U S Chemical

Providing Exceptional Quality Since 1962

Understanding the Warewash Environment & Warewash Product Selection

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Restaurants, hotels, and other foodservice establishments in the U.S. buy billions of dollars in cleaning and sanitation chemicals each year. But contrary to popular belief, customers don't really buy cleaning and sanitation chemicals. They buy clean dishes, clean floors, stainless steel that shines, clean bathrooms, clean food processing equipment, and clean windows. In short, customers buy the end result. The cleaning products are just a means to the end. To properly identify the products a customer needs, as the first step in the selling of a new account, a process called a survey is used. In a survey, all of the necessary information is gathered, either through observation, testing, or asking questions of the customer, so that the appropriate products are selected to insure satisfactory results. The question "What product is the best one for the customer?" can only be answered if there is an understanding of how environmental factors influence product performance.

This brochure examines the fundamentals of cleaning in mechanical warewashing and the warewash environment. Mechanical warewashing is explained both from a scientific and a surveying perspective.

BASIC DISHMACHINE OPERATION

While dishmachines come in a variety of styles and options, they all operate the same basic way. Whether the dish-machine is an undercounter dishmachine (as is used in a home), a door-type dishmachine washing a single rack at a time, or a multitank conveyor (as is used in high volume kitchens and which washes a continuous stream of dishes) the principles by which all dishmachines operate are the same. Ware (dishes, cups or flatware) is collected, sorted by type, rinsed off by hand and stacked in racks (or on conveyor belts) that go into the dishmachine. The racks of dirty dishes are always fed in from the same side (dirty side) of the dishmachine and the clean dishes are removed from the other side (clean side) of the dishmachine. This prevents potential contamination problems. The chemicals and chemical dispenser are always located on the dirty side of the dishmachine to avoid potential contamination problems.

The dishmachine sprays a highly alkaline detergent solution over the ware for a period of time. There is a short dwell time to let the detergent drain off of the ware, and then the ware is rinsed with fresh water and sanitized at the same time. Sanitizing is the process of reducing the number of bacteria so that it is safe to eat off of the ware.

There are 2 basic types of dishmachines, high-temp and low-temp. In a dishmachine, the last portion of the cycle is a fresh water rinse called a final rinse. This is the last time that water touches the ware inside the dishmachine. While this final rinse is happening, the dishes are also being sanitized. In a standard door type dishmachine, if the dishes are sanitized by hot water, the final rinse water is 180°F - 195°F. This type of dishmachine is called a "high-temp" dishmachine. The kitchen will be equipped with an additional heater, called a booster heater, to raise the temperature of the final rinse water. If the dishes are sanitized by chemicals instead of hot water, a solution of 50 - 100 ppm chlorinated sanitizer is injected in the final rinse. This type of dishmachine is called a "low-temp" dishmachine. Apart from the 2 basic types, there are many variations found in the field. In either case, if hot water does the sanitizing, it is a high-temp dishmachine. If a chlorinated sanitizer is injected, it is a low-temp dishmachine.

The temperatures used in dishwashing are based on recommendations by the National Sanitation Foundation (NSF). The NSF issues guidelines which each state can incorporate into their health codes. In some cases, the state codes are different from the NSF recommendations. However, the NSF recommendations are only guidelines. They are not laws, as the NSF is not a government agency. High-temp dishmachines have a wash temperature of 140 - 160°F and a final rinse temperature of 180 - 195°F. Some high-temp dishmachines have 165°F final rinse water. If that is the case, then the final rinse is a minimum of 30 seconds instead of the 9 - 12 seconds that it is in a door-type dishmachine.

High-temp dishmachines only come in a tank-type, meaning that they have a wash tank holding from 11 to 30 gallons of recirculating detergent solution that is sprayed on the ware during the wash portion of the cycle.

Low-temp dishmachines have a wash temp of 120 - 140°F. The final rinse temperature is 120°F or higher. Low-temp dishmachines come in a tank type and a "fill & dump" variety. In a fill & dump dishmachine, the wash tank is usually less than 2 gallons and the wash solution is dumped down the drain at the end of the wash portion of the cycle. The tank then refills with fresh water and the chlorinated sanitizer and rinse aid are injected. This solution is then sprayed over the dishes during a final rinse and then stays in the tank for the start of the next cycle. On a fill & dump dishmachine, the final rinse water from the previous cycle has fresh detergent added to it for the next cycle. As a result, dishes are always

washed in the “clean” water by a fill & dump dishmachine.

