Chemistry and Tools: Designing Your Grocery and Food Service Sanitation Program

April 2022

Organized by: **Food Hygiene and Sanitation** PDG

Moderator: Christopher Jordan, Diversey

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Please consider making a contribution

This webinar is being recorded and will be available to IAFP members within one week.

Webinar Housekeeping

- It is important to note that all opinions and statements are those of the individual making the presentation and not necessarily the opinion or view of IAFP.
- All attendees are muted. Questions should be submitted to the presenters during the presentation via the Questions section at the right of the screen. Questions will be answered at the end of the presentations.
- This webinar is being recorded and will be available for access by IAFP members at www.foodprotection.org within one week.

Today's Moderator

Christopher Jordan

Director of Business Development, Food Safety & Technical Consulting
Diversey, Inc.

For 21 years, Chris Jordan has worked in food safety & kitchen hygiene within the retail sector at Diversey, Inc. Chris has led key account sanitation programs, business development, food safety auditing, and food safety training programs. He works to strengthen customers' cleaning & food safety programs by focusing on actionable, science and data driven results. Chris led the development of several key customer data and reporting plans within Diversey's customer base, and he continues to work on innovation paths to continuously improve food safety systems. Chris is currently the Director of Business Development and the Food Safety & Technical Consulting Team for Diversey's North American Retail, Foodservice, and Hospitality sector.

Today’s Presenters

David Buckley, Diversey

David Buckley is the Director of Technical Consulting for the Retail and Food Service sectors in North America at Diversey, Inc. He is responsible for consulting on food safety, sanitation, and infection prevention, and control programs. He liaises with marketing and R&D to help guide sanitation product development, and he leads and conducts independent field research tied to improving customer hygiene and sanitation practices.

Prior to working at Diversey, David earned his Ph.D. in microbiology from Clemson University where he focused on environmental control of noroviruses and improving hygiene outcomes in food settings. David was also a postdoctoral research microbiologist at the USDA-ARS.

His focus was on the investigation of novel intervention technologies to improve food safety.

David is also active within the IAFP community and currently serves as the secretary for the Food Hygiene and Sanitation PDG.

Today’s Presenters

Debra Smith, Vikan

Deb has over 35 years of food safety & research experience. Before joining Vikan she worked for the UK governments Food Safety Division; and as Food Hygiene Research Manager at Campden BRI. Deb holds qualifications in Applied Microbiology, Nutrition & Food Science, Advanced Food Hygiene and HACCP. She is also a qualified FSSC 22000 Lead Auditor.

Deb has authored & co-authored numerous food safety & hygiene publications, and regularly presents her work at National and International food safety events. Deb is current Chair of the CampdenBRI Microbiology MIG; a Fellow of the IFST, and sits on their Scientific Committee, and Food Processing Special Interest Group.

Deb has been a member of IAFP for nearly 20 years and is Treasurer of the UK IAFP Affiliate.

At Vikan Deb provides food safety and hygiene advice, training, and support, both internally and to the food industry.

3 Essentials for Facilty Hygiene

Vikan
ADVANCING HYGIENIC CLEANING

Cleaning and Antimicrobial Chemistry

David Buckley, Ph.D.

Cleaning and Microbial Control

Safety

Estimated annual number of domestically acquired, foodborne illnesses, hospitalizations, and deaths due to 31 pathogens and the unspecified agents transmitted through food, United States

Foodborne agents	Estimated annual number of illnesses		Estimated annual number of hospitalizations		Estimated annual number of deaths	
	Number (90% credible interval)	%	Number (90% credible interval)	%	Number (90% credible interval)	%
31 known pathogens	9.4 million (6.6–12.7 million)	20	55,961 (39,534–75,741)	44	1,351 (712–2,268)	44
Unspecified agents	38.4 million (19.8–61.2 million)	80	71,878 (9,924–157,340)	56	1,686 (369–3,338)	56
Total	47.8 million (28.7–71.1 million)	100	127,839 (62,529–215,562)	100	3,037 (1,492–4,983)	100

List of Selected Outbreak Investigations, by Year

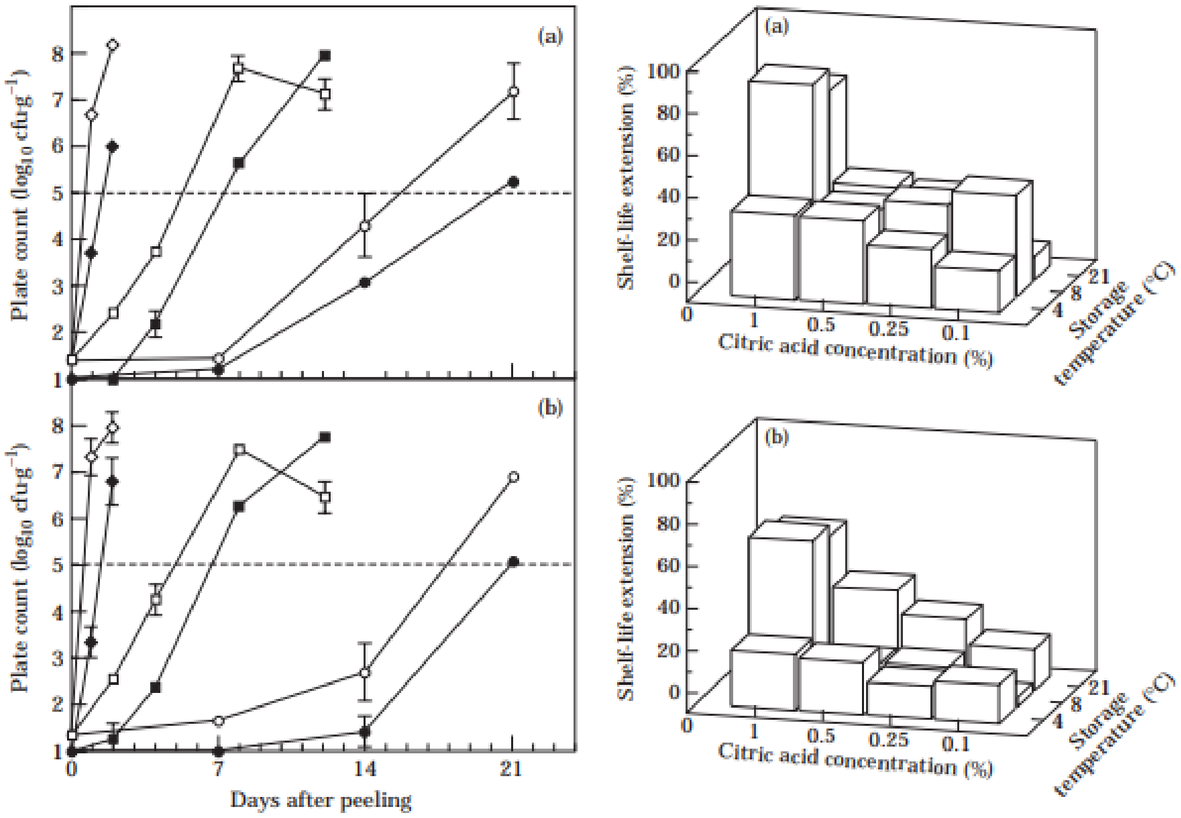
2021 | 2020 | **2019** | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011-2006

