# Devan trademarks

CONCERN FOR ECOLOGY DRIVES NEW BUSINESS DEVELOPMENT AND IS REFLECTED IN OUR PRODUCT RANGE



# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- Dust Mites: : Double Action
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- Conclusions



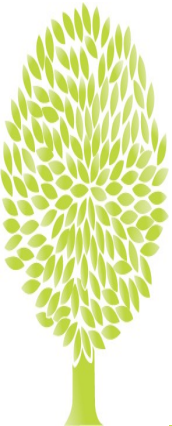


# Probiotics



Use as directed

New look outside, same great product inside!



# The origin: bifidobacteria



- Beginning 20th century, Henry Tissier, Pasteur Institute,
- Bifidobacteria are predominant in the intestinal flora of breast-fed babies
- The mechanism claimed that bifidobacteria would displace the proteolytic bacteria that cause disease



# Introduction Probiotics

- “Probiotics” introduced in 1953 by Kollath
- Greek, means “for live”
- FAO/WHO “Live microorganisms which when administered in adequate amounts confer a health benefit on the host”
- First use:
  - Improving intestinal microbial balance
  - Inhibiting pathogens and toxin producing bacteria



# Probiotics: Today

- Most common in food additives
  - Lactic-acid bacteria (found in decomposing lactic products, produce lactic acid)
  - Bifidobacteria (found in intestines, aid digestion)

Producer	Brandname	Strain
Yakult	Bifene	<i>Lactobacillus casei</i>
Procter & Gamble	Align	<i>Bifidobacterium infantis</i>
Danone	Actimel	<i>Lactobacillus casei</i>



# Probiotics: Applications

- Medical use:
  - Alleviation of chronic intestinal inflammatory diseases
  - Prevention and treatment of pathogen-induced diarrhoea
  - Urogenital infections
  - Atopic diseases
- Other species have been introduced with beneficial properties.
  - Agriculture
  - Household products
  - Hand Soap
  - Deodorants
  - Toothbrush cleaners



# Conclusion Probiotics

- Beginning of 20th century: principle first discovered
  - 1958: creation “Probiotic”
  - WHO: Specific good bacteria providing a health benefit
  - Used first in food (Yakult)
  - Many new developments during last 10 years
- 
- Goal:
    - Improving microbial balance
    - Lowering risks of pathogens and toxin producing bacteria



# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- Dust Mites: : Double Action
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- Conclusions