Undercounter dishmachines are a special type of dishmachine. Modeled after a homestyle dishmachine, they are installed under counter tops in a kitchen. However, there are several differences. Industrial undercounter dishmachines are made from stainless steel, like standard high and low temp dishmachines. Homestyle undercounter dishmachines are made from plastic or ceramics. In an undercounter dishmachine, the rack is loaded while in the machine. In a door type dishmachine, the rack is loaded and then pushed into the dishmachine. Because of the extra time needed to load and unload the undercounter dishmachine, they cannot run as many cycles in an hour as a door type dishmachine. In addition, the cycle time for an undercounter dishmachine is 2 to 3 minutes long instead of the 60 to 90 seconds for a door type dishmachine. Undercounter dishmachines should only be used in low volume kitchens.

In all types of dishmachines, a chemical called a rinse aid or rinse additive is added to the final rinse water to make the water “sheet” off of the ware. This eliminates spotting and filming on the ware, especially on the glasses. High-temp dishmachines have detergent and rinse aid while low-temp dishmachines have detergent, rinse aid and a chlorinated sanitizer. While there are a variety of dishmachine types, the most basic is the door-type single rack dishmachine. An industrial dishmachine can cost a few thousand dollars for a standard door-type single rack dishmachine up to tens of thousands of dollars for multitank conveyor dishmachines.

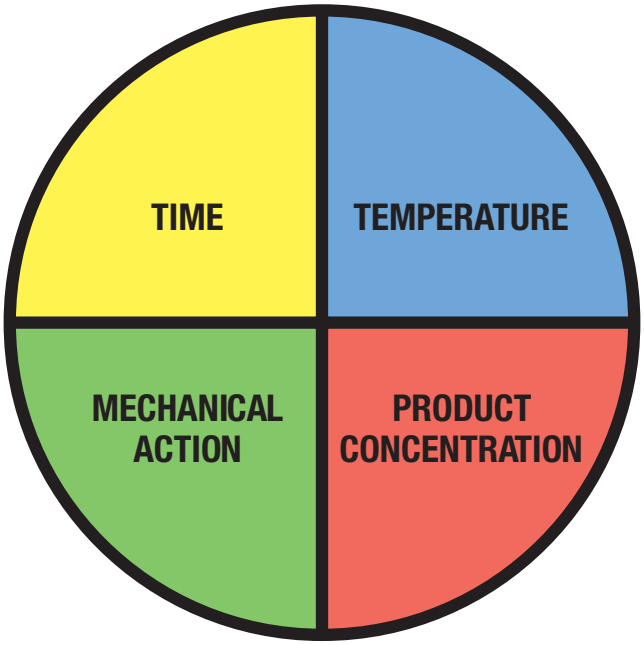
ESSENTIAL COMPONENTS OF CLEANING

The four essential components of cleaning are: time, temperature, mechanical action and product concentration. These four factors work in balance with each other to clean. If any one area is to be decreased, such as cleaning time, there must be a corresponding increase in another area. These factors hold true for all cleaning, not just warewash. Water works hand-in-hand with these components. Water is known as the universal solvent and is necessary to perform proper cleaning in the dishmachine. There are 2 basic soil types: water soluble and non-water soluble. Whenever the soils are water soluble, the presence of large quantities of water will aid in the cleaning.

Time

In mechanical warewashing, the standard doortype high-temp dishmachine has a 60 second cycle that can be broken into 3

ESSENTIAL COMPONENTS OF CLEANING



parts. The wash is the first portion of the cycle and lasts 45 seconds. The wash is followed by a 3 second dwell and then a 9 - 12 second final rinse. For low-temp dishmachines, the cycle can be up to 90 seconds long, while for undercounter dishmachines, the cycle can be 2 to 3 minutes long. In all cases, once the cycle is set, it always runs for the same amount of time on that particular dishmachine. The specifications for the time of a cycle can be found on the NSF sticker that all dishmachines must carry.

Temperature

High-temp dishmachines have a wash temperature of 140 - 160°F and a final rinse temperature of 180 - 195°F. Some high-temp dishmachines have 165°F final rinse water, but this is not common today. If that is the case, then the final rinse is a minimum of 30 seconds instead of the 9 - 12 seconds it is in a door-type dishmachine. Low-temp dishmachines have a wash temp of 120 - 140°F. The final rinse temperature is 120°F or higher.