- Hard-boiled Eggs – *Listeria monocytogenes*
- Cut Fruit – *Salmonella* Javiana
- Fresh Express Sunflower Crisp Chopped Salad Kits – *E. coli* O157:H7
- Romaine Lettuce – *E. coli* O157:H7
- Ground Beef – *Salmonella* Dublin
- *Listeria monocytogenes* Infections
- Fresh Basil from Siga Logistics de RL de CV of Morelos, Mexico – *Cyclospora* (2019)
- Northfork Bison – *E. coli* O103 and O121
- Papayas – *Salmonella* Uganda
- Flour – *E. coli* O26
- Karawan Brand Tahini – *Salmonella* Concord
- Raw Oysters – Multiple Pathogens
- Deli-Sliced Meats and Cheeses – *Listeria monocytogenes*
- Frozen Raw Tuna – *Salmonella* Newport
- Pre-Cut Melon – *Salmonella* Carrau
- Ground Beef – *E. coli* O103
- Butterball Brand Ground Turkey – *Salmonella* Schwarzengrund

https://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html

Quality and Shelf-Life

USDA’s Economic Research Service estimates 31% of food loss at the retail and consumer levels. This corresponding to about 133 billion pounds and $161 billion of food



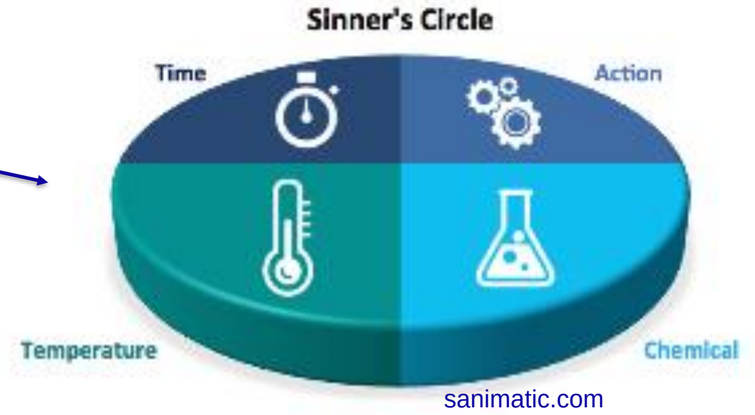
Pao, S., and P. D. Petracek. "Shelf life extension of peeled oranges by citric acid treatment." *Food Microbiology* 14.5 (1997): 485-491.

Aesthetics

Rules to Sanitation

- **Rule 1:** Process beats chemistry EVERY time
- **Rule 2:** Cleaning boils down to 4 factors
- **Rule 3:** There are uncontrollable variables that impact cleaning

Cleaning performance = $T_i * A * C * T_e$



sanimatic.com

Where

T_i = Time
A = Action
C = Chemical
T_e = Temperature

Time

- The longer you clean, the cleaner a surface
- Soil removal may not be linear over time
- May not require user to continually work

0 Minutes

10 Minutes

Mechanical Action

- Sometimes, the best cleaning chemical is elbow grease

- There are many ways to increased mechanical action but most are not practical or safe in retail and food service operations
  - Manual scrubbing
  - Abrasives
  - High pressure spray – not recommended
  - Ice blasting – not recommended

More on mechanical action from Vikan…

Chemical

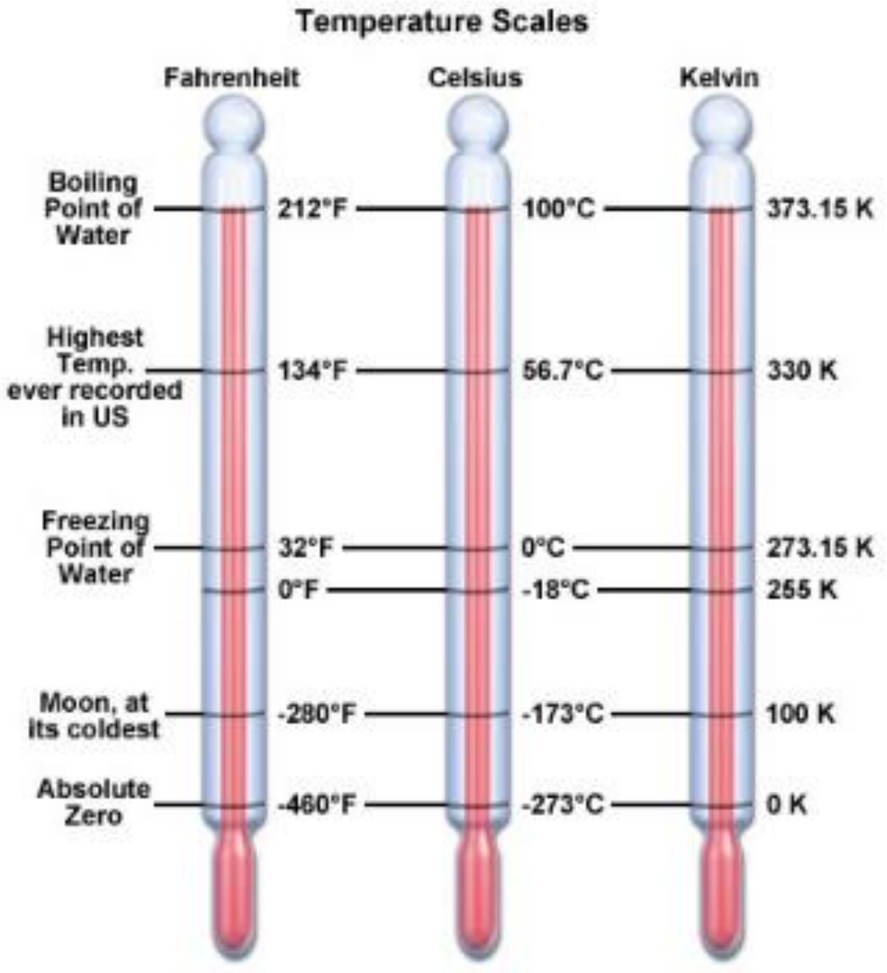
- Many types of cleaners and active ingredients.
- The nature of a cleaning chemical greatly impacts cleaning results.

Ingredient
Acids
Caustics
Free Available Chlorine
Quaternary Ammonium Compounds
Peroxides
Peracids
Acid Anionics
Alcohols

Temperature

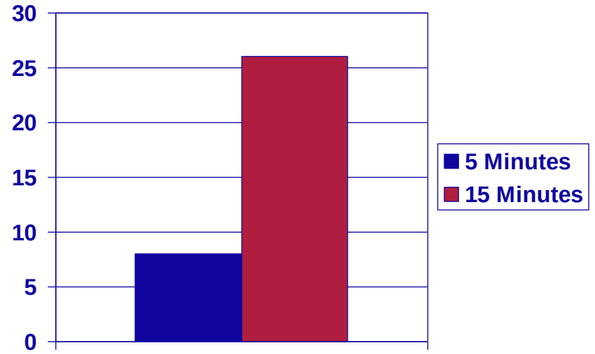
- In general, higher temperature removes more soil

- However, too much heat can be problematic.
  - Hot water temperatures may inactivate some cleaners –
    - Enzymatic
  - High temperatures can make some soils more tenacious and hard to clean
    - Burn on soils



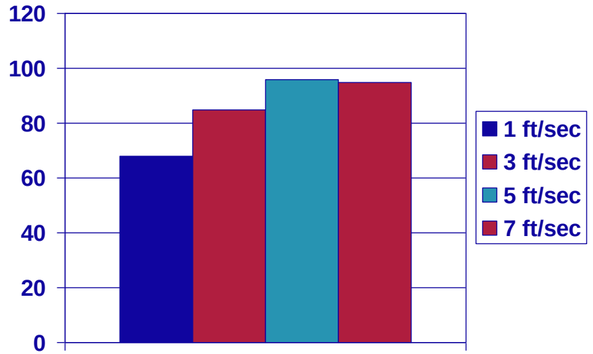
TACT

Time

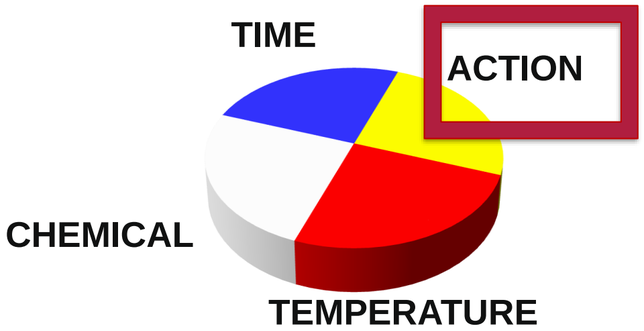


Percentage of biofilm removed from stainless steel surfaces with circulating water. Flow = 5 ft/sec.

