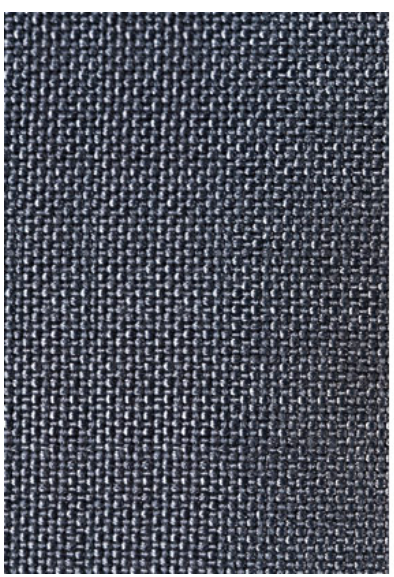
A brief overview of odor in textile apparel

1. What causes our clothes to smell ?
2. Odor control methods.
3. Chemistries available
4. Test methods




What causes our clothes to smell ?

- Exertion causes perspiration
- Micro climate created depending on fabric composition/structure
- Perspiration has little , if any, smell
- Perspiration varies according to areas of the body

Why:

- Lubrication – armpit
- Cooling
- Stimulation of nervous system

How and Where:

- 2.6 million sweat glands
  - 20% of all sweat glands are on your feet
  -
- Two types of sweat glands
  - Eccrine – mostly water and salt
  - *Aprocrine* – water, salts *and* proteins and fatty acids
- Max normal production one litre per hour
  - Desert climate 2-3 litres

The Body's Sweat Zones

- **Bacteria** (on skin, hair and garment) metabolize the proteins (Isovaleric acid) in perspiration from the *Apocrines*
- Proteins broken down into smaller fatty acids
- Smaller fatty acids are volatile (they evaporate, we can now smell them!)

- Men have more *Apocrines* than women, and Europeans and Africans more than Asians

- **So, smell is caused by the action of bacteria on the components of perspiration**

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How can we control this mal-odor?

By one of two methods:-

Absorption- simple capture of the offending molecules. No change is made to the process of decomposition.

or

Prevention- Bacteria are prevented from multiplying, the offending molecules are not generated.

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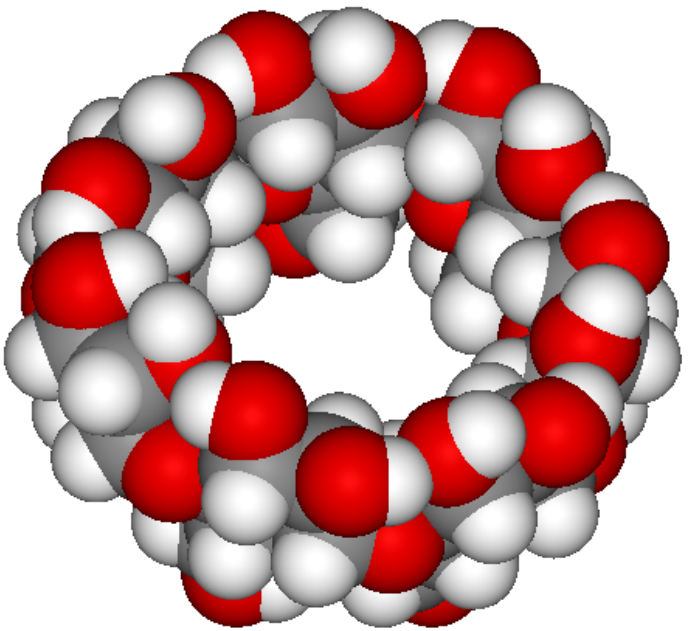
Absorption techniques