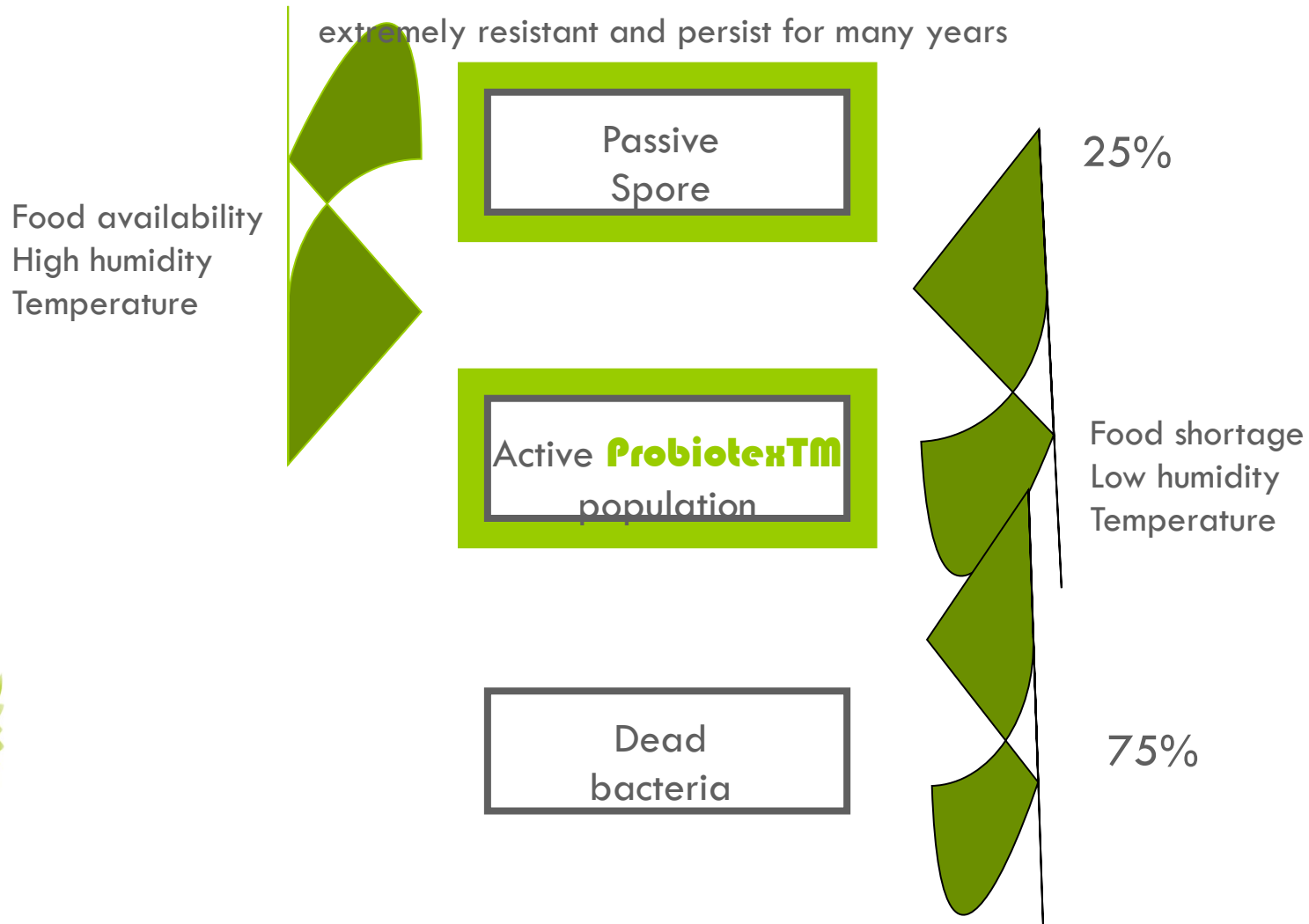
# Sporulation process

- Intestines are a protected environment, textiles are not
- Strict survival conditions are demanded
- Probiotic bacteria (*Bacillus*) used in Probiotex™ have the unique ability to sporulate.
- Spore: a reproductive structure that is adapted for surviving in unfavourable conditions for many years
- Process makes it possible for bacteria to survive hard conditions and regain activity as soon as environmental parameters improve





# Sporulation process



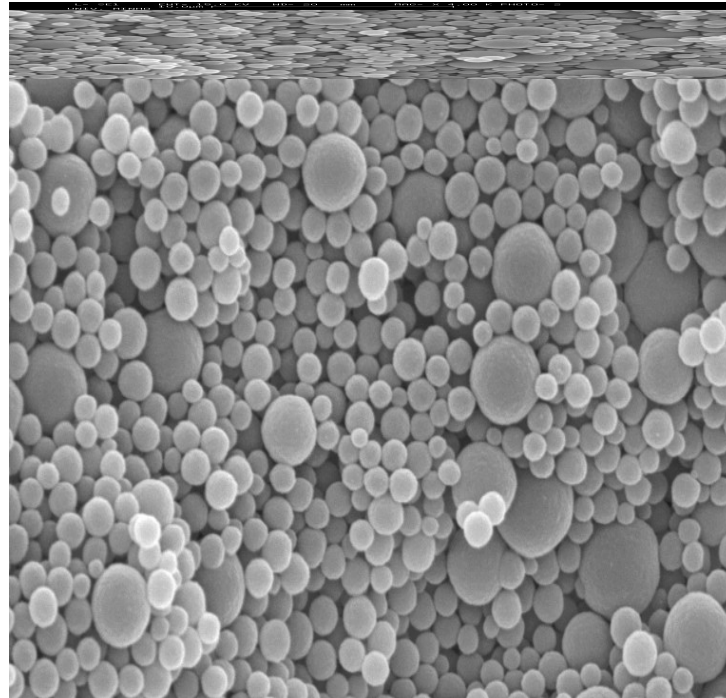
# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- Dust Mites
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- Conclusions