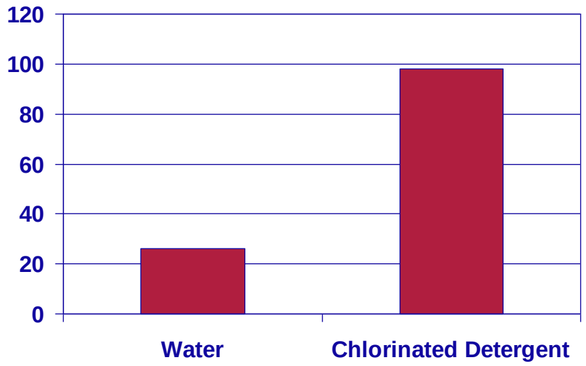
Action



Percentage of biofilm removed from stainless steel surfaces at various flow rates of a chlorinated detergent after 5 minutes in a circulation cleaning system.

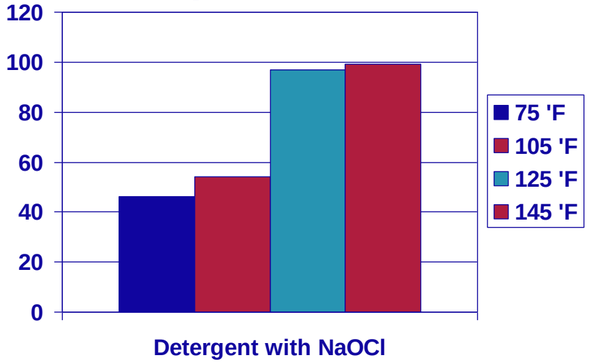


Chemical



Percentage of biofilm removed from stainless steel surfaces with circulating water or detergent. Flow = 5 ft/sec.

Temperature



Percentage of biofilm removed from stainless steel surfaces at various temperatures of a chlorinated detergent in a circulation cleaning system.

So what is the BEST Cleaning process formula?

Cleaning performance = $T_i * A * C * T_e$

- Correct answer: it depends!
- Optimizing TACT is about compromise. One TACT approach is likely not the same for another environment.
- That means that there is no BEST TACT equation.
  - It needs to be set empirically
  - It needs to be set for each location
  - It needs to be set for each task

Remember Rule 3:
There are uncontrollable variables that impact cleaning

- Optimum TACT variables need to be established empirically because there are other variables that impact cleaning when you're **NOT** cleaning
  - Regulatory issues
  - Nature of the soil
  - Nature of the equipment
  - Nature of the product being processed
  - Nature of the production process
  - When the surface was soiled
  - Sustainability issues
  - Safety
  - Compatibility
  - Cost

Let’s Talk Soils

- What is soil?
  - Most soil in grocery and foodservice areas is (oddly enough) food.

- Breaks down into several large categories:
  - **Organic soil**: carbohydrate, protein, lipid
  - **Inorganic: salts** and scales
  - **Miscellaneous:** Stones, machine oils, etc

- How do you remove these soils?

This is usually what we deal with…

- Soils we worry about are **not** water soluble
  - Water soluble soils exist but they do not get a lot of attention because they readily dissolve in water

- Aqueous cleaning solutions
  - Solvent based cleaning systems exist (i.e. dry cleaning) but not in the environments that we are discussing today

We have many ways to address this issue

Modify the solution properties

- Surfactants
- Solvents
- Chelants (note that these are often called “Builders”)
- Alkalinity

Modify the soil properties

- Chelants
- Acidity
- Bleaches
- Enzymes / Microbes

Modify the substrate

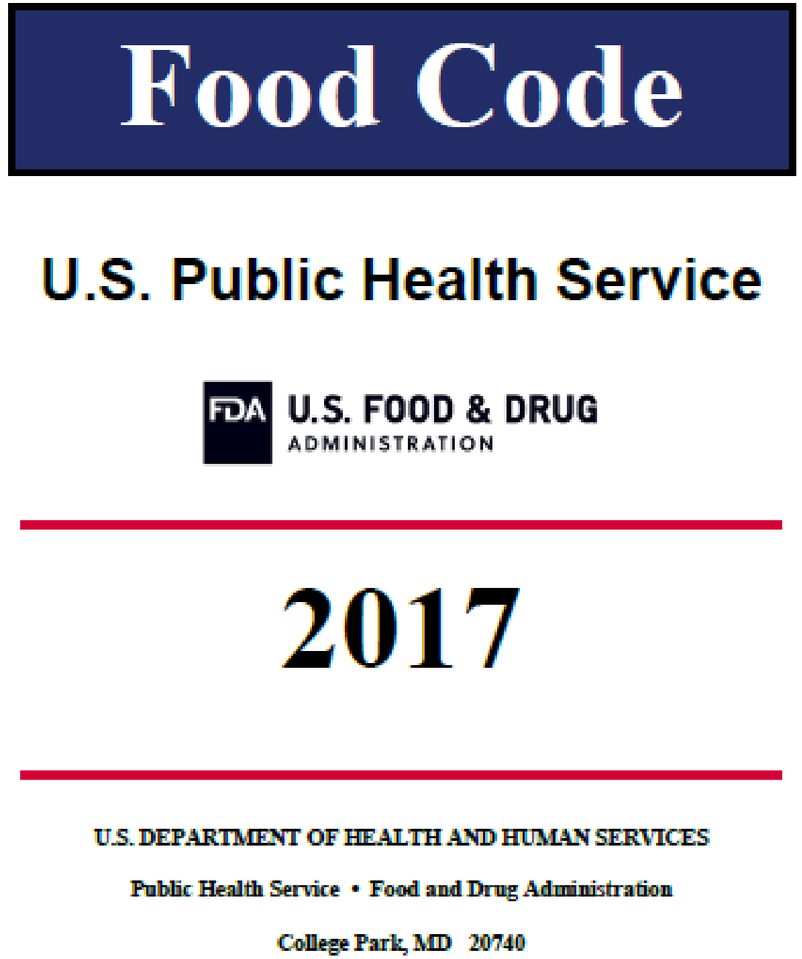
- Beyond the scope of this talk

Which chemical do you use to clean?

Type of soil	Example	Optimum cleaner chemistry
Organic soils		
Carbohydrate	Sugar, starch, caramel	Surfactant, alkalinity
Protein	Casein	Chlorine, alkalinity, surfactants
Fat	Tallow, lard, seed oils, resins	Alkalinity, surfactants
Petroleum	Greases, oils, lubricants	Solvent
Inorganic soils		
Monovalent salts	sodium chloride	Acid or high levels of Chelant
Milk stone	Calcium nitrate	Acid or high levels of Chelant
Food stone	Beer, milk, and celery stone	Acid or high levels of Chelant
Metallic deposits	Rust, aluminum oxide	Acid or high levels of Chelant

A Regulatory Pause

- **Cleaning.** Part 4-6
- **Rinsing**. Section 4-603.16
- **Sanitizing**. Part 1-2 (40 C.F.R § 180.940)
- **Detergent-Sanitizer**. Section 4-501.115
- **Nonfood-contact surfaces**. Requirement not addressed
- **Disinfectants**. Annex 3, section 2-501.11 Vomiting and Diarrheal Events
- **Concentration verification**. Subpart 4-302.14



From Fraser et al. 2021

How About Some Practical Advice?

https://www.dreamstime.com/

Some Practical Advice

Meat, poultry, seafood leads to high fat, high protein, and large quantity soil.