CYCLODEXTRIN

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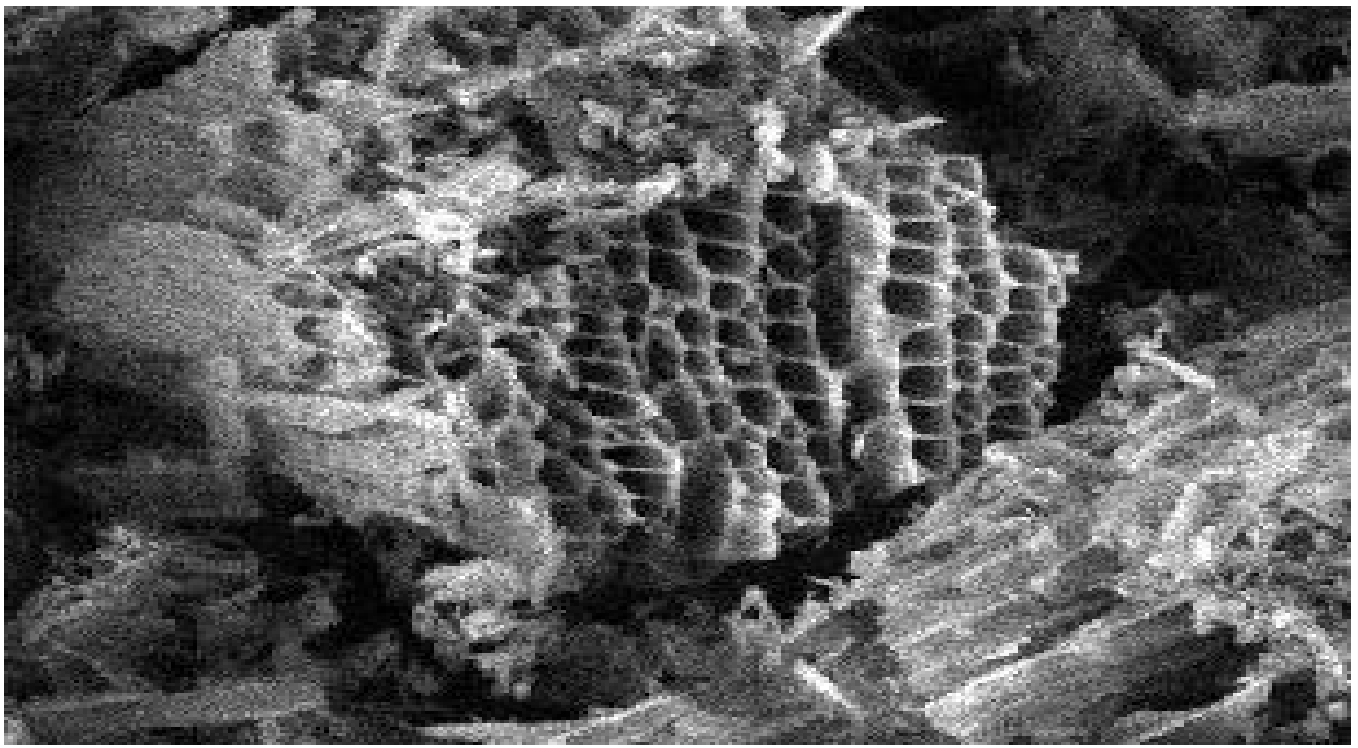
Absorption techniques



Physical

`Activated Carbon`

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Preventative method

Various chemistries are available, including, in no particular order:-

CHITOSAN
SILICONE QUATS
COPPER
SILVER metal, nano, salts
ZINC
TITANIUM DIOXIDE (nano)
TRICLOSAN
BIGUANIDINE
n-HALAMINES(CHLORINE)