Mechanical Action

In an industrial dishmachine an impeller pump with (typically) a 1.5 hp motor sprays the detergent solution through small jets in metal tubes called wash arms. These wash arms may be fixed or may rotate. In either case, the wash arms create a spray pattern that allows the machine to spray all of the surface of the ware. The velocity of the detergent solution helps remove food soils from the ware. In a door-type single rack dishmachine, when the final rinse water is sprayed on the ware, the final rinse water is sprayed

through a separate set of jets and arms. The pressure of the water is 15 - 25 psi, which is again based on a NSF guideline. Some dishmachines (fill & dump low-temps) pump the water through the same arms as the wash water. The action of washing and rinsing provides the friction or mechanical action that does the majority of the cleaning in a dishmachine.

Product Concentration

The concentration of mechanical warewash detergent used in a dishmachine varies due to the environmental conditions discussed in this brochure. While the amount of product varies, product concentrations from 1000 ppm to 2500 ppm are the most common. As a percentage of the whole circle of essential components of cleaning, product concentration is the smallest slice. However, it is a very important slice because the use of chemicals allows us to have a short (60 second) total cycle. All the other 3 essential components of cleaning are fixed and can't be changed. This is the only component that is easily changeable in dishwashing.

THE ENVIRONMENT

The environment for a warewash operation consists of the following five areas. By surveying all five areas, all of the areas that can cause poor results can be identified.

THE WAREWASH ENVIRONMENT

1. **Procedure**
2. **Water Quality**
3. **Equipment**
4. **Nature of Substrate**
5. **Nature of Soil**

Procedures

Warewash procedures are a common and easily correctable source of problems. The ware must be handled properly to get good results. When customers start to have poor results, one of the first areas to check are the procedures. These procedures include: bussing/sorting, presoaking of flatware, prescraping, racking, washing, rinsing, air drying and dishmachine cleaning.

1. Bussing/Sorting

Bussing or sorting is the physical collection of soiled ware from the foodservice operation tables. When bussing a table, check to see if the busperson is stacking glasses inside one another, putting flatware inside glasses or allowing soiled ware to sit for extended periods of time. Each of these can lead to poor results.

2. Presoaking

When soiled flatware is brought into the dishroom area, the flatware should be placed in a presoaking solution. This will loosen the soils and make it easier to clean the flatware in one pass through the dishmachine. Presoak should be added to the water in the buspan before the ware is added. If presoak is placed directly onto the flatware, especially if the flatware is plated (lower quality), this can damage the flatware. To test if flatware is plated, use a magnet. Lower quality flatware is magnetic. After presoaking, the flatware is placed on a rack and rinsed before being washed in the dishmachine. Failure to rinse the presoaking solution from the flatware can lead to foaming in the dishmachine.

3. Prescraping

On the soiled side of the dishmachine, there should be a scrap sink and a garbage disposal with an overhead hose and sprayer. This sprayer is used to rinse food particles off of the dishes prior to washing in the dishmachine. The dishmachine is not a garbage disposal. If the dishmachine operator puts large amounts of food waste into the machine by failing to prescrape, results will be poor and detergent will be wasted.

4. Racking

When dishes have been sorted by type and prescraped, they can be loaded into the dishmachine. Most machines have square racks that the dishes are loaded onto. Plates should have a 10° back angle so that the upper rinse arm can wash the front of the plate. Racks should be full but not overloaded. It is important to sort the ware by type and load like ware in the same rack, because otherwise the variety of sizes shields smaller pieces from the proper mechanical action of the machine. If large and small plates are alternated in the same rack, the small plates will not get cleaned properly. In some cases a large pan or tray is placed on the rack last and covers all of the ware underneath. This is always an improper procedure, because it severely limits the mechanical action of the dishmachine. When flatware is placed in a rack, the flatware should be less than 2" deep on the rack.

5. Washing

Dishmachine temperatures and rinse pressure should be

within the correct operating ranges. Machine temperature gauges often get limed up. To accurately measure the tank temperature, use a holding thermometer or temperature sensitive tape. In a high-temp dishmachine, the wash is 140 - 160°F. Low-temp dishmachines should wash between 120 - 140°F.

6. Rinsing

On a high-temp dishmachine, the final rinse temperature should be between 180 - 195°F. U S Chemical recommends keeping the final rinse temperature between 180 - 185°F. Higher temperatures lead to poor rinsing and problems with glassware as will be explained later. On a low-temp dishmachine, the final rinse temperature should be 120°F or higher.

7. Air Drying

After a rack of dishes comes out of the dishmachine, the dishes should be allowed to air dry. This will help insure they dry without spots and insures that the dishes are sanitary. Towel drying or stacking the dishes when wet can lead to bacterial growth and unsanitary conditions which can cause disease. Glasses with indented bases should be tipped immediately after removal from the dishmachine to prevent streaking or evaporative pooling. Tipping the racks drains the water from the base and keeps the water from causing problems. If the water cools in the base, when the rack is finally moved, the water will drip down the side of the glass and form streaks.