Cleaner of choice is usually chlorinated alkali

Dough, batters, pastas usually contain high carbohydrate level and high protein

Chlorinated alkali is a common choice. However, built cleaners with ethoxylated alcohol and acid does well, too

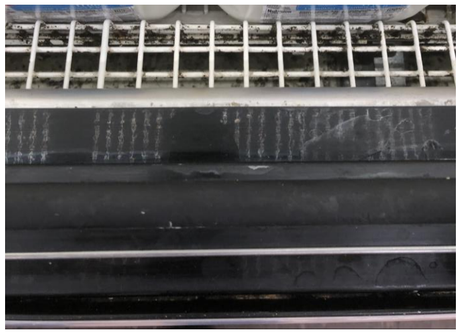
Vegetables have high carbohydrate with some stone issues (e.g. celery and spinach stone).

Any cleaner with surfactant cleaners can work well for these applications, it helps if it is “built”

www.kitchenviva.com/

Carbonized or burnt on soil of any sort is usually cleaned with high caustic levels (1-5%)

Potassium hydroxide

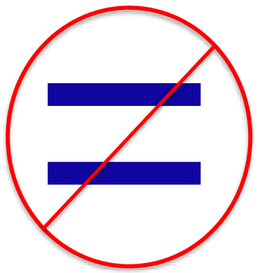


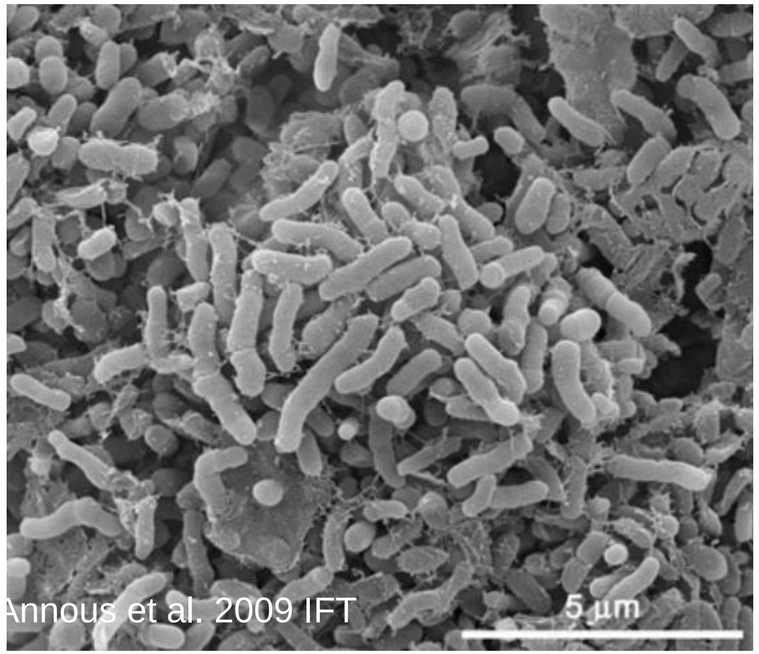
Milk contains Carbohydrate (milk sugar), protein, fats, minerals, and water

Use chlorinated alkali cleaners

Allergen removal

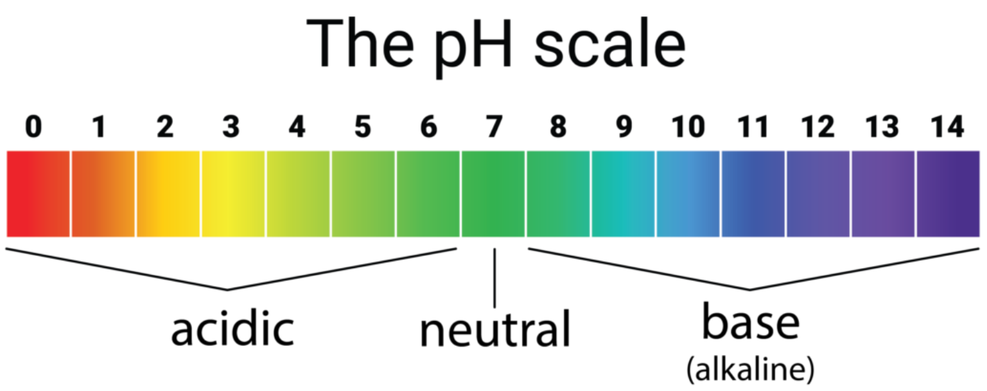
- Allergens are not bacteria.
  - You cannot sanitize them away.
  - You cannot (practically) degrade, denature, heat, oxidize, or otherwise inactivate allergens.





Cleaning to remove allergens

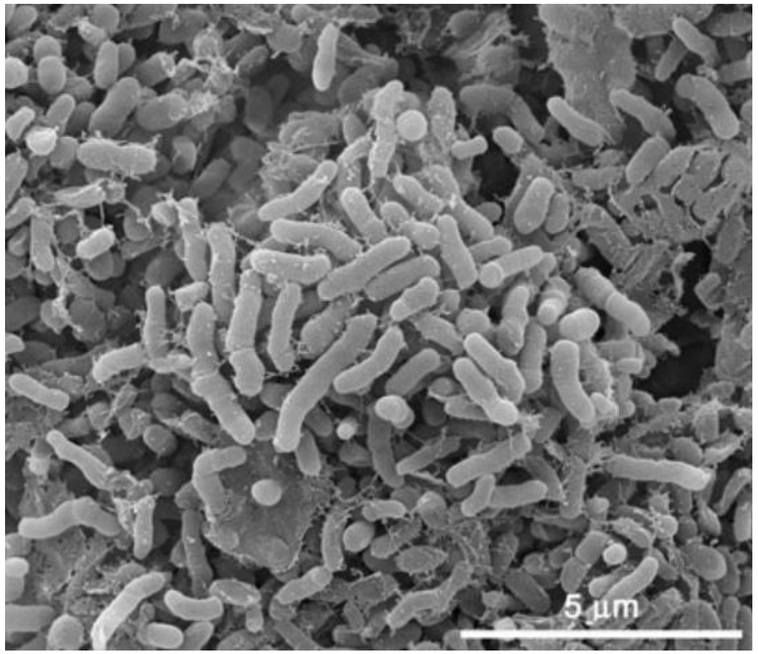
- Wet cleaning
  - Allergens are almost always proteins so a cleaner that is well suited to cleaning high protein soil is often a good choice.
    - Chlorinated alkali detergent is a standard and effective choice
    - Remember the variables (TACT and others) they apply here too
      - Removal is the most important piece abatement of allergens



17
Cl
Chlorine
25.4527

Why do we care about biofilms?

Biofilms are concern because they may act as **sources of contamination** resulting in, product contamination, quality failures, reduced shelf life, organoleptic changes, and corrosion of equipment.



Annous et al. 2009 IFT

Where will biofilm grow

Slicers, Grinders, Band saws, Dicers, Blenders,

Hand Tools, Gloves, Aprons, Containers, Bins,

Baskets, Equipment Framework, Floors, Sinks, Inside Hoses,

Sponges, Brushes, Green scrubbies, Floor scubbers, Trolleys, Fork Lifts,

Condensate, Carts, Gaskets, Walls, Ice Makers,

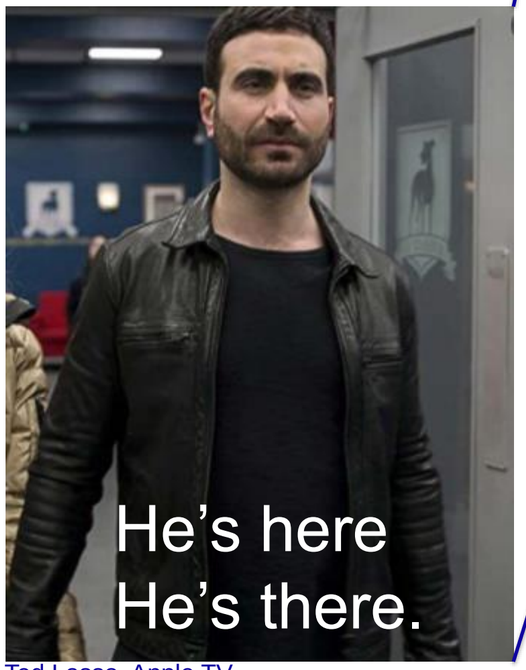
Mops, Tow Motors, Racks

On/Off Switches, Inside Air Lines,

Standing H_20, Scrapers,

Trash Canss, HVAC……...