ETC,ETC

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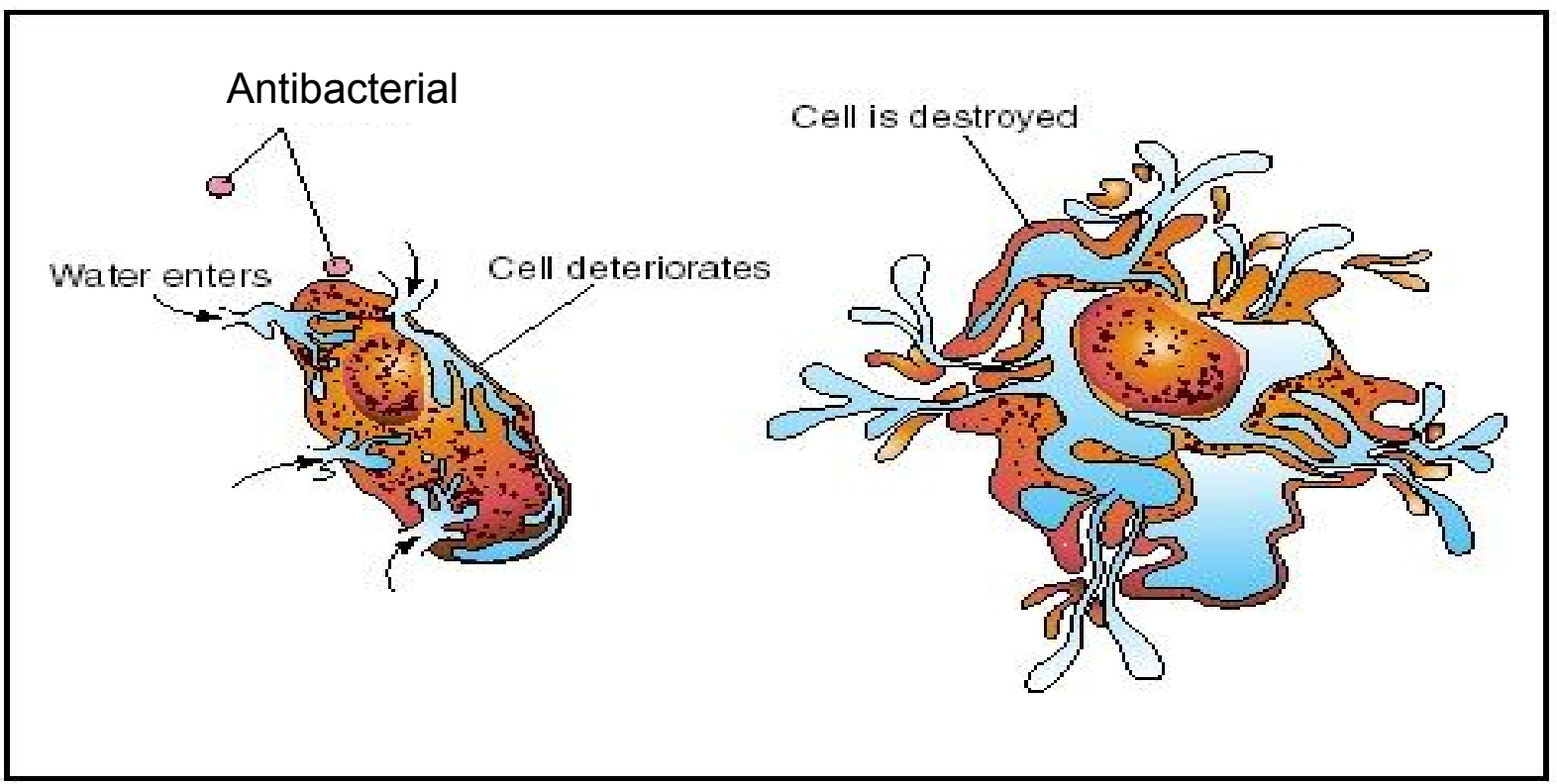
Preventative methods

