Unit I – Topic 7

Sanitization of Dairy equipment - CIP SYSTEMS

CLEAN-IN-PLACE (CIP)

The recommended steps in a clean in place (CIP) operation may involve the following:

1. Remove those items that require manual cleaning such as fill tubes, manhole gaskets, plugvalves, etc.
2. Provide physical breaks between any circuits or tanks containing product.
3. Pre-rinse or flush thoroughly with cool water not to exceed 80oF.
4. Discard pre-rinse water, flushing until relatively clear.
5. Circulate an effective detergent solution throughout the circuit for the period of timenecessary to remove the residues in the circuit.
6. Circulate a rinsing water.
7. Circulate an acid detergent when needed followed by another rinse.
8. Sanitize immediately before use.

Most modern plants have installed clean-in-place systems throughout the plant. Prior to this, plantscleaned all their processing equipment, including tanks, vats, pumps and lines manually which involved complete disassembly, manually brushing with a cleaning solution, rinsing, reassembly and finally sanitizing. This was of course all highly labor intensive.

The basic components of any CIP system will include the following:

1. Permanently installed product piping and air operated valves

2. CIP solution make-up tanks
3. CIP pumps
4. CIP supply and return solution piping
5. Spray devices(either permanently mounted or drop- type)
6. Solution collection manifolds
7. Chemical feed systems and equipment
8. The CIP control/monitoring systems and necessary recorders. CIP temperature recordersmust meet all requirements as listed in Appendix H, page 207 of the Ordinance.

WATER CHARACTERISTICS AND AFFECTS ON MILK PLANT CLEANINGOPERATIONS

Water hardness is the term applied to water supplies characterized by either a high mineral content,usually high in calcium or magnesium bicarbonates, or magnesium chlorides, and sulfates.
Generally water hardness is precipitated by most alkaline materials but not by heat.

Some plants may need to condition their water by either selecting the proper detergents or in moresevere hard water cases may need to install ion exchangers to remedy the problem.

Water over 100ppm hardness apply in the latter cases and usually softeners are required for boilerwater or cooling tower feed water supplies.

Manual Cleaning Operations

Regardless of the automation and engineering built into a plants operation, there is usually a needto manually clean the contact surfaces of the many small parts used in a normal days

operation.

This may include filler parts, valves, filler surfaces (mandrels, shields, guides, etc.), small vats, cultured product packaging equipment appurtenances, tanker pumps, fittings, and valves, culture room product handling utensils and equipment (processing vats, curd cutting knives, whey drainers,steam cookers, curd movers and stirrers, etc.).

Manually washed fillers require hand brush washing of the filler bowl, gaskets, the product supplyline, ells, and bushings.

Since brushes are used in manual washing operations, they must be of the non-absorbent, nylon orplastic bristled type and designed to not retain soil (not recommended to use hollow body or handled type) and be quick to dry. Brush integrity must be maintained so that brushes used for floor drains or similar surfaces are not used on contact surfaces. This may be accomplished by color coding, marking, etc.

Utensils should be cleaned using a two compartment wash and rinse sink. Sanitizing with chemicals must be accomplished using a third treatment vat, unless heat is used for sanitizing.

The use of absorbent items, such as rags and sponges should be eliminated to reduce the potentialof spreading microorganisms throughout the plant environment.

Separate brushes should be used for product and not-product surfaces and the use of woodenhandled brushes, tools, paddles, etc. should not be used in production areas.

Particular attention must be given to cleaning underneath gaskets, "o-rings", and other smallorifices in which residue and bacteria may accumulate.

Special emphasis should be given to the following when evaluating the effective cleaning of milkcontact surfaces:

- AUP air blow devices/fittings;
- Storage tank agitator blades, shafts, fill inlets, vents, gaskets, shaft "O" rings;
- Filler valves, tanks, small parts (springs, screens, gaskets and "O" rings, vents, drain valveand lines, underside of shielding,);
- Plug valves, "butterfly valves";
- Fruit feed pumps, (varigators), fruit pumps;
- Homogenizer stand pipes;
- Reclaimed product surge tanks, milk cans, lines;
- Silo manhole doors (inside surfaces, sampling cocks, tank surface on inside below dooropening);
- Silo vent caps (mold, slime);
- Liquefier (powder mixing tanks) outlet valve and connecting piping;
- Raw receiving lines and fittings;
- Product pumps ("O" rings, back plates, covers);
- Filter housings, springs, gaskets in raw receiving area;
- Air eliminators in receiving areas, air "burps" on product and CIP lines;
- Pasteurizer regenerator plates (points of greatest temperature differential);
- vacuum breakers, single stem flow diversion valves;

- Tank fill goose necks; and In-door sample valves.