Did we say Drains???



Ted Lasso, Apple TV

Eliminating Biofilms

Exopolysacharide
- Carbohydrates
- Protein
- DNA

Microorganism
- Carbohydrate
- Protein
- Lipid
- Minerals
- Trace compounds

What is soil in a food processor made of?
- Carbohydrates
- Protein
- DNA
- Lipid
- Minerals
- Trace compounds

Biofilms = Soil

Sanitizers

EPA 40 CFR § 158.2203

“a substance, or mixture of substances, that reduces the bacteria population in the inanimate environment by significant numbers, but does not destroy or eliminate all bacteria. Sanitizer meeting Public Health Ordinances are generally used on food contact surfaces and are termed sanitizing rinses”

EPA Product Performance Testing Guidelines

The EPA quantifies this definition through their Product Performance Testing Guidelines. That is, food contact, non-food contact surface, and soft surface sanitizers must meet a 5-log (99.999%), 3-log (99.9%), and 3-log (99.9%) reduction, respectively, of specific Gram positive and negative bacteria.

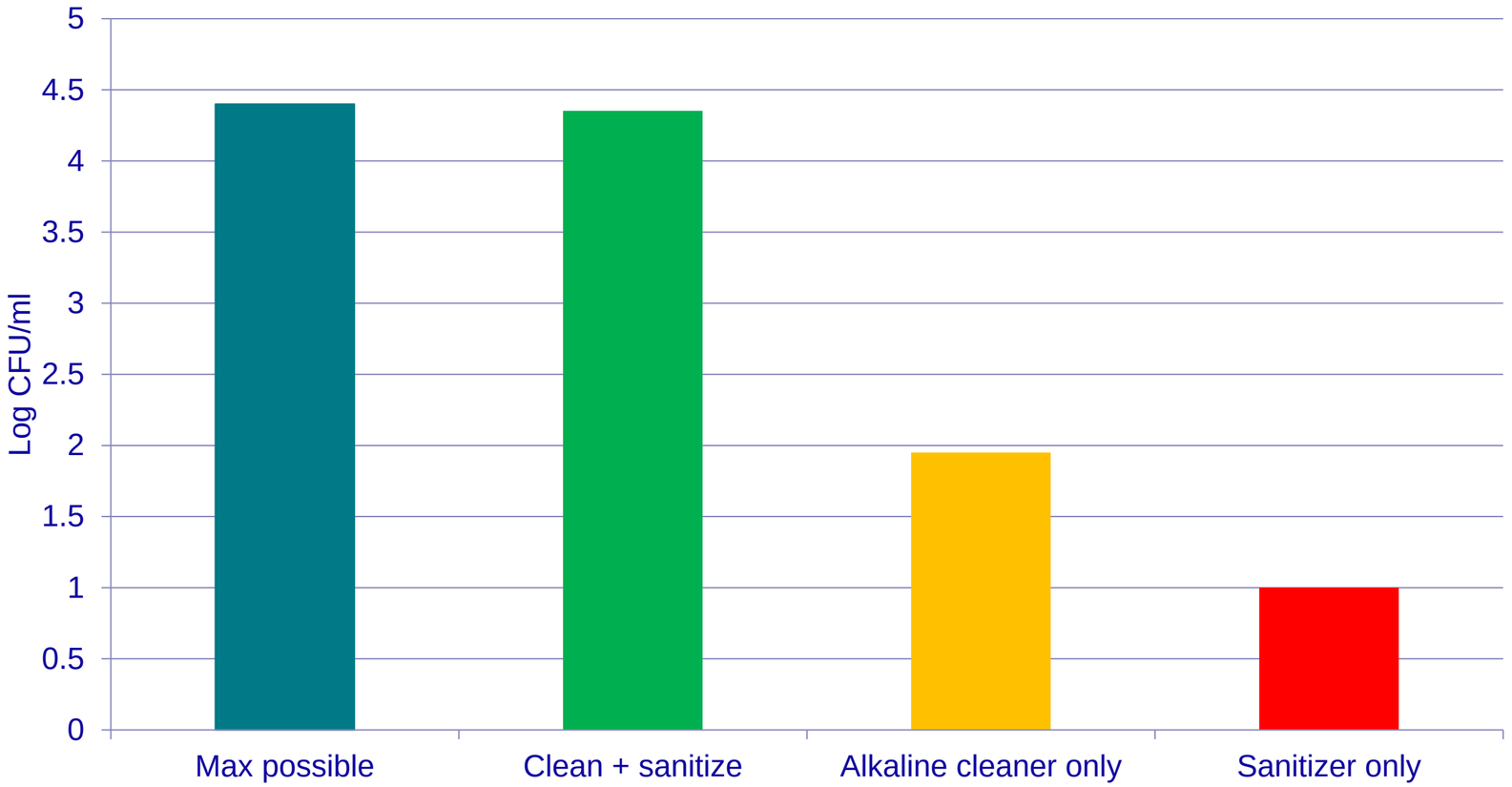
FDA Food Code Section 1-201.10 (B)

“reduction of 5 logs, which is equal to a 99.999% reduction, of representative disease microorganisms of public health importance”

Sanitizers are critical to sanitation but require adequate cleaning prior to application

Conclsuion

Results of a two step process that combined first a cleaning step and then a sanitizer



Alkali 10 min. followed by Mixed Oxidizing Sanitizer 10 min., glass coupon, measured in triplicate, *B. licheniformis*

Food Hygiene in Grocery & Food Service

Hazards:

- Microbial (Norovirus, *Listeria*, *Salmonella*, *E. coli*, microbial biofilms)
- Allergens
- Foreign material


Milk


Egg


Tree nuts


Fish


Crustacean


Wheat


Peanut


Soybean


Sesame

Risk:

1. CDCs top 5 major risk factors related to food safety practices within the retail food industry includes:

- Food contamination due to unclean facilities, equipment, or utensils

1. Foodborne Illness Outbreaks at Retail Establishments — National Environmental
Assessment Reporting System, 16 State and Local Health Departments, 2014–2016.
MMWR (cdc.gov)

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Minimizing the Risk

Control:

- Selection
- Use
- Maintenance

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Vikan Food Safety Webinar Series

- **Selection**
  - *Materials of construction
    - food contact compliance
    - durability
  - *Design & construction
    - cleanability
    - fitness for purpose
    - colored for ease of identification
  - People
- **Use**
  - preparation for first use
  - minimizing spread of contamination
- **Maintenance**
  - equipment as a source of contamination
  - equipment decontamination
  - inspection & replacement
  - storage

*Hygienic Design

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Selection

Hygienic Design

- Materials of construction
  - EC Directive No. 10/2011, & Regulations 178/2002 & 1935/2004,& subsequent amendments & updates.
  - The FDA Regulation CFR21
- Design and construction

Materials of construction must not allow the,

- *migration of harmful substances, or*
- *impart colors, odors, or tastes to the food under normal conditions.*
- *Must not be a source of foreign bodies*

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Selection

Hygienic Design

Design and construction

Good hygienic design principles

- avoid recesses, nooks & crannies
- no fixings & fastenings
- all areas accessible for easy decontamination
- of one-piece construction, or quick & easy to take apart / re-assembled
- have a smooth surface

https://www.3-a.org/Knowledge-Center/E-learning-Modules/Overview-of-Principles-of-Hygienic-Design

*EHEDG Guideline 8
"Hygienic Equipment Design Criteria”
https://www.ehedg.org/guidelines/free-documents/

https://www.vikan.com/uk/services/hygienic-design-of-cleaning-tools

http://viewer.ipaper.io/vikan/food-safety-information/ultra-hygiene/ultra-hygiene-advertorial-en-300/

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Selection

Bad Hygienic Design

Biofilm build-up under the screw thread handle fixing

Site-made floor scraper contamination traps / difficult to clean
Materials of construction?

