Cleaning Technology and Hygiene in Food Industry

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Production of foodstuffs

Consists of a number of processing steps until the final product.

In food production sites, they can be categorized into the processes of

- **Separation**: division into smaller parts
- **Joining**: pooling of two or more components
- **Shaping**: change of or creation of a new form
- **Transportation**: transport of foodstuffs within a machine or between machines and facilities
Purpose of cleaning in food premises

- To reduce hazards that come along with the production of foodstuffs
- To increase the shelf life of foodstuffs.
- To obtain a clean and pleasant working environment
**Food Hygiene**

What does food legislation mean by hygiene?

**Food hygiene**: all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

Hygiene measures are

- cleaning and disinfection
- maintenance
- removal of any kind of *contamination* = biological or chemical agent, foreign matter, or other substances which may compromise food safety or suitability.

*Hygieia* is the Greek goddess of health.
Hazard analysis

Food processing introduces a hazard for contamination of foodstuffs. A hazard analysis according to HACCP principles would look at three types of hazards.

**Hazard**

- **biological**
  - Pathogenic microorganisms (=causing illness)
  - Food spoiling microorganisms
  - Toxins
  - Varmints

- **chemical**
  - Remainders of cleaning and disinfecting agents
  - Lubricants

- **physical**
  - Sand, Stones (as part of the original foodstuff)
  - Abrasion particles from machines and tools
  - Personal items
A clean and maintained environment

Removal of soil, food residue, dirt, grease or other objectionable matter

- Adsorption of the soil particles on the surface is a reversible process.

- The **cleanability** of the surfaces decreases with its roughness, various scratches and pores.

- That is why we need **easy to clean** materials, use the appropriate **chemicals**, and apply **efficient cleaning methods**
Cleaning as a pre-requisite for disinfection

The process of cleaning

- **Cleaning** removes **unwanted substances** *(soil, contaminations)* of any kind (physical, chemical, biological)
- Cleaning is a prerequisite for any disinfection process,
- soil can not be disinfected!

Factors for the success of cleaning measures are

- **Chemistry** *(type of cleaner being used)*
- **Mechanics** *(pressure, shearing force)*
- **Temperature**
- **Time** *(application time)*
Disinfection

The process of disinfection

- **Inactivation** or **killing** of microorganisms that results in inability to cause an infection
- The aim is to hamper or to kill **pathogenic bacteria**

Prerequisite

- **Clean** and **dry** areas without chemical or organic residues
- First cleaning, then disinfection!

Techniques

- **Thermal** disinfection
- **Chemical** disinfection
- Combination of thermal **and** chemical disinfection
Example for a cleaning and disinfection process

- Perform **gross cleaning** (dry or wet cleaning methods)
- Perform **cleaning** with cleaning solution
- **Rinse** carefully with water to remove remainders of the cleaning solution
- Apply disinfectant solutions with **clean working tools** (mops, buckets, transportation units …)
- Surfaces must be completely covered by the disinfectant solution
- Check for the **correct concentration** of the disinfectant – remember that remaining water will dilute the disinfectant
- Keep the **contact time**
- Rinse with **clean water**
Which substances to be removed?

Cleaning: removal of contaminations => substances, that pose a hazard to foodstuffs. Includes living and dead material

Substances, that are a hazard to foodstuffs:

- Food residues
- Microorganisms and biofilms
- Abrasion particles
- Encrustations
- Corrosion
- Remainders of cleaning and disinfection agents
Living substances

Hygiene means the control of biological hazards

Microorganism must be controlled because of:

1. Their ability to survive and multiply (alimentary infection)

2. Production and persistence of toxins (alimentary intoxication)

....so **pathogenic** bacteria

1. Lower product quality (corrupting of food)

2. Cause health problems
Living substances

Pathogens in dairy production

- A common pathogenic bacteria to find in dairy production is *Salmonella*. This bacteria can cause a dangerous disease and also can survive in our digestive for a very long time.

- Another pathogenic bacteria is *Listeria monocytogenes*. This bacteria is able to multiply in fridge temperatures (4 °C) and can cause disease can end with death. In danger are especially pregnant women, children and elderly people.
Pathogens in meat production

- Also in meat production, *Salmonella* poses a threat for the consumer, but it is not the only important meat associated pathogenic microorganism causing health problems.

- For example *Bacillus cereus* which persist as spores (resting –life forms) which are highly heat resistant or *Campylobacter* and also *Clostridium perfringens*. These bacteria are producing toxins which are causing alimentary infection.
Cleaning technologies

Special technologies in the food industry are:

- Cleaning-off-place (COP): either manually or by using machines
  - Pressure cleaning
  - Foam cleaning
  - Dry ice cleaning
- Cleaning in place (CIP) cleaning
- Open CIP systems (OCIP) cleaning
- Washing in Place (WIP)
COP cleaning

Pressure jet cleaning and foam cleaning

- In this type of cleaning, pressure jet cleaning is a pre-treatment for foam cleaning.
- The water is forced through a jet nozzle (20-40 bar).
- Thereafter, the surface covered with a thin layer of foam. The foam can be a carrier for cleaning and disinfection substances.
- After a certain contact time, the foam will be rinsed with water. Depending on the type of foam technology, cold or warm water (50-60 °C) may be used.
COP cleaning

Dry ice cleaning (CO₂)

- Means **cleaning without water**, using carbon dioxide pellets (CO₂ at -78°C).
- Cleaning effect is based on 3 **physical effect** of the carbon dioxide ice which:
  - rapidly **cools down** the surface (cryo shock)
  - the low temperature causes **tensions** between soil and surface, and thus embitters the soil
  - while hitting the surface, the pellets are transferred into gas (sublimation). Due to the 700 times higher volume of the gas, the already embittered soil will be removed from the stream of dry ice pellets.
CIP cleaning

Cleaning in Place (CIP) cleaning

- Used for systems that can **not be dismantled** for cleaning purposes like **closed tube systems**
- Pumping of cleaning fluid through the system by upstream flow of cleaning solution. **Reuse** of cleaning fluid. Fresh water is only used for the **final cleaning step**.
- All systems are filled automatically. The velocity is 0,5 – 3 m/s, which is generally sufficient to **remove loose soil**. Persistent soil removal however relies on the physico-chemical properties of the solvent.
OCIP cleaning

Cleaning of open CIP (OCIP) systems

- **Storage tanks** and other parts which have enough volume are cleaning manually by spraying and sprinkling systems.
- The **spray nozzles** are fixed systems (many wholes covering an angle of $360^\circ$) or rotating nozzles with gaps or wholes.
Washing in place (WIP)

• **Reusable bottles and barrels are cleaned in automated systems, with the process of**
  - Emptying
  - Pre-rinsing
  - Pressure jet cleaning
  - Alkaline cleaning
  - Rinsing
  - Disinfection
  - Final rinsing with sterile water

• **Transport containers, trading units are cleaned with a number of techniques, e.g.**
  - Submersion
  - Pressure jet cleaning
  - High-pressure steam
Washing in place (WIP)

• **Dish washers**
  - Machines with a hood
  - No separation between **clean** and **unclean areas**

• **Special dish washers**
  - **Separation** between clean and unclean areas
  - **Loading** from the unclean side
  - **Unloading** from the clean side
End of module

The modules and additional information on cleaning technology and hygiene in food industry can be obtained from

- www.hygiene-for-cleaners.eu

„Though I know a lot, I want to know everything."

J. W. v. Goethe (1748 – 1832)

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Further on with module 3!