

HYGIENIC DESIGN OF EQUIPMENT – AVOIDING HIDDEN TREASURES

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The Challenge

□ The competitors:

- Microorganisms (bacteria, yeasts, mold, viruses)
- Rodents (mice, rats)
- Insects (flies, cockroaches, beetles, etc)
- Birds

□ Opportunistic competitors

- Take advantage of our errors (creation of opportunities)

The Challenge

- ❑ Keep opportunistic organisms from getting into the processing plant and equipment
- ❑ Minimize opportunities for undesirable microorganisms to become established in processing plant
- ❑ Maintain an environment that does not attract rodents and other pests to the processing plant
- ❑ Maintain equipment to avoid metal, glass and plastic fragments

Microorganisms

- Microscopic

- Bacteria: ~0.5 to 1 micron wide x 0.5 to 1 micron long

- Depending on environmental conditions bacteria can:

- Survive, Proliferate, Die

Viruses

- Food can be a vehicle of transmission;

- Cannot reproduce in food

Microorganisms

- Yeast and moulds
 - Proliferate under conditions considered adverse for bacteria
 - Low pH
 - Low water activity

Biofilms

- Many bacteria produce extracellular polysaccharides (glycocalyx) that anchor cells and colonies to surfaces creating biofilms
- Biofilms become increasingly difficult to remove over time
- Bacteria can break away from biofilms to colonize other surfaces or contaminate products flowing over biofilms
- Bacteria in biofilms:
 - more resistant to removal by cleaning agents and sanitizers
 - more heat resistant

Microorganisms

- Hygienic design can minimize risk posed by airborne and waterborne pathogens
- More difficult to control for microorganisms associated with raw materials
 - Application of good agricultural/aquatic practices
- Hygienic design can minimize risk posed by pathogens associated with personnel

Rodents and insects

- Seek safe refuge
- Seek food (and water)
- Present a constant challenge
 - Take advantage of any opportunity provided by a weakness in the hygienic system

Hygienic Design

- Must be applied to:
 - Building construction
 - Air flow
 - Processing equipment
 - Material flow during processing
 - Personal Hygiene
 - Waste management
- Items above form interconnected system

Building

- Building construction and material composition should facilitate hygienic operation of food processing
- Floors:
 - must be self draining
 - must be impervious to water
 - must be resistant to corrosion by cleaning and sanitizing agent
 - Must be designed to minimize physical entrapment of soils

Building

- Walls must:
 - Be smooth
 - Constructed from or coated with material to enable cleaning and sanitizing
- Interface between walls and floors:
 - Must be curved to facilitate cleaning
 - Must be impervious to water and soils
 - Must be resistant to corrosion by cleaning and sanitizing agents

Building

- Doors and windows
 - Designed to prevent intrusion by
 - Contaminated air
 - Rodents
 - Birds
 - Insects
- Loading docks (raw material and shipping) present major challenge to prevention of invasion of plant by intruders

Air

- Do you know your neighbors?
 - What potential sources of undesirable microorganisms exist in the vicinity of the processing plant
- What is the air quality (microbial; particulate matter; odours) in the vicinity of the processing plant
- Air distribution system can be a source of pathogenic microorganisms if not properly designed and maintained

Air

- What is the direction of airflow in the processing plant?
 - Air flow must be away from finished product/packaging areas toward raw material side of processing plant or food service facility

Processing Equipment

- Must be functional
 - Meets operational objectives
- Must have hygiene built in
 - Constructed from smooth, impervious, food grade materials
 - Must be self draining
 - No dead ends or low spots to trap food

Processing Equipment

- Welds, joints must be smooth and impervious to microorganisms and soils
- Gaskets
 - no interaction with food
 - Resistant to corrosion by cleaning and sanitizing agents
 - Must form water tight seal between equipment components

Processing Equipment

- Components must be resistant to corrosion by cleaning and sanitizing agents
- Construction must facilitate cleaning and sanitation: clean in place or clean out of place
- Are cleaning and sanitation equipment compatible with processing equipment?
 - Are cleaning agents compatible with food based soils?
 - Are sanitizing agents effective against microorganisms of concern?

Processing equipment

- Corrosion causes surface roughness which:
 - Increases rate and extent of soil deposition during processing
 - Decreases efficiency of soil removal during cleaning
 - Increases opportunities for biofilm formation by bacteria
 - Increases risk of product contamination or processing failure

Surface smoothness

- Crack, scratch or fissure
 - Eg. 0.1 mm wide
 - 100 to 200 times as wide as bacterial cell
 - Can entrap soil and bacteria
 - Difficult to remove during cleaning
 - Protect microorganisms embedded in soil from sanitizing agent
 - Promotes biofilm formation
 - Can lead to contamination of food material during processing

Cleaning of Equipment

- ❑ Design determines ease of cleaning
- ❑ Avoid sharp corners that entrap material
- ❑ Ensure ease of cleaning built into equipment
- ❑ Ensure maintenance is easy to perform

Avoiding extraneous matter in food

- Equipment design must minimize introduction of foreign matter into food products.
 - Metal fragments
 - Plastic fragments
 - Broken glass
 - Filth
 - Chemicals (cleaning and sanitizing agents; lubricants, etc)

Location of equipment

- Ensure walls nearby and floor around and under equipment can be accessed for easy cleaning
- Ease of access to equipment for maintenance

Material Flow

- ❑ Avoid cross over by raw materials and processed or semi-processed product
- ❑ Employee movement should not compromise product safety and hygiene

Personal Hygiene

- Facilities for hand washing
 - Do hand washing facilities encourage or discourage hand washing
 - Can employees exit a washroom without recontaminating cleaned hands
 - Are handwashing stations:
 - Accessible
 - Easy to use
 - Clean
 - Functional

Personal Hygiene

- ❑ Does processing plant design empower employees to follow good personal sanitary habits?
- ❑ Good employee hygiene practices essential to ensure effective utilization of hygienic design of equipment

Waste Management

- Waste disposal must be conducted in a manner that does not:
 - Attract rodents and other vermin
 - Permit growth and proliferation of pathogenic microorganisms
 - Permit contamination of ingredients or processed product
 - Create aerosols that can enter processing plant

Conclusion

- Well designed and maintained equipment, facilities and motivated employees are key components in production of safe, high quality food products

References

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