UV gel ‘contamination’ trapped in surface defects
after cleaning

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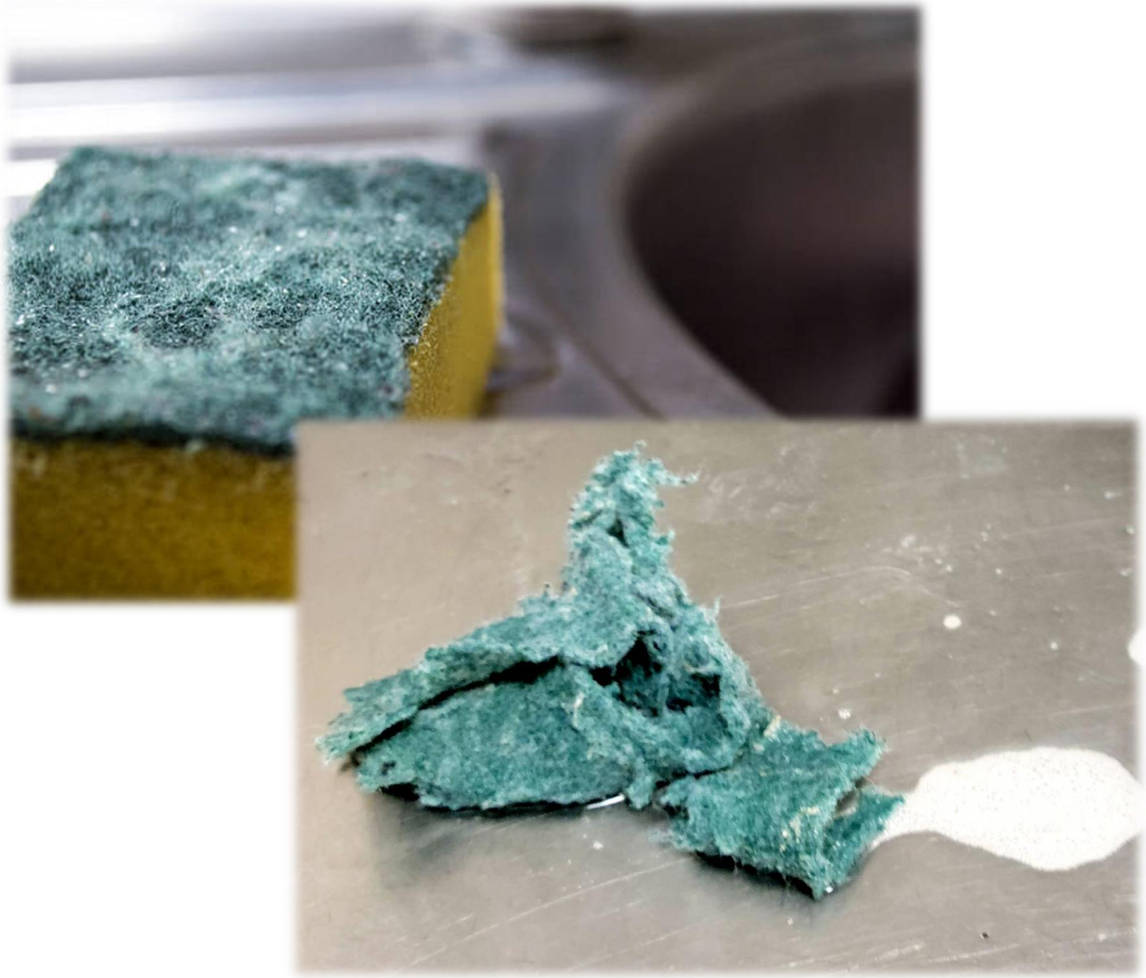
Selection

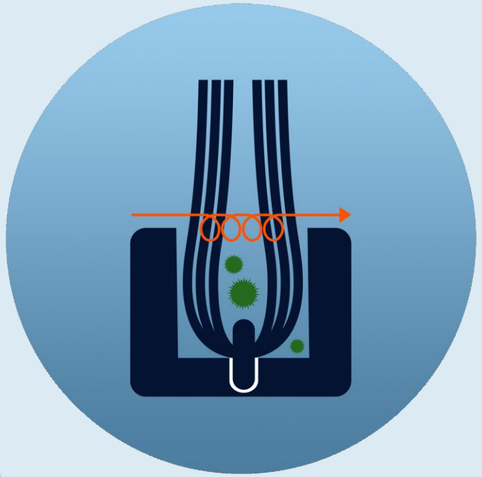
Bad Hygienic Design



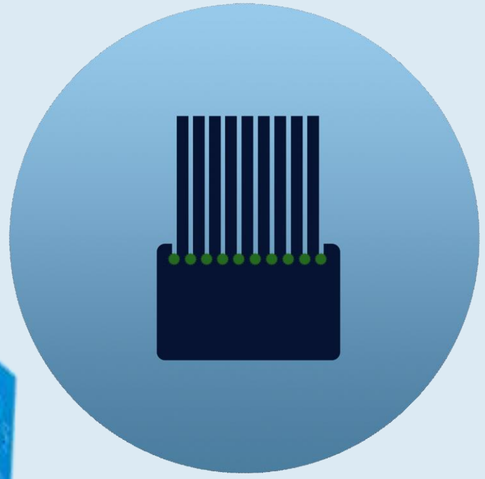
Selection

Good Hygienic Design

One-piece or Fully-molded construction



Drilled and stapled construction



Fully-molded construction

https://www.vikan.com/uk/services/vikan-blog/understanding-bristle-fixation-in-food-industry-brushware/

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Selection

Fitness for Purpose

Foam-bladed squeegee

- With easy to remove, replaceable cellular rubber blades
- Effective & efficient removal of liquids in low-risk areas

Fully-molded Squeegee

- With single TPE bladed
- Very good hygienic design
- For high-risk areas & food contact surfaces

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Selection

Fitness for Purpose

Soft bristled brush

- Soft bristled for removal of loose dry powders

Stiff bristled brush

- Stiff bristled for removal of dried on soils (can be used wet or dry)

Squeegee

- Sometimes used instead of a broom as more effective on some floor types, doesn’t clog and is easier to clean.