8. Dishmachine Cleaning

At the end of a shift, the outside and inside of the machine should be rinsed. The wash and rinse arms should be removed and cleaned. Wash arms with caps on the ends should have the caps removed and the arms should be rinsed out. If the dishmachine is equipped with curtains, they should be removed and washed. Scrap trays should be removed and cleaned. When necessary, the machine should be delimed as well. As part of the inservice provided for the dishmachine operator, cleaning, deliming, and stainless steel polishing procedures should be taught. The machine should be left clean and empty with the doors open overnight.

Water Quality Parameters

The water quality affects the choice of detergent and rinse aid. (see chart on below)

1. Total Dissolved Solids (TDS)

TDS is a measure of all of the minerals present in the water supply. High TDS can contribute to problems with soil removal and poor rinsing. Where there is high TDS, detergents with good water conditioning can help with the wash and higher quality rinse aids can help with the rinse.

2. pH

pH is a measure of the relative alkalinity or acidity of the water supply. The lower the pH, the less problems expected in rinsing.

DESIRED WATER QUALITY PARAMETERS

Total Dissolved Solids (TDS)	< 500 ppm
pH	6-8
Silica	< 50 ppm
Iron	0 ppm
Copper	0 ppm
Manganese	0 ppm
Chloridees	< 50 ppm
Sulfates	< 200 ppm
Bicarbonate Alkalinity	< 200 ppm

Calcium & Magnesium Hardness (gpg = grains per gallon) (1 gpg = 17.1 ppm hardness)	**gpg**	**Classification**
	0.0-2.0	Soft
	2.0-4.0	Slightly Hard
	4.0-7.0	Moderately Hard
Softening recommended for water above 7 gpg hardness.	7.0-12.0	Hard
	12.0-20.0	Very Hard
	20.0 and up	Extremely Hard

3. Calcium and Magnesium
Water hardness (lime scale) is made up of calcium and magnesium. Where there is heat, cold or alkalinity, water hardness will become insoluble and attach itself to surfaces. In a dishmachine, heat and alkalinity are present, so water hardness can cause problems. Where there is high water hardness, a mechanical warewash detergent with good water conditioning ability is needed. This will allow for chelation or sequestration of the hardness, which means that the hardness can be held in suspension and prevented from depositing onto the ware. Poor water conditioning ability of the detergent can lead to white films on glasses, plates, and flatware. Water softeners are often installed in foodservice operations to remove the water hardness so that it doesn't cause problems in the dishmachine as well as throughout the kitchen.

4. Silica
Silica in the water supply can contribute to the formation of a nonremovable white film on glasses. This nonremovable white film is called a silica film. Silica filming is accelerated by rinse temperatures over 185°F, high levels of silica in the water supply, detergent residues on glassware, and improper drying, where moisture is allowed to remain on the glass for prolonged periods of time. Silica also is found naturally in glass. Anything that attacks the surface of the glass (removing silica from the glass itself) can leave a hazy film that is nonremovable. Proper rinse aid selection helps control silica filming, but over time, especially in a high-temp dishmachine, glassware surfaces will break down and become hazy. This is a natural occurrence for glassware and is not correctable.

5. Iron
Iron can cause a rust colored and/or bluish residue on the inside of the dishmachine. Chlorine will react with the iron in the water supply and precipitate out as rust. Low-temp dishmachines have this problem frequently because chlorine is always present in the dishmachine. In high temperature dishmachines, using a non-chlorinated detergent can help minimize the problem.

6. Copper and Manganese
Although these metals are part of a standard water analysis, they are rare. They don't generally cause problems in warewash, only in laundry.

7. Chlorides
Chlorides are salts that can cause corrosion of metal parts in the dishmachine and can cause filming and streaking problems on glassware. High levels of chlorides are usually caused by water softener malfunctions. Better quality rinse aids help control problems with naturally occurring chlorides.

8. Sulfates
Sulfates are generally not a problem in warewash, although at high levels (>200 ppm) they can cause rinsing problems similar to chloride problems.

9. Bicarbonate Alkalinity
Bicarbonate alkalinity (bicarb) is inactive alkalinity naturally occurring in the water supply. The water supply picks up these minerals as water is filtered through the ground into the water table. Bicarbs tend to raise the pH of the water supply and can cause spots and filming on the ware, especially glasses. Bicarbs are not removed by using a water softener. As the water table changes during the year, it is very common for the bicarb levels to change as well. Using a better quality rinse aid helps to control spotting and filming problems when high bicarbs are a problem.