Basically two distinct methods:-

KILL existing population, by cationic charge, or enzyme. Cell wall destroyed

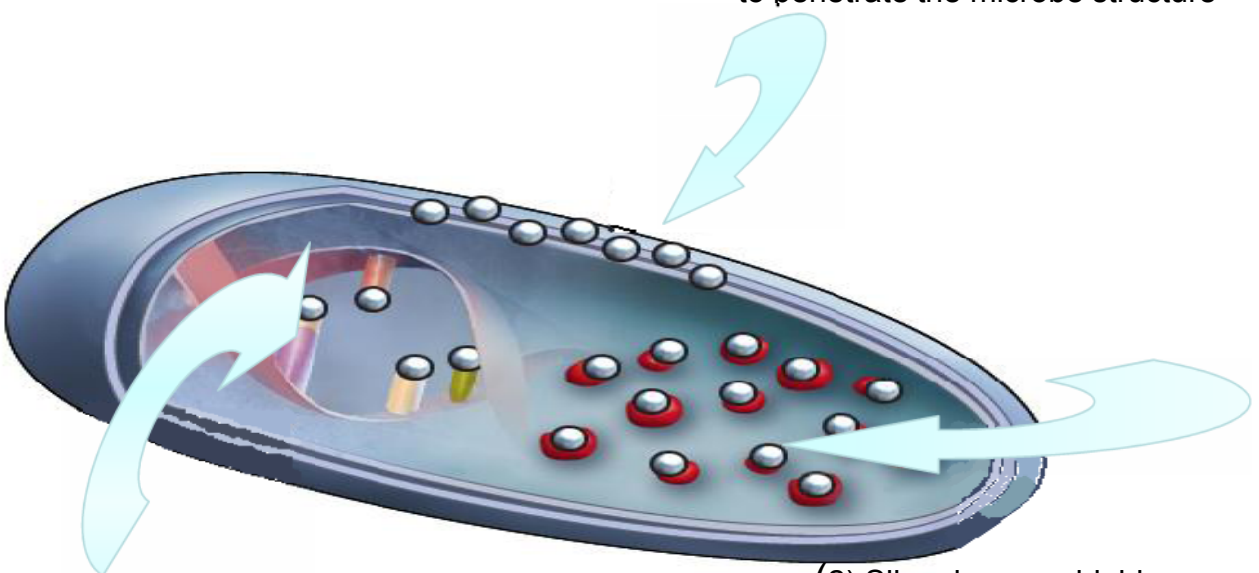


Preventative methods

Basically two distinct methods:-

Prevent replication- biostatic eg silver ions

(1) Silver ions may bind non-specifically to cell surfaces, causing some disruption to the cellular membrane function and allowing the silver ions to penetrate the microbe structure