# Microencapsulation

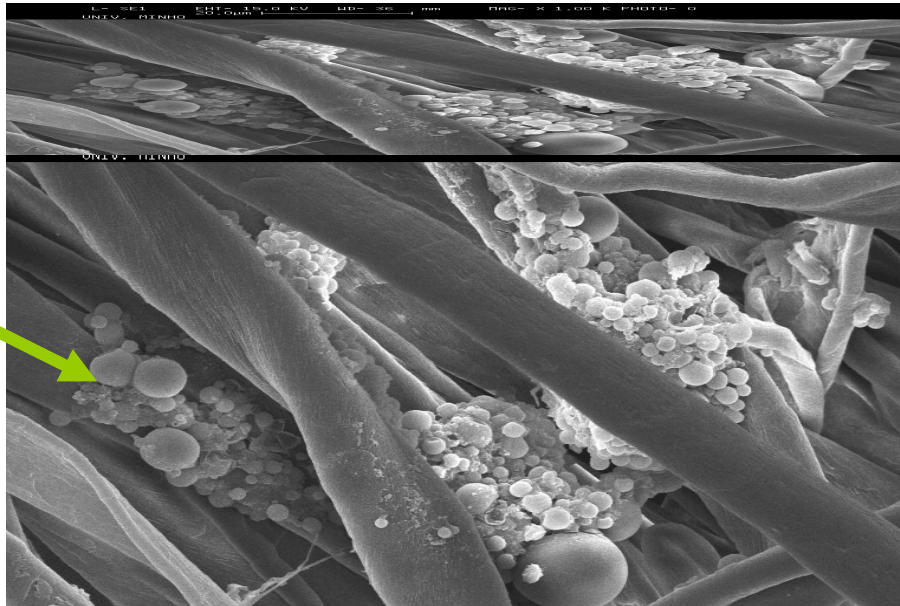
- In order to work over long term, spores should be slowly liberated
- The spores are micro-encapsulated



# Microencapsulation

- The microcapsules are bound to the textile in order to be washable
- More than 100.000.000 microencapsulated spores are applied to 1m<sup>2</sup> of textile