Equipment
The equipment (dishmachine) that the customer has should be investigated and anything that might be a problem should be identified. Among the things to check are the:

1. Wash and Rinse Arms
Wash and rinse arms can easily become plugged with food soil or mineral buildups. This can reduce the mechanical action of the dishmachine. Check to see that the jets are clear of obstructions, that the rinse jets are not limed up, and that both sets of arms turn freely.

2. Probe
A probe is a sensor used to monitor the conductivity of the wash tank. The conductivity changes as the concentration of detergent changes in the wash tank. Fill & dump dishmachines with their small wash tanks do not use a probe. The 3 main types of probes are: button, bayonet and spark plug probes. These probes all work the same way. As the alkaline detergent solution circulates in the wash tank, the probe senses changes in conductivity and relays a signal to the chemical dispenser that either it is OK or that it needs more detergent.

If a probe wire becomes disconnected, the dispenser will feed detergent continuously. If the probe becomes limed up, the dispenser will feed continuously as the probe poles become shielded by the lime. It is important to keep the probe in good working condition by cleaning and deliming it frequently.

When the probe is initially installed in the wash tank, it should be located 3 inches from the bottom of the wash tank, opposite the detergent injection point, and away from the heating element. If the probe is located under the detergent injection point, it will cause the dispenser to turn on and off constantly. First, it senses detergent and shuts off the dispenser. Then, as the detergent is mixed in the tank water, the probe will call for more detergent. Locating the probe near the heating element will cause it to lime up more quickly.

3. Heating Element
The heating element should be checked for lime and cracks. Split heating elements can send stray voltage into the wash tank interfering with probe operation and causing the detergent dispenser to feed constantly.

4. Wash and Rinse Temperatures
Check to see that the wash and rinse temperature gauges are operational. Use a holding thermometer or temperature sensitive tape if the gauges are defective. Defective temperature gauges are routinely written up by health departments when they perform their inspections, so advise the customer of this situation if there is a problem.

5. Drain O-Rings
Drain O-rings can become cracked or fall off. This can cause a leaking drain which will cause excessive detergent and water usage with a potential for burning out of heating elements.

6. Lime Buildup
Lime buildup on the inside of the dishmachine is an indication of a water hardness problem. Lime buildup is a hard white film that can cause overuse of detergent or poor results. This buildup can be caused by insufficient water conditioners in the detergent, not enough detergent, or a water softener malfunction. Acid delimers will remove lime films through deliming of the dishmachine, which is a routine procedure in dishmachine maintenance.

7. Rinse Pressure
The final rinse pressure should be 20 psi, with 15 -25 psi as the acceptable NSF range. On most dishmachines, the final rinse line will have a pressure regulator in it. This regulator usually has an adjustment knob to control water flow so that the water pressure can be changed if necessary.

8. Dishmachine Voltage
Dishmachines can operate on 110, 208/220 or 440/480V. Be sure to check the NSF sticker to identify the voltage before installing your equipment. Always be sure to turn off the power and take appropriate lockout/tagout precautions. With U S Chemical produced equipment, a stepdown transformer is required if the machine voltage is 440/480V.

9. Dishmachine Make and Model
Take the time to familiarize yourself with any dishmachine being seen for the first time before starting an installation. If U S Chemical Training Department is called for technical support, be sure to have all of the relevant information at hand. Since not all equipment works on all machines (as an example, a probed dispenser can't be used on an undercounter dishmachine) check the instruction/installation manuals or call the U S Chemical Training Department for any questions.

Nature of Substrate

This section is about the surfaces (substrates) being washed. Glass, plastics, and metals all behave differently, so when doing a survey it is important to know what materials are being put into the dishmachine.

1. Plastics
Unlike glass, plastics don't hold heat very well, so they have problems drying. Plastic scratches and stains easily, but it is more durable than glass or ceramics. As a result, plastics will last longer than glass and will often look more worn because of their age.

Styrene etch is a nonremovable white film on plastics caused by the breakdown of the protective coating on plastics (the styrene finish). This is a natural occurrence in the life-cycle of plasticware. Styrene etching is accelerated by high final rinse temperatures, excessive detergent concentrations, or presoaking in chlorine bleach. U S Chemical recommends a final rinse temperature of 180 - 185°F to help control this problem. Even though the acceptable range for the final rinse temperature in a high-temp dishmachine is 180 - 195°F, rinse temperatures over 185°F accelerate

styrene etching. Some customers use higher booster heater temperatures to make up for undersized water heaters. As the water going to the booster heater cools down during a meal, they can still maintain the 180°F necessary to meet the health codes.

