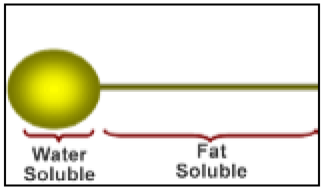
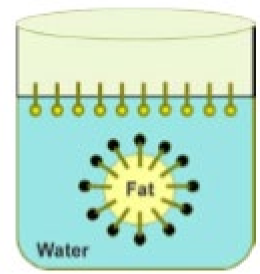
Surfactant Cleaners

Surfactants form bridges between fats and water because each molecule has two chemical groups; one that is attracted to water and one that is attracted to fat-soluble soils. In a cleaning solution, the fat soluble end of the surfactant molecule orients and binds to the insoluble fat, oil, or grease molecule while the water-soluble end binds to water molecules. Surfactants are thus able to penetrate insoluble soils and disperse them into the cleaning solution where they are carried away from the surface. Because detergents are manufactured from synthetic materials, their properties can be varied to a considerable extent.



Many surfactants produce foam as they clean. However, foaming capacity is not always related to cleaning efficiency. In fact, too much foam can make cleaning less effective, rinsing more difficult, and can cause problems with drainage and sewage systems.

Nonionic detergents are made from electrically neutral molecules and do not carry a charge when dissolved in water. They have low foaming properties and are, therefore, useful in clean-in-place systems where rapid and complete rinsing after cleaning is a desirable property. Specially formulated nonionic surfactants may be added to other detergents to decrease foaming properties.



Nonionic detergents can be formulated to remove specific types of soils by varying their hydrophilic ("water loving") or hydrophobic ("water hating") characteristics. Because they are neutral, they do not interact with other anionic or cationic detergents or with minerals in hard water. For this reason, they are widely used in many general use cleaning formulations. Examples of nonionic detergents include polyethenoxyethers, ethylene oxide-fatty acid condensates, and amine-fatty acid condensates.

Anionic detergents are negatively charged in water solution. They are compatible with acid or alkaline cleaners. However, they are disadvantaged by their high foaming capacity and incompatibility with cationic detergents. Examples include sulfated alcohols and hydrocarbons, aryl alkyl polyether sulfates, sulfonated amides, and alkylauryl sulfonates.

Cationic detergents are usually derivatives of ammonia compounds and carry a positive electrical charge. They are not as effective in cleaning as nonionic and anionic detergents. However, they have found wide use in the food processing industry because they also possess antimicrobial properties. The most common class of cationic detergents are the quaternary ammonium compounds, also called "Quats". Quat detergents also have anti-microbial properties and are widely used as sanitizers.

Identification Chart

Identification	Description	Probable Causes	Procedure for Removal
Biofilm	Slimy layer in continuously wet areas	Inadequate cleaning and sanitizing	Clean with manual scrubbing and sanitize with Quat detergent
Protein Film	A blue or rainbow colored film having a varnish-like appearance similar to dried apple sauce	Use of a non-chlorinated cleaner. Inadequate pre-rinse. Periodic instead of regular cleaning.	Make a paste with equal parts of chlorinated cleaner, alkaline cleaner and water and apply this to the soil. Allow to soak and then wash with water
Fat, Grease or Oil Film	A greasy, oily sometime white film on which water forms into beads.	Use of an acid product for washing. Low wash temperature. Oil from equipment.	Wash with a hot alkaline surfactant solution
Factory soil	A black and/or greasy film	Oil and din from manufacturing process. Grease or oil for protection during storage.	Wash with a hot foamy, alkaline detergent. If rusty wash with an acid product.
Surfactant film	A blue film.	Poor rinsing	Wash with hot detergent solution. Brushing may be necessary.
Food Stabilizer Film	A white, sandy deposit	Adherence of food stabilizers from foods such as cheese, ice cream, convenience foods, etc. when only alkaline cleaners are used	Wash with an acid solution
Rubber Film	Black streaks or a film which may be sticky	Reaction of rubber with a chlorinated product or gaining of rubber.	Wash with an acid solution. Replace rubber parts that are sticky or that still have black streaks.
Silica Film (Very Rare)	A white or gray glaze	Silica from a water supply when there is poor rinsing or when mechanical cleaning is used where manual cleaning is specified	Clean with a special acid wash, hydrofluoric acid. This acid is very dangerous and cannot be used without proper approval
Mineral Deposit	A white, gray or yellow deposit such as with milkstone, beerstone, waterstone, etc	Minerals in water settling out or reacting with substances in milk, beer, meat, or fruit and then settling out.	Wash with an acid product. In breweries, a solution of EDTA in water is often used to remove beerstone.
Iron Deposit	A red, brown, or black deposit	High iron content in the water supply or iron from systems components and a lack of iron removal equipment.	Wash with an acid product, a 5% citric or oxalic acid solution are good examples or a strong chelator.