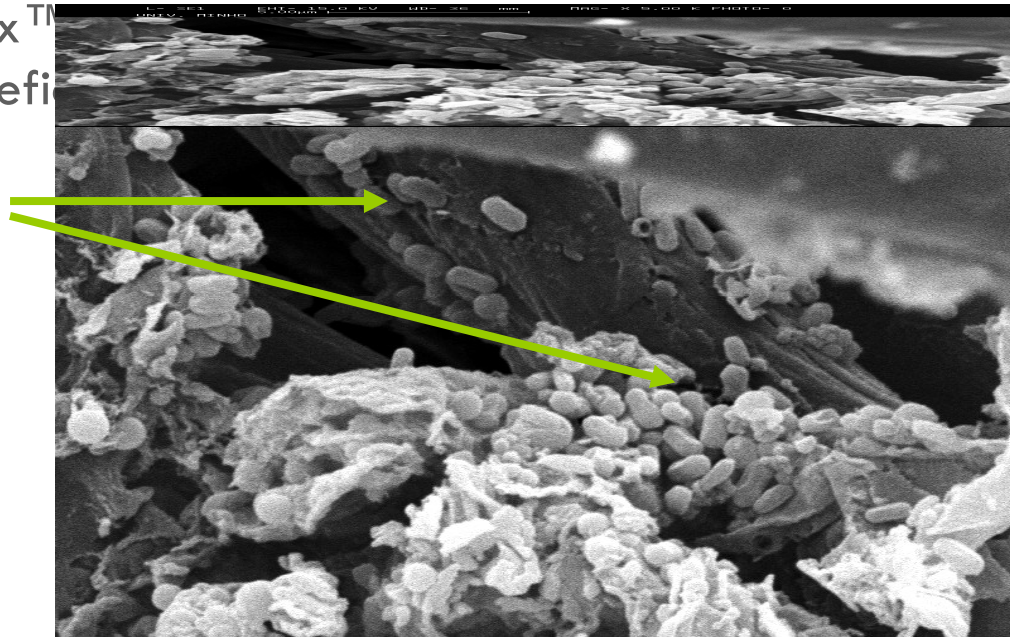
Probiotic  
μcapsule



# Microencapsulation

- The microcapsules break by friction and spores are released
- Spores in contact with food sources transform to probiotic bacteria
- Probiotex™ with beneficial bacteria

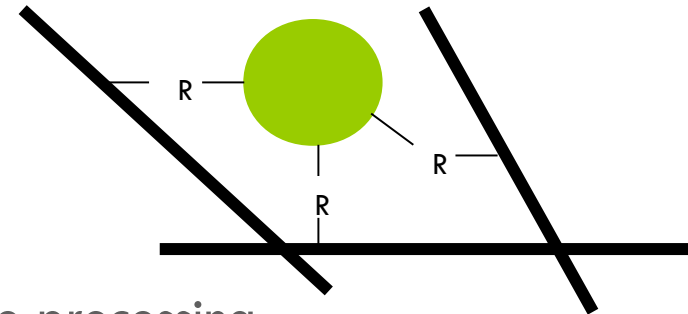
Probiotic  
bacteria



# Reactive microcapsules

- Microcapsules with functional reactive groups on the shell surface
- Patent number: PCT/IB2006/050605
- Without the use of binders the capsules can react with:

- Cellulosic (Cotton, Viscose,...)
- Synthetic (PES, PA,...)
- Protein (Wool)



- Application can be through conventional textile processing
- The **Probiotex™** population resist 20 minutes at 120 °C when encapsulated and 60°C when not encapsulated





# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- Dust Mites: : Double Action
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- Conclusions



# Antibiotics

- Anti (= against) + biotic (living matter)
- Bacteria killing agents to treat infections
- Disadvantages
  - Selective action, not universally applicable!
  - No action against viruses (= non living!)
  - Resistance is becoming an increasing problem (hospital infections cfr MRSA, VRE)
- Future
  - Lack of efficient antibiotics
  - Untreatable infections
- Antibiotic era is ending!