2. Glass
Glass breaks easily and can be damaged by silica filming (explained in the water quality section) and etching. Etching or scratches are caused by rubbing 2 glasses together or rubbing some other hard surface against a glass. Flatware stacked inside glasses causes etching as does nesting (stacking) glasses.

3. Porcelain
Porcelain is a ceramic coating on a metal surface. Porcelain pieces should be hand washed, but can be run through a dishmachine as long as the detergent is metal safe. If a heavy duty detergent were used and the ceramic were to be chipped, the caustic would attack the metal and degrade it.

4. Metals
Metals can be categorized into several groups. Chemical safe hard metals include most varieties of stainless steel. Soft metals include aluminum, gold, tin, copper, lead, silver and pewter. Mechanical warewash detergents can be either heavy duty or metal safe. Heavy duty detergents contain high active alkalinity in the form of caustic soda (or caustic potash in liquids). This strong alkalinity will damage any soft metal by pitting or blackening it. If any of the listed soft metals are being washed, use a metal safe detergent. Many of the soft metals, especially gold and silver, are also damaged by chlorine. If anything with gold or silver trim or silver plated flatware is being washed, use a nonchlorinated detergent in addition to the detergent being metal safe. A chlorinated detergent may be metal safe and be safe on soft metals, such as aluminum, but not be safe on precious metals, such as gold or silver. This distinction is very important, as doing it wrong can be very expensive.

5. Flatware
There are many grades of flatware. There is aluminum flatware, stainless plated flatware, solid stainless flatware, and silver plated flatware. The lower quality plated flatware is magnetic, so it can be differentiated from high quality stainless which is not magnetic. Aluminum flatware is dull, not shiny. With cheaper flatware, more care must be used to protect it from damage.

Nature of Soil
It is important to review the types of foods that the foodservice operation is serving, so that problems that might be encountered can be identified. Certain foods, especially those that are heavy starches or heavy greases, can cause results problems. Before explaining how to clean food soils, the concept of pH first needs to be explained.

pH is a measure of the relative acidity or alkalinity of a substance. Everything has a pH. Chemicals, water, milk, skin, everything. pH is not strictly a measure of strength. It is a logarithmic scale going from 0 to 14. A pH of 7 is neutral, meaning it is neither acidic nor alkaline. As the pH changes from 7 to 8 to 9, the substance becomes more alkaline. Whereas pure water has a pH of 7, baking soda has a pH of 8 - 9, meaning that it is slightly alkaline. Bar soap is more alkaline with a pH of 9 - 9.5, while mechanical ware-wash detergents have a pH from 11 - 12.5. Pure caustic soda (sodium hydroxide or lye) has a pH of 13.2. The higher the pH, the more the substance will desire to react with an acidic soil.

On the acidic side, the lower the pH the more acidic the substance. The pH of skin is 5 - 5.5. The pH of a laundry sour is 3 - 3.5. The pH of a strong mineral acid, like phosphoric or hydrochloric (muriatic) acid is 1 - 1.5. The lower the pH, the more a substance desires to react with something alkaline.

Foods that are acidic, such as tomato sauces and fats, greases and oils, will react with alkalinity. This reaction makes them easier to remove. Foods without much acidity, like starches, can be tougher to remove. To understand how a mechanical warewash detergent works, next is a look at the cleaning processes at work in the dishmachine.

CLEANING PROCESSES
1. Saponification is the reaction of an alkaline detergent with an acidic soil which forms a water soluble soap. All mechanical warewash detergents use this cleaning process. Acidic soils are generally fats, greases, and oils associated with food, food preparation and humans. Acidic soils can be found in fryers, grills, ovens, kettles, dishes, dishmachines, floors, grill vents and screens, floor grates, drains, sinks, toilets, walls, coolers and freezers.

2. Oxidation is a reaction that removes the color or pigment of an organic stain. The chlorine in a dishmachine detergent does this. Chlorine does very little cleaning, it mostly destains. If small amounts of food (stains) remain on

a dish, the chlorine will remove the color of the stain. The only soil chlorine helps remove is protein.

3. Dissolving is the reaction of an acidic detergent with an alkaline soil. The acidic detergent breaks down (dissolves) the alkaline soil. All delimers use this cleaning process. Alkaline soils are associated with water, water minerals and detergent residues. Alkaline soils can be found in sinks, dishmachines, toilets, ice machines, coffee machines, steamers, chafing dishes, coolers and freezers.