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Corrosion	A rusty or pitted surface	Migrating metal particles or excessive contact time with high chlorides at low pH	Wash with an acid product and brush to remove rust. Re-polish and passivate pitted surface.
Corrosion	A black residue or deposit	Contact of two different metals such as two type of stainless steel	Wash with an acid product.
Corrosion	A blue to black film on stainless steel in high temperature equipment	Oxidation through foaming or aeration under conditions of high alkalinity and high temperature	Treat with potassium permanganate and phosphoric acid, de-staining procedure (check with supervisor)
Etching	Pitting, usually with a white deposit	Use of improper chemicals or failure to use chemicals correctly	Re-polish and passivate pitted surface

*The conditions listed below pertain to plastic materials, normally tubing, that are ordinarily clear and colorless. All of them can be prevented or postponed by careful adherence to good cleaning procedures. However, all plastic must be replaced eventually.

Opaque condition	Plastic no longer clear; may appear white.	Adsorption of moisture due to poor draining or lack of drying	Expose to heat and light (sunlight). Forced air drying may be necessary
Yellowing	Gradual formation of yellow discoloration	Ageing of plastic of improper use of iodophor	Cannot be removed. Replace the plastic.
Brown or black film	Brown or black deposit may appear as specs, steaks or film and may appear suddenly or gradually.	Migration of rubber particles or carbon particles from motors	Wash with acid solution. Replace the plastic if washing does not remove the film.
Red stain	Bacterial pigment	Pigment from the organism, Serratia marcescens	No procedure is known to remove this stain
Pink or purple stain	Bacterial pigment	Pigments from the organism, Steptococcus rubrireticuli	Wash with highly alkaline solution

Types of Cleaners

Cleaner	Description	Mode of Action	Advantages	Disadvantages
Surfactant	• Soaps • Detergents Non-ionic (neutral charge) Anionic (negative charge) Cationic (positive charge)	• Increases penetration of cleaning solution by reducing surface tension. • Emulsifies and suspends soils so they are more easily dispersed into solution	• Effective against fats, oils, and greases • Cationics also have disinfectant properties	• Soaps form insoluble precipitates in hard water • Anionics and cationics tend to from hard to rinse foams
Alkaline Cleaner	• Strong alkalis Sodium hydroxide (caustic soda) or tri-sodium phosphate (TSP) • Moderately strong alkalis Sodium, potassium and ammonium salts of phosphates, silicates and carbonates	• Disrupts and swells soil particles and disperses them into solution • Reacts with insoluble fat molecules to form soluble soap • Chemically breaks down large molecules into smaller, more soluble pieces	• Effective against proteins, fats, and oils	• Caustic solutions may be hazardous to workers • Strongly caustic cleaners may damage metal and ceramic surfaces unless corrosion inhibitors added • May form mineral films when used with hard water
Acid Cleaner	• Strong acids Phosphoric acid, nitric acid, sulfamic acids • Weak acids Hydroxyacetic acid, citric acid, lactic, gluconic acid	• Dissolves mineral deposits • Chemically breaks down large molecules in smaller soluble pieces	• Regular use prevents buildup of mineral deposits • Breaks down fats and carbohydrates • May be used as an acid rinse after alkaline cleaning	• Strong acid cleaners are hazardous to workers • Corrosive to metal surfaces • May form hard to remove protein deposits on surfaces
Oxidizing Agents	• Sodium hypochlorite, sodium perborate, sodium percarbonate, hydrogen peroxide.	• Chemically breaks down large molecules in smaller soluble pieces	• Effective for removing protein deposits	• High alkalinity may cause mineral films to form in hard water • Some require high temperatures to be effective
Enzymes	• Protease (proteins) • Lipase (fats) • Amylase (Carbohydrates	• Highly specific reactions break down large molecules in smaller soluble pieces	• Effective against proteins, fats and oils, and carbohydrates	• Activity is strongly dependent on pH and temperature • Inactivated at high temperatures • More expensive than other cleaners

Enzyme Cleaners – Enzymes speed up chemical reactions by binding reactants to the enzyme and altering them so that they require extremes in pH or temperature to may be carried out under milder conditions. Enzyme reactions can be explained by the lock and key analogy. Each type of enzyme molecule has a specific shape (lock) that will only accept a particular substrate (key) can fit into that lock. Once the reaction is complete, the products are released from the enzyme surface and the enzyme is available for another reaction cycle. Enzymes are generally named according to the substrate on which they act and usually have a suffix "ase". Thus, for example, proteases act on proteins, lipases act on lipids and amylases on amylase starch molecules.

Acid Cleaners – Acids are applied directly or added to detergents to increase their cleaning power. Some commonly acids used are phosphoric acid, nitric acid, and sulfamic acid. Milder organic acids such as hydroxyacetic acid, citric acid, latic and gluconic acid are also used.

Alkali Cleaners – Alkaline cleaners range from mild to highly alkaline (caustic compounds with pH values of at least 8.0. Cleaner strength is measured, not just by pH, but also by the ability to resist pH change during use. Milk alkalis have surfactant properties that make them useful for removing fat and protein soils. Moderately strong alkalis such as sodium, potassium and ammonium salts of silicates and carbonates are less corrosive. Stronger alkaline cleaners remove protein deposits by detergency but also by chemically reacting with them so that they break down into smaller, water soluble protein units, or individual amino acids.