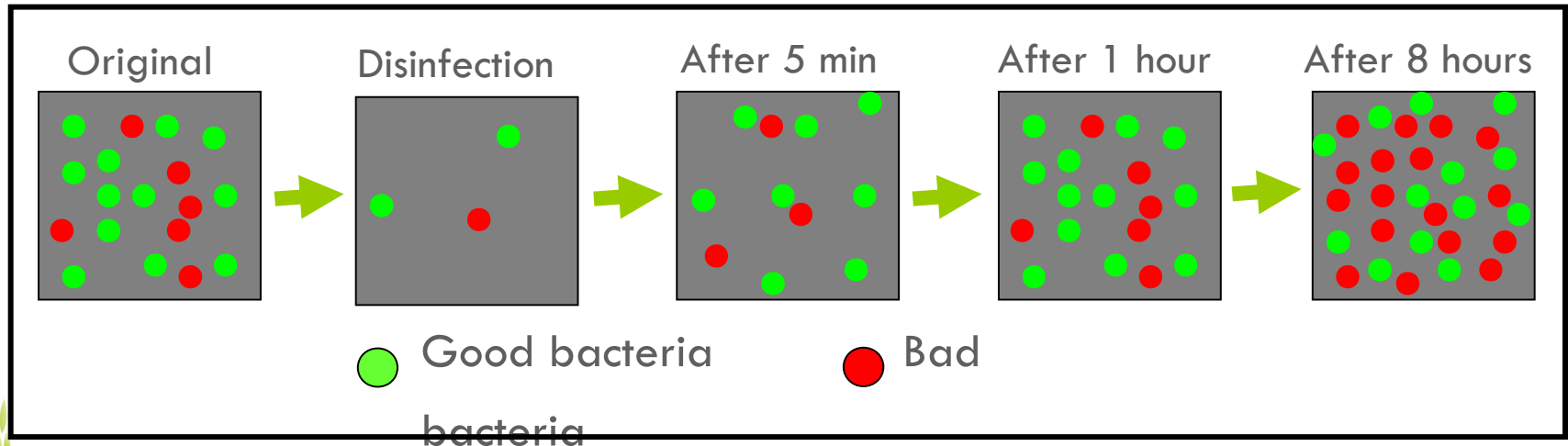
# Disinfection

- Chemical agents with the aim to totally kill microorganisms
- Advantages
  - Not selective
  - Fast decrease in microorganisms
- Disadvantages
  - Kill good as well as pathogenic (bad) bacteria
  - Short-term action, superficial (no penetration in the surface)
  - Negative influence for the environment (persistent)
  - Negative influence on material properties (corrosive)
  - Resistance



# Disinfection

- Disinfection leaves organic matter (food) behind
- Fast re-colonisation of the surface.
- 1 pathogenic cell can multiply to 1 million in only 8 hours.
- Disinfection has a very short and unstable effect

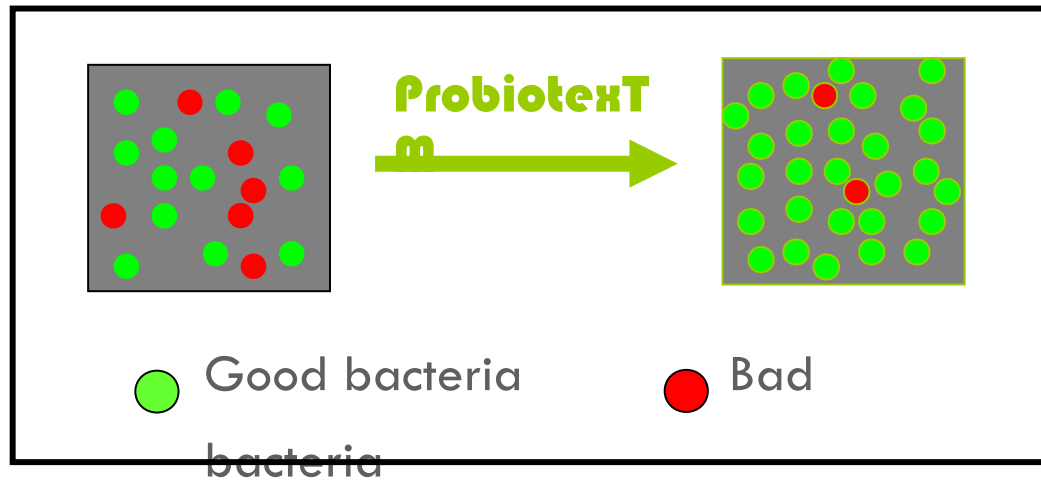


- Due to resistance, increasing concentrations and frequencies of disinfection have to be applied
- Disinfection era is ending!