These are the three cleaning processes that take place in a dishmachine. The detergent will saponify the soils and chlorine will oxidize the stains left on the ware. To clean the dishmachine, delimer is used to dissolve the mineral buildup inside the dishmachine. Having explained how the cleaning processes work, the chemistry of mechanical warewash detergents is now described.

MECHANICAL WAREWASH PRODUCTS

Mechanical Warewash Detergents

The determination of which product is appropriate is one of the results of doing a good survey. The amount of detergent used is based on the environmental factors, which detergent is being used, and ultimately, results. Regardless of the detergent being used, detergent concentrations of 1000 to 2500 ppm are most common in dishmachines. Detergents are formulated with a combination of the following five ingredients. Not all detergents will have all 5 of these chemical types, which is why there are so many varieties of warewashing detergents.

1. Alkalinity

Regardless of the source, alkalinity is a substance with a high pH that provides saponification. Products in which the alkalinity comes from free caustics (sodium or potassium hydroxide) are considered “heavy duty” as they will handle the heaviest of soil conditions. However, they are not safe to use on soft or precious metals. Metal safe detergents use silicates, phosphates, and carbonates to provide alkalinity without damaging metals. However, even a metal safe detergent can damage soft metals if used improperly, so care should be exercised in using the product.

2. Water Conditioners

Water conditioners are used to chelate or sequester the water hardness. Water conditioners can also help suspend minerals in waters with high TDS. Some types of water conditioners can also contribute a small amount of alkalinity. However, their primary purpose is to control the precipitation of water hardness minerals.

3. Silicates

Silicates are often used as metal protectors or corrosion inhibitors. Especially in older dishmachines, it was common to not use stainless steel for various parts. Using a detergent with metal protectors will help protect the dishmachine from corrosion, especially if the parts in question are made from iron.

4. Chlorine

Chlorine is added to the detergent to provide destaining. Typically used at levels of 10 - 25 ppm in the dishmachine wash tank, the chlorine in the detergent does not provide sanitization. Nonchlorinated detergents are often used when there are precious metals (which the chlorine would attack), if the dishmachine is a low-temp dishmachine (chlorine is already present as a sanitizer in much higher concentrations), in pot washers (where only metals, especially aluminum, are being washed and no destaining is needed), or if there are high iron levels in the water supply (which can cause staining of ware and the dishmachine).

5. Surfactants

Surfactants are used in warewash products as defoamers. “Surfactant” is a shorthand term for a chemical that is a “surface active agent”. Surface active agents reduce the surface tension of the water. All surfactants foam at some temperature. The surfactants used in a mechanical warewash detergent have a special property in that they help control foaming caused by food soils or high TDS when used at normal operating temperatures in a dishmachine.

When selecting a mechanical warewash detergent, there are 3 basic questions to ask. Apart from deciding if a liquid, powdered or encapsulated detergent is most appropriate, answering these 3 questions during a survey will allow for the selection of the correct detergent every time.

1. Heavy Duty vs. Metal Safe

It is assumed a heavy duty detergent is the best choice. Reasons are then sought which might indicate that there is a need to use a metal safe product. If the foodservice operation is running aluminum or any soft metals through the dishmachine, a metal safe detergent is needed.

2. Hard Water vs. Soft Water
During our survey, the water hardness is checked using the Total Test Kit. The result of that test determines how much water conditioning the detergent needs to have.

3. Chlorinated vs. Nonchlorinated
It is assumed that a chlorinated detergent is needed to provide proper destaining. Reasons are then sought that might indicate a need for a nonchlorinated detergent. These reasons include using a low-temp dishmachine, iron in the water or precious metals being washed.

Rinse Aids

Rinse aids or drying agents are formulated with a blend of surfactants. These surfactants are very specialized in that they do not foam at all above a certain temperature. While all surfactants foam at some temperature, the surfactants in rinse aids do not foam above 120°F. At this temperature, the rinse aids change chemically so that they cannot foam. When used at proper operating temperatures in a dishmachine, rinse aids do not foam and help to control foaming caused by other sources.

Rinse aids are added to the water in the final rinse so that it drains off of the ware without leaving spots or filming. The surfactants do this by reducing the surface tension of the water, which is called "sheeting". When this happens, the water can't form drops. For a rinse aid to work, the glasses and ware must be clean. Also, the final rinse pressure and temperature must be correct.

In a high-temp dishmachine, if the final rinse temperature is too high, the water mists instead of giving droplets. This keeps the water from sheeting. If the final rinse pressure is too low or too high, the amount of water on the ware is incorrect and the ware doesn't drain properly.