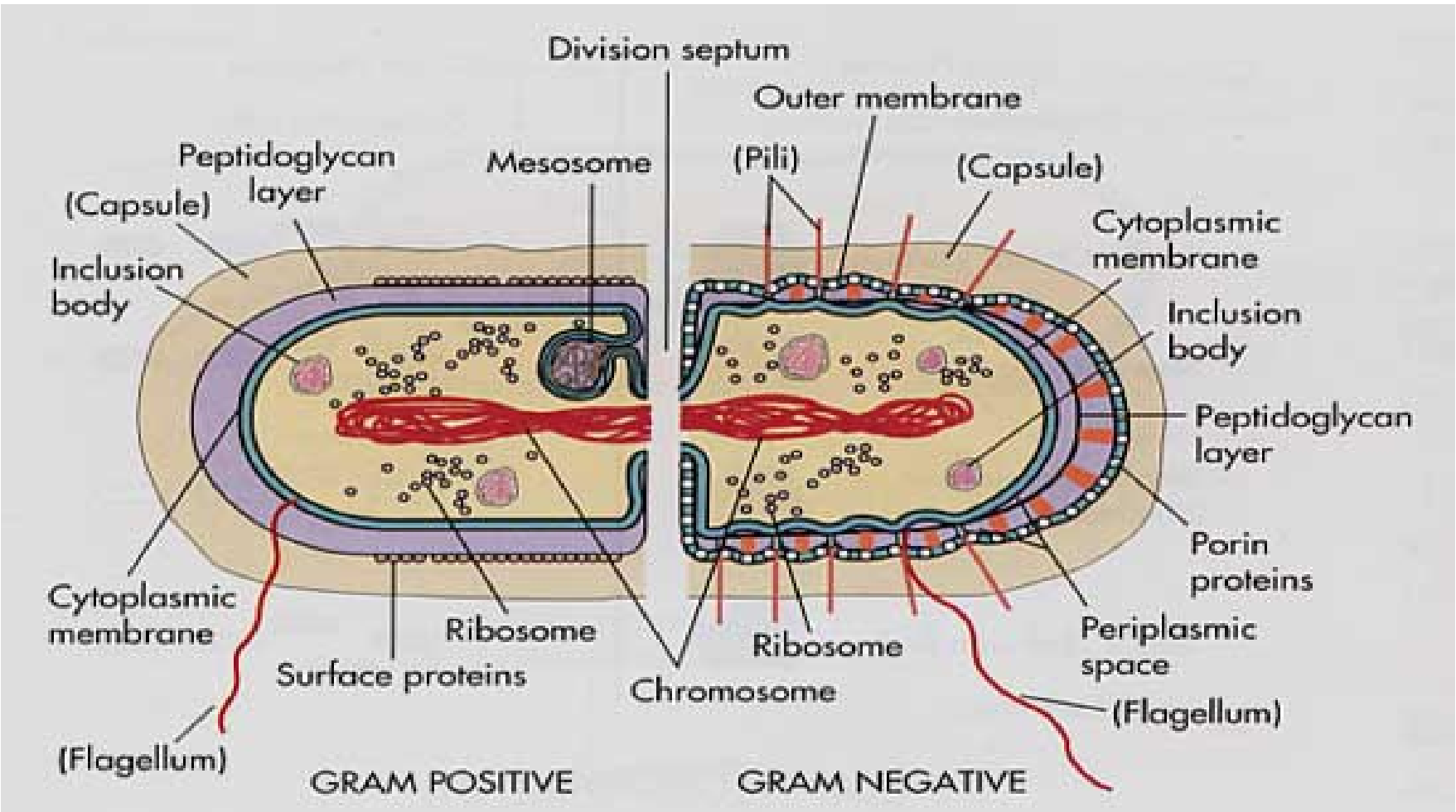


(3) Silver ions react with the base pairs of DNA thus preventing DNA replication

(2) Silver ions are highly reactive and readily bind to electron-donor groups, prime targets being the thiol groups (-SH) which are commonly found in enzymes within the microbe

Gram positive

Gram negative



Test Methods

Antimicrobial

AATCC147 not for non leaching

SN 195920-1992	Textile fabrics: Determination of the antibacterial activity: Agar diffusion plate test	Agar diffusion tests, semi-quantitative
SN 195921-1992	Textile fabrics: Determination of the antimycotic activity: Agar diffusion plate test	
AATCC 30-1993	Antifungal activity, assessment of textile materials: Mildew and rot resistance of textile materials	
AATCC 147-1993	Antibacterial assessment of textile materials: Parallel streak methods	
AATCC 90-1982	Antibacterial activity of fabrics, detection of: Agar plate method	
AATCC 174-1993	Antimicrobial activity assessment of carpets	
JIS L 1902-1998	Testing method for antibacterial of textiles	
AATCC 100-1993	Antibacterial finishes on textile materials: assessment of	Challenge test, quantitative
SN 195924-1983	Textile fabrics: Determination of the antibacterial activity: Germ count method	
XP G39-010-2000	Properties of textiles-Textiles and polymeric surfaces having antibacterial properties. Characterization and measurement of antibacterial activity	
JIS Z 2911-1992	Methods of test for fungus resistance	Fouling tests, soil burial tests
ISO 846-1997	Plastics – Evaluation of the action of microorganisms	
ISO 11721-1-2001	Textiles – Determination of resistance of cellulose containing	
New Methods	ISO TC38 WG23: “Testing for antibacterial activity”, CEN TC248 WG 13: “Textiles – Determination of the antibacterial activity – Agar plate diffusion test”	