# Microbial Management

- Completely sterile environments are not always necessary
- Colonisation with probiotic bacteria forms a self-regulating population
- Creation of a healthy and stable micro flora

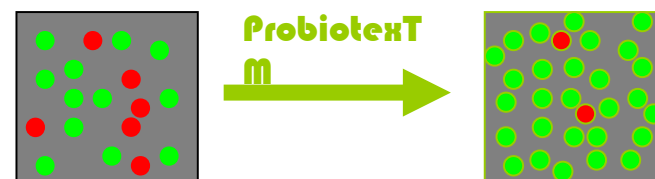


- Simply said: bad bacteria are being replaced by good ones
- **Probiotex™** population does not produce excrements, only CO<sub>2</sub> dead bacteria : 98% water, 2% protein + saccharide



# Mechanism microbial management

- Competitive exclusion
  - Probiotic bacteria will consume remaining food sources, leaving nothing behind for potential pathogenic (disease causing) invaders.
  - Probiotic bacteria are much more active in this competition and outdo other bacteria
    - Probiotic bacteria rapidly colonise the field



- Quorum Sensing
  - Extremely fast way of communication between bacteria
  - Using of numerous signal molecules
  - Pathogenic bacteria will inform each other about these unfavorable conditions
  - This leads to subsequent removal



# Field test with mattress covers

- 2 samples of mattress covers were compared
  - PES
  - **Probiotex™** treated PES
- 3 weeks trial by 4 test persons
  - Persons slept every night on mattress
    - Total bacterial count: measure for general burden
    - Enterobacteriaceae: indication of bad hygiene
    - *Staphylococcus aureus*: indication of presence of pathogens
- Samples taken with 3M Petri films
- Contact with mattress covers for 1 minute



# Field Test

	Untreated	Probiotex™	Reduction
Total count	337	226	
Enterobacteriaceae	39	2	95%
<i>Staphylococcus aureus</i>	30	9	70%
Yeast	302	36	92%
Fungus	36	3	88%

- 94,9% reduction of Enterobacteriaceae
  - indicates a highly improved hygiene
- 70% reduction of *Staphylococcus aureus*
  - indicating an efficient control of pathogen development
- 92% reduction of fungi
  - indicates an improved moisture reduction.



# Non biocidal activity

- Filtrate of a 48 h bacterial suspension of **Probiotex™** in contact with healthy bacteria

Bacteria	Live (%)	Dead (%)
<i>Streptococcus faecalis</i>	99,80	0,59
<i>Streptococcus faecalis</i> + <b>Probiotex™</b>	99,68	0,65
<i>Staphylococcus aureus</i>	99,87	0,12
<i>Staphylococcus aureus</i> + <b>Probiotex™</b>	99,68	0,31

- No biocidal activity found
- No bacterial resistance can be induced



# Conclusion microbial management

- Antibiotics and disinfection lead to resistance
- Disinfection leaves organic material for microbes to grow fast
- Completely sterile environments are no longer necessary
- Grow surface with probiotic bacteria
  - Exclusion of competitive bacteria
  - Quorum sensing
- Proven by real life test that **Probiotex™** results in lower risk of pathogen development and has a positive effect on hygiene
- No biocidal action





# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- **Dust Mites: Double Action**
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- Conclusions



# Dust mites' allergens

- Allergy: an over-reaction of our immune system to allergens
- Allergen: the cause of the allergic reactions
- Dust mites produce 200 times own body weight in excrements