There is an older style of rinse aid on the market called an acidic rinse aid. These rinse aids control the minerals by using a mineral acid. The problem with them is that they can't be used in low-temp accounts as the chlorine in the sanitizer would react dangerously with the acid, resulting in a release of chlorine gas.

To select the correct rinse aid, a water hardness and bicarbonate alkalinity test must be done during our survey. The combination of hardness and bicarbs can then be used to select the correct rinse aid based on the parameters that the rinse aids are designed to handle.

Delimers

Delimers are acid based cleaners for the dishmachine. Used to remove mineral buildups from hardness or bicarbonate alkalinity, delimers are either a single acid, such as phosphoric acid, or a blend of acids, such as phosphoric and hydrochloric (muriatic) acids. The delimers that are only phosphoric acid based can be used on plated metals found in equipment such as ice machines. Any delimer with hydrochloric acid is designed for stainless steel only. Although the hydrochloric does contain an inhibitor to keep the acid from reacting with the stainless, if hydrochloric acid were left on stainless steel overnight, the stainless can be damaged.

To delime a dishmachine, start by turning off the detergent dispenser. Drain the dishmachine tank and refill it with water. If the dishmachine is equipped with a manual fill, refill the dishmachine tank from 1/2 to 2/3 full and then add the delimer. If the wash tank is filled completely full, as when the dishmachine has an automatic fill, there is a danger that the delimer will overflow down the drain tube instead of staying in the dishmachine wash tank. Delimer is then added to the wash tank. Some dishmachines have deliming switches that keep the dishmachine in a wash mode without going into the rinse. After running the dishmachine for 15 minutes, or however long it takes to remove the lime from the inside of the machine, drain and rinse the dishmachine tank. If the dishmachine is not going to be used immediately, leave the dishmachine open to air dry. Otherwise, refill the dishmachine and continue to wash dishes, making sure that the chemical dispenser is turned back on and the delimer switch is reset in the "run" position before washing dishes.

Warewash Specialty Products

Two important types of warewash specialty products are oxygen destainers and flatware presoaks. Oxygen destainers are designed for use in 120°F+ water for removing coffee and tea stains from the inside of cups and mugs. Oxygen destainers can also be used on plates, trays, cups, mugs, glasses and other plastics. As the protective coating on plastics breaks down, the underlying plastic is more susceptible to staining. Because there is no way to repair this damage, the oxygen destainer can be used to prolong the life of the plasticware by removing stains. An easy test to demonstrate that the surface of the plastic has been damaged is to use

a #2 pencil and make a mark on the plastic. If the mark can be wiped off with your finger, the finish is still fine. If the mark cannot be easily removed, the plastic coating has been damaged. The damage to the plastics is caused by contact with chlorine, contact with high alkalinity, or simply normal wear and tear as the plastic is used.

Flatware presoaks are used to loosen foodsoils on flatware prior to washing in the dishmachine. Coming in powders, liquids, solid or encapsulated forms, all presoaks are a combination of alkalinity and surfactants.

When silver plated ware is being used, a presoak can also be used to detarnish. Simply line the buspan with aluminum foil, add water and the presoak, and then add the ware. After 15 minutes remove the ware and wash normally. Do not leave the silver plated ware in the presoak too long. Stainless plated ware is not detarnished by this method.

SURVEYING

Now that the areas to survey in a foodservice operation have been explained, here is a list of what is needed to perform a proper survey.

1. Procedures

Check all of the procedures to insure that the customer is using the dishmachine properly.

2. Water Quality

Test the water hardness and the bicarbonate alkalinity and look for evidence of problems caused by the water.

3. Equipment

Note what equipment the foodservice operation is using and any problems with the equipment. What dishmachine is being used is also important in selecting our dispensing equipment.

4. Nature of Soil

What types of food soils are present? What gives the foodservice operation the most cleaning problems?

5. Nature of Substrate

What types of ware and flatware are being washed? Are there other materials (baking pans, kettles) being washed in the dishmachine?

Having surveyed the environment, the detergent and rinse aid can be selected. A cost per rack or cover can be calculated, an appropriate proposal can be written, and the sales presentation can be made. For assistance in survey selling, U S Chemical has created institutional survey programs appropriate for use on laptop computers.

SUMMARY

This brochure explained all of the factors that are important in a warewash environment and how those factors can affect results. The fundamentals of cleaning in mechanical warewashing were reviewed as was proper mechanical warewash product selection. This brochure is designed as an aid for the sales/service specialist to familiarize them with the factors important in surveying and ultimately, in getting and maintaining good results.