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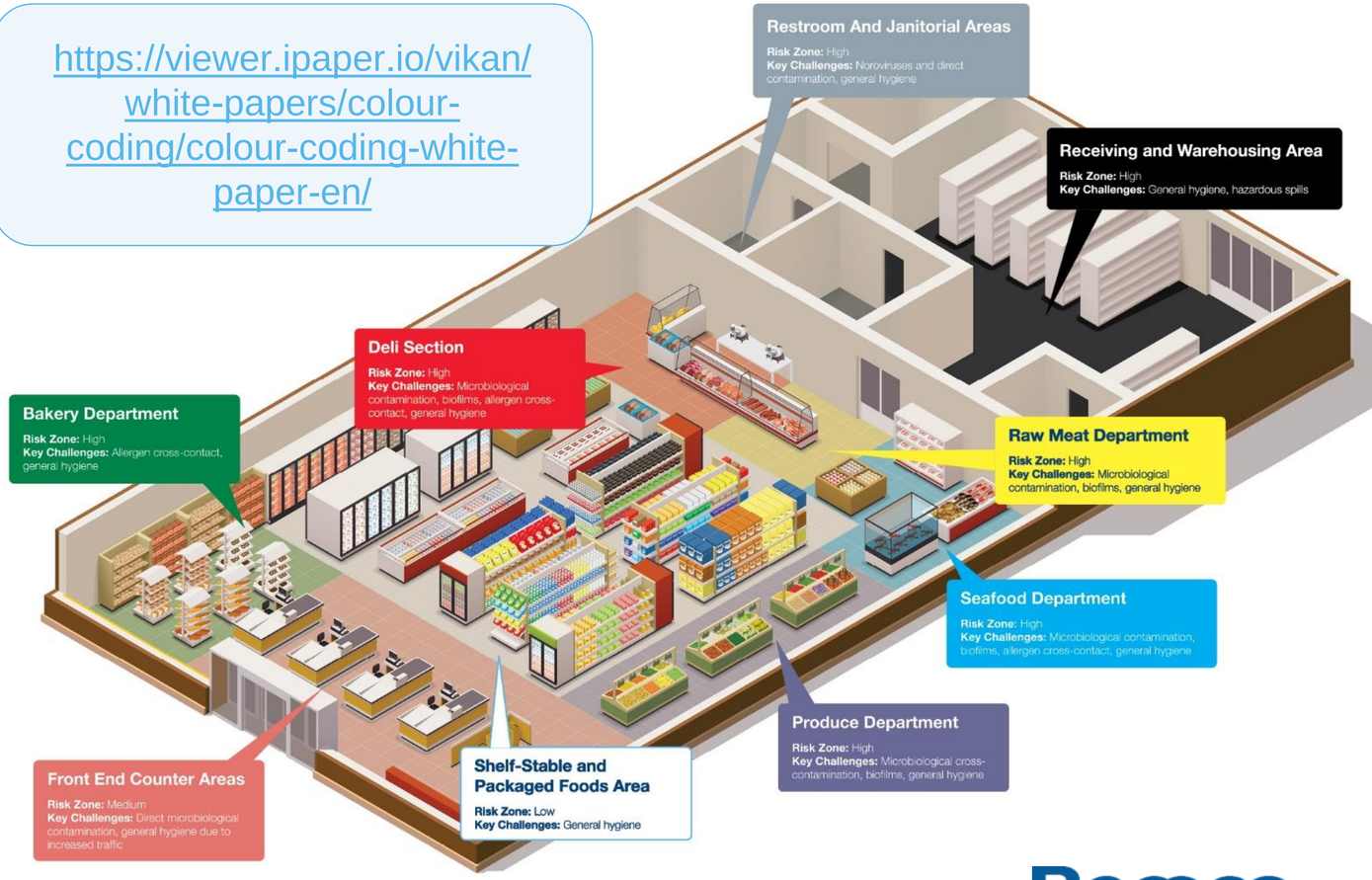
Selection

Colored for Ease of Identification

https://viewer.ipaper.io/vikan/white-papers/colour-coding/colour-coding-white-paper-en/



Use of color-coded equipment and zones provides a visual check that only equipment color-coded for use in that area / for that task is used.

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Selection

People

Hygiene Staff

Did you know? ~60% of foodborne illness outbreaks associated with food retail are linked to staff[1]

Experienced, qualified, competent, conscious people are invaluable.

Invest in *training, e.g., ServSafe® Food Handler Certification (administered by National Restaurant Association), & food safety culture.

[1] CDC - U.S. food retail industry - statistics & facts | Statista

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Selection

Health & Safety - Ergonomics

Ergonomic handle

- Rounded top
- Comfortable diameter
- Vertical ridges & matt finish to improve grip

Ergonomic scoop

- Designed with a handle that reduces stress on the wrist.

Ergonomic bucket

- Robust side handles for ergonomic handling and a good grip
- For heavy contents two people can lift the bucket on each side

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Use

Equipment Preparation for First Use

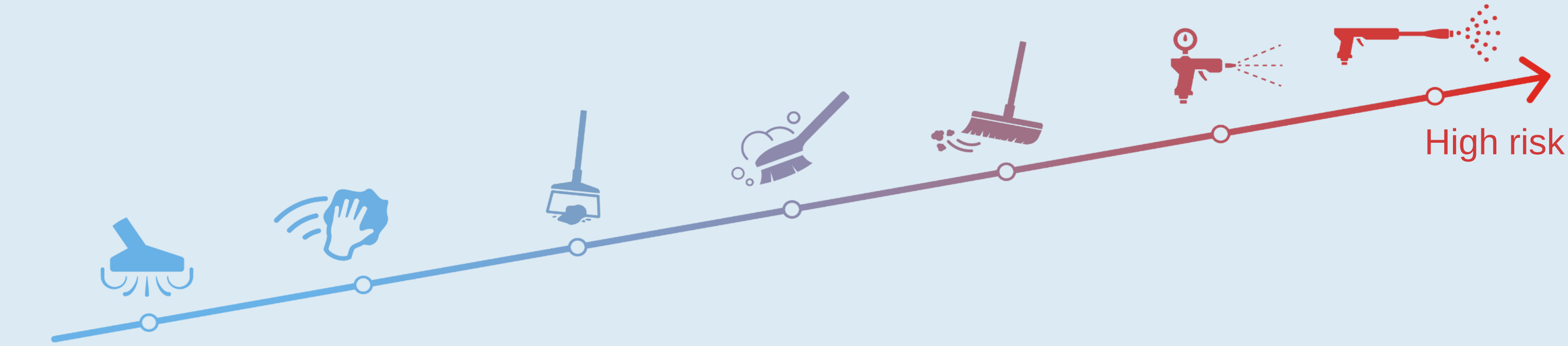
- Most cleaning and food handling equipment is not decontaminated before it is sent to the user
- Equipment may be contaminated with:
  - microorganisms
  - chemical residues (inc. allergens)
  - foreign bodies
- All equipment should be decontaminated, as appropriate to its future use, before use

Remove all labels!

Use

Minimizing Spread of Contamination

All cleaning activities can spread contamination



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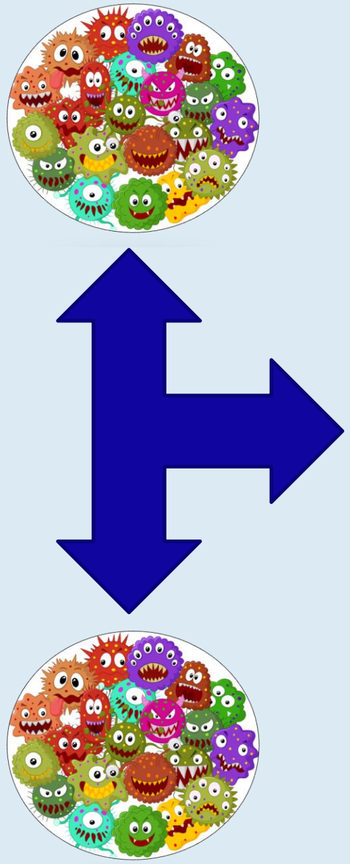
Use

Minimizing Spread of Contamination

- Choose cleaning equipment and methods that maximize contamination removal and minimize its spread
- Clean carefully near open food product, and food preparation surfaces.
- If possible, remove equipment to be cleaned to a physically segregated area, to protect food product from splashes, aerosols etc. (separate washing up area / use of screens)