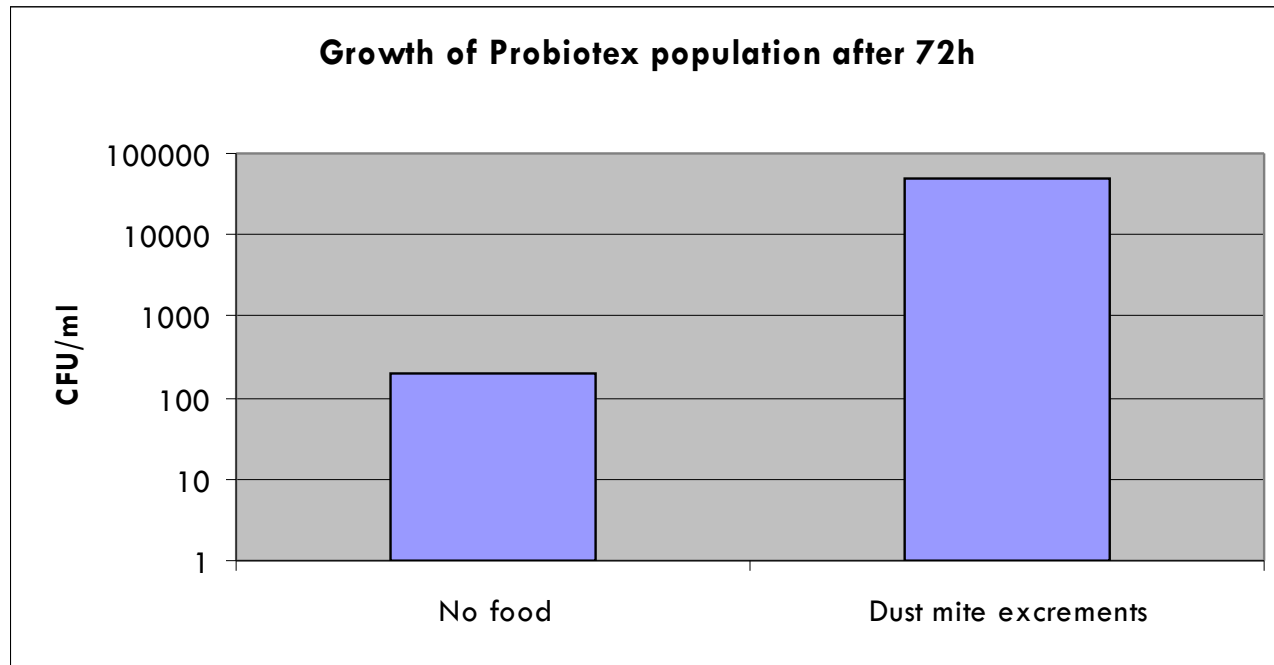
Components responsible for allergic reactions:

- Enzymes on food particles
- Dust mites' excrement
- Dust mite allergy symptoms:
  - asthmatic reactions
  - watery, irritated eyes
  - sneezing, coughing
  - running nose
  - eczema, skin irritation



# Action 1: allergen consumption

Growth of **Probiotex™** population using dust mite excrement as only source of nutrition



Faculty of Bio Engineering Sciences, LabMET, University of Ghent (RUG)



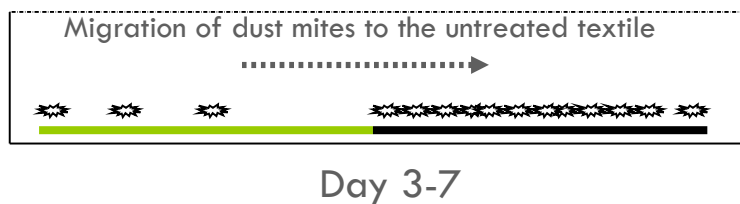
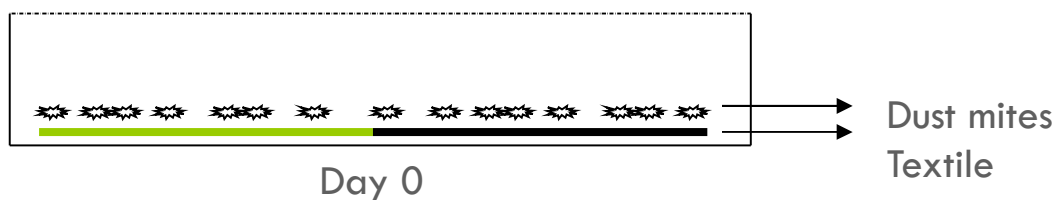
# Action 2: consumption humidity

- The **Probiotex™** bacteria reduce humidity during transition from spore to cell
- The decrease in humidity is unfavorable to dust mite and the fungus *Aspergillus*
  - The dust mites will migrate to zones with more humidity or
  - The dust mites will force themselves in a dormant phase and no allergens will be produced
- Research University of Ghent
  - Measuring the nr. of dust mites on a textile treated with **Probiotex™**