Wash test procedures

AATCC 135 Top loader machine, typical USA market

Wash test procedures

ISO 6330 Part A typical European Front loader

ISO 6330 Part B is EXACTLY the same as AATCC 135

NOTE There is no specific test for durability of `finishes`

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Suitability for textiles

The textile industry has a huge range of antimicrobial products to choose from but for apparel several important criteria must be met:-

NON MIGRATING

SKIN SAFE

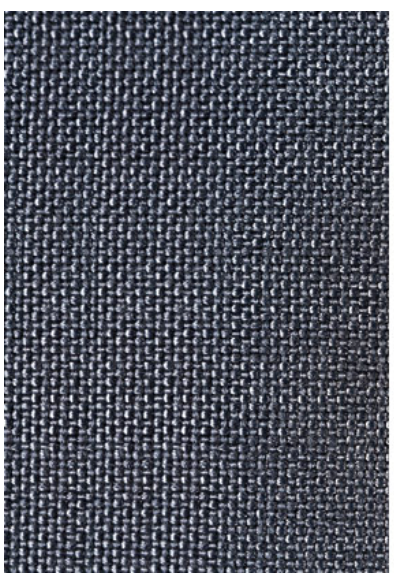
ENVIRONMENTAL IMPACT, BOTH IN APPLICATION AND USE

PERFORMANCE- IN USE AND WASH DURABLE

EASE OF APPLICATION / COST

LITTLE IF ANY EFFECT ON OTHER PROPERTIES e,g WICKING, F/R, DWR etc

THANK YOU




MJS SLC OR 2010 slides notes

1) Introduction page
2) No comment required
3) It is the proteins and fatty acids that are decomposed to make molecules we can smell
4) Large molecules are not released into the atmosphere so we cannot smell them. These larger molecules, mainly present in Apocrine sweat, are broken down into component parts that are released (volatile) so can smell them.
5) Two distinct control methods. Absorption- simple capture. Prevention- bacterial control
6) Typical cyclodextrin shape. Volatiles are trapped inside the centre of the ring. They are not chemically altered, and can be re-released under the right conditions. Once all the rings are full the product ceases to function.
7) Absorption due to surface area and shape. Small molecules become trapped in the intricate shapes, once full stop working. It is possible to clean out during washing, but the full effect is never regained and is reduced every wash. NOTE this type of product is non-discriminating, it works on every volatile molecule not just those caused by sweat. It also begins working the moment it is applied at the mill NOT when t he customer first wears the garment.
8) Some of the types of chemistry that can be used as preventative measures.
9) Kill method of bacteria control. The cell wall is ruptured, cytoplasm leaks out, cell dies. NOTE cells can learn to develop thicker walls to overcome this single approach.
10) Silver three stage attack:
    i) silver ions can disrupt the cell wall, and begin penetration.
    ii) attach to sulphur groups on enzymes, cell slows down and begins to starve
    iii) attach to part formed DNA during replication, new cells cannot fully form and die
11) Gram negative/positive
    Named after Dr Gram, a Danish microbiologist. Positive accept dye stain, Negative does not. Negative cells have a thicker cell wall and also more fats present.
12) AATCC 147 now the wrong test for non-migrating antimicrobials. The Zone of Inhibition shows that the product has leaked away from the textile, and in practise could transfer to the skin.
13) List of existing test methods. Highlight AATCC 100 and JIS 1902, which are essentially the same. AATCC 100 still does not represent real world, so nutrient level is reduced to 1/500
    To prevent staining during the test as well as requiring artificially high levels of product just to pass a laboratory test. These so called challenge tests actually start with a high level of bacteria which must be reduced during the test. In real life we start with a low level of bacteria which must simply be maintained.

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14) and

15) Wash methods AATCC 135, USA standard using typical top loader. Europe ISO 6330 using a typical front loader. Note ISO 6330 part B is exactly the same as AATCC135. There is no existing standard to test the durability of a finish, both these standards are designed to test the physical performance of fabrics-shrinkage, appearance etc.

16) Product profile.

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