CHEMICALS USED IN MILK PLANT CLEANING OPERATIONS ALKALINE DETERGENTS

Used to neutralize, break-up, and suspend soil in the cleaning solution. Alkalines have been termedthe "guts" of the dairy cleaners and are usually termed generically as "caustics" and or alkaline chlorinated cleaners.. Chemically they are sodium hydroxide (NaOH, OR CAUSTIC SODA),

potassium hydroxide (caustic potash), sodium carbonate (soda ash) or sodium hypochloride (NaOCL) and sodium silicates and have a pH higher than 7. They attack the fat and proteinresidues on all types of dairy processing equipment.

They are generally combined with a water conditioning additive such as liquid phosphate underhard water conditions and usually contain surfactants or wetting agents which enhances the cleaning action.

The water properties must be considered, since most cleaning solutions are made up of 99% waterand the amount of neutralizers used should be customized to meet the individual demands. These detergents condition the water to prevent scum formation, and help to prevent saponification (the

chemical reaction which converts the actions of alkali and fats into soap and glycerin) during thecleaning cycle.

Most alkaline detergents contain chlorine which also breaks down the fats and proteins.

ACID CLEANERS

Acid detergents are those with a pH of lower than 7 and react with mineral deposits which have accumulated on milk contact surfaces. These acid cleaners may contain either nitric, phosphoric ora mixture of both acids; however phosphoric acid based cleaners are the most widely used in the U.S.

Milk and water mineral deposits (termed milk stone) become hardened and layered on the equipment surfaces and provide excellent surfaces on which "biofilms", which are adherent macro-colonies of bacteria, may thrive. Milk stone may consist of milk solids, calcium, magnesium, iron, sulfates, etc.

Acid based detergents (or rinses) do not saponify. They do, however, tend to neutralize any alkalinity and react with the milk minerals which are then carried away in the rinse cycles. Acid rinses will usually provide a bacteriostatic condition, however the equipment must be effectivelycleaned with an chlorinated alkaline based detergent prior to using the acid rinse.

Using an acid detergent without first removing the fats and proteins with a chlorinated alkaline detergent will result in fixing the protein soil to the surface. Acid rinses may also tend to protectagainst corrosion and when used in proper strengths will not attack rubber parts.

MILKSTONE White to yellow Minerals from milk Acid wash Regular and proper cleaning procedures coupled w/ acidified rinse FAT/ GREASE Hanging water droplets Greasy (white) appearance 1. Low water temperatures 2. Improper detergent concentration

3. Regular use of acidsin place of alkaline detergent 1. Proper water temperature 2. Correct concentration of alkaline detergent Regular and proper cleaning procedures coupled w/ acidified rinse MINERAL (Calcium,Magnesium) White (water- stone) chalky to gray 1. Rinse too hot, drop-out of minerals from watersupply 2. Failure to use acid detergents 3. No acidified rinse 4. Alkaline detergent used cannot handle hard water at present concentration Acid wash 1. Acid wash 2. Alkaline detergent used has good water conditioning 3. Water softener or treatment

NOTE: NEVER MIX CHLORINE AND ACID BASED DETERGENTS TOGETHER

The following is a list of terms commonly used when referring to the properties of detergents usedin the food industry.

1. Emulsification - The spontaneous dispersion of substances (proteins, gross soil particles,etc.) when brought in contact with water.
2. Peptize - The mechanical action combined with a surfactant which results in twoimmiscible liquids to form a stabilized colloid.
3. Saponification - The combination of fatty acids and oils with alkali to produce soap.

4. Sequestering and Chelating - The prevention of precipitation of hard water constituents bykeeping them in suspension as stable and solid compounds.
5. Wetting - Lowering of surface tension which permits cleaners to break the bond between thesoil and surfaces.