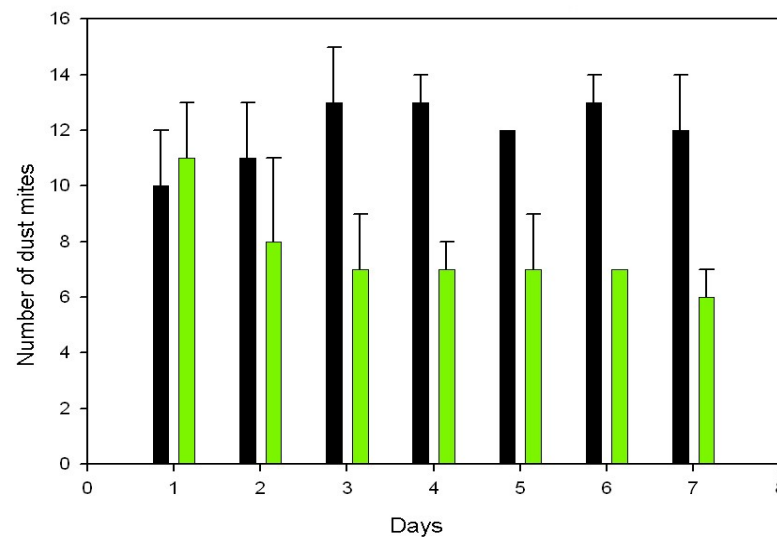


# Dehydration effect on dust mite

Dust mites on a textile where half of textile treated with **Probiotex™**



— Control  
— **Probiotex™**



■ No treatment  
■ Allergy Free treatment



Faculty of Bio Engineering Sciences, LabMET, University of Ghent (RUG)

# Indirect elimination of dust mites

- Research Technique Environments Consultants (TEC, France)
  - Assessment of the efficacy of a fabric intended to control dust mites
  - Following standard AFNOR G 39-011
  - Dermatophagoides pteronyssinus
  - 25°C; 76% relative humidity
  - 50 adults of mixed sex
  - 6 week test

	Mean	Reduction
Untreated	949	-
<b>Probiotex™</b> treated PES	0	100%
<b>Probiotex™</b> treated Viscose	0	100%



# Conclusion dust mite management

- Action 1: **Probiotex™** bacteria consume the dust mite allergens (excrement and partly digested food)
- Action 2: the **Probiotex™** population reduces humidity which is unfavorable to dust mite
  - The dust mites will migrate to zones that have more humidity
  - The dust mites will force themselves in a dormant phase
- This dual action result in a lower allergen concentration on the textile



# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- Dust Mites: Double Action
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- Conclusions





# Safety profile

- Safe to use with humans and animals.
- Classified Biosafety level 1 (ATCC)
- Natural origin (not genetically modified)
- Food grade organisms (probiotic)
- Toxicologically screened towards the following:
  - Acute oral toxicity (OECD guideline 423)
  - Skin sensitisation (OECD guideline 406)
  - Acute dermal irritation/corrosion (OECD guideline 404)
  - Acute eye irritation/corrosion (OECD guideline 405)



# Probiotex™ Technology

- Devan Chemicals
- Probiotics
- Microorganisms – Probiotic bacteria
- Microencapsulation
- Microbial Management
- Dust Mites: Double Action
  - Allergen reduction
  - Dust mite reduction
- Safety Profile
- **Conclusions**



# Probiotex™ the natural allergen control

## Feature and benefits

- Microbial management: specific good bacteria providing a health benefit
- Reduces dust mite allergens by using it as a food source
- De-hydrates the microclimate in the bed :
  - Mites lack essential water
  - Avoids the growth of fungi
- Supported by lab tests and real-life tests showing increase in hygiene
- No biocidal activity, no resistance
- A unique, patented technology





powered by  
*Devan*