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Use

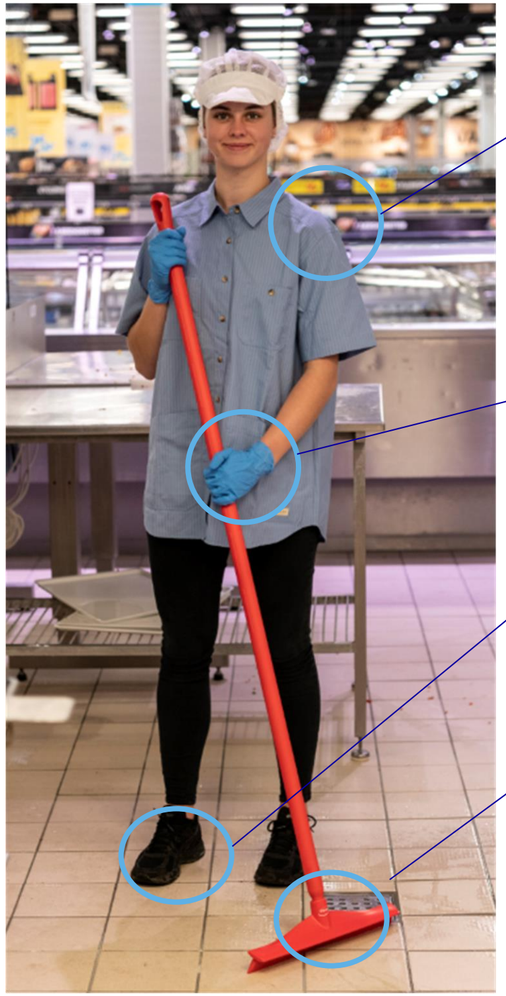
Minimizing Spread of Contamination

Hygiene staff & Food Handlers

Use knowledgeable, competent, conscientious people.

Train in microbiological food safety, control of cross-contamination, allergen control

Use different people for different areas – deli, bakery, meat, fish



Control of cross-contamination

Transfer by clothing

Use disposable aprons, gloves - change between tasks

Transfer by hands

Wash & dry hands between tasks

Transfer by footwear

Clean & sanitise regularly

Contamination transfer by equipment

Keep captive to different areas/tasks, use color-coding, clean & sanitize regularly

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Maintenance

Cleaning Equipment as a Source and Vector of Contamination

CampdenBRI[1]

- Survey of cooked product areas for Listeria monocytogenes - 10,000 samples
- Cleaning equipment - 47%
- Cleaning equipment as a microbiological ‘collector’

1. Holah, J.T. (1998). Effective microbiological sampling of food processing areas. Guideline No. 20, Campden & Chorleywood Food Research Association.

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Maintenance

Equipment Decontamination

General principles

Wet cleaning

- Rinsing down
- Immersion in a ‘sanitizer bath’, with/without agitation or scrubbing
- Use of an automated washing system, e.g., commercial dishwasher, or washing machine
- https://www.linkedin.com/posts/kurt-fryer-5411236_haccp-foodsafetyandhygiene-electroluxprofessional-activity-6660535624031965184-yZP9

Dry cleaning

- Brushed, wiped, knocked, shaken to remove debris

Dispose of after use (strictly limited or single use items)

- Cloths, sponges, scourers, mop heads

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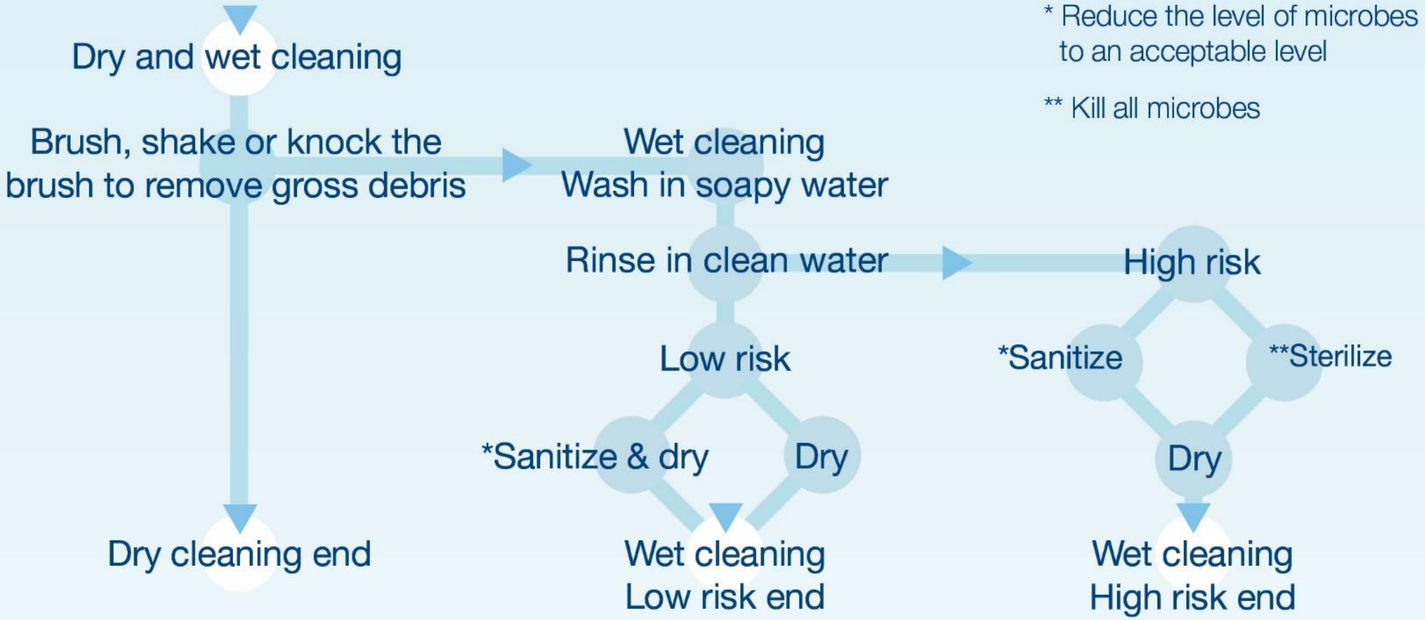
Maintenance

Equipment Decontamination

Generalized process decision tree for brush tool cleaning



http://viewer.ipaper.io/vikan/white-papers/cleaning-tool-maintenance/cleaning-tool-maintenance-whitepaper-en-300/#/

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Maintenance

Inspection and Replacement

- Cleaning tools should be:
  - regularly inspected for damage and wear and tear
  - replaced as appropriate, based on risk assessment
- Have descriptions/images of what is acceptable and what is not
- Keep records of tool inspection and replacement.
- Don’t make poor quality repairs to damaged equipment as this can increase the safety risk to the food product.

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Maintenance

Equipment Storage

- Cleaning tools can be stored on colour-coded wall racks or shadow boards,
  - help minimise equipment damage and cross-contamination
  - improve efficiency - provide a place for tools to be stored and found quickly when needed.
  - provide a visual check that the right-coloured tools are being used and stored in the right area.

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Maintenance

People

The Hygiene Team, Food Handlers and the resources they use are critical to ensuring food safety and future business

Recognize them for the food safety heros they are!

Invest in them – Training, resources, reward

Equipment Selection, Use and Maintenance

Key things to consider

- **Selection**
  - Hygienic design – easy to clean, durable, made of food safe compliant materials,
  - Fit for purpose
  - Color-coding
  - Ergonomics
- **Use**
  - Preparation for first use
  - Maximize contamination removal, minimize spread – methods, people
- **Maintenance**
  - Equipment decontamination
  - Equipment inspection and replacement
  - Equipment storage
  - Food safety culture

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Questions?

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April 13 A 360° Review for Food Safety Training-Perspectives From Trainers and Business Owners

April 21 Processing Environment Monitoring in Low Moisture Foods Production: Setting Up a Meaningful Program

April 26 Foundations of Produce Safety in Hydroponic and Aquaponic Operations

May 17 Avoiding Premature Water Activity Testing Results When Meeting Safety Regulations

May 26 Making Your Environmental Monitoring Performance Smarter

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GERMANY 4-6 May 2022
IAFP'S EUROPEAN SYMPOSIUM ON FOOD SAFETY

Pittsburgh
PENNSYLVANIA
IAFP 2022 July 31–August 3

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