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CLEANING CHEMISTRY

The Five Factors

Properly cleaning linen requires understanding the five factors involved: The nature of the soil, the surface to be cleaned, the method of product application, the environmental concerns, and the role of water and pH, which are all affected by TACT (Time, Agitation, Concentration, and Temperature). The more time a cleaner is given to work, the better the results. Agitation helps suspend soils so the detergents can carry them away. Higher concentrations of the cleaner generally increase cleaning power. Increasing temperature increases the rate of the chemical action. **Always follow label directions. If you are not trained in using a particular chemical, ask for help and consult the M.S.D.S.**

1. THE NATURE OF SOIL

Soil is either visible or invisible. Visible soil requires the right cleaner and invisible soil requires the right disinfectant. Soil is organic (contains carbon), inorganic (no carbon), or petroleum. Organic soil includes body oils, starches, and proteins. Inorganic soil is comprised of mineral or lime deposits and rust. Petroleum includes motor oils, wax, and soon.

Chemicals commonly used to remove organic soils include: for proteins–alkali, acids, oxidizing agents, or enzymes; for carbohydrates–alkali, acids; and for fat removal–alkali and surfactants. Mineral salts are the most common inorganic soils. Calcium, magnesium, iron, and manganese from water sources are responsible for most mineral, salt, or scale deposits. Acids are most commonly used to remove inorganic soils. Typically, phosphoric, hydrochloric and citric acids are used. Petroleum-based soils will likely be encountered. The cleaners of choice for petroleum-based soils are solvents and alkali.

2. THE SURFACE TO BE CLEANED

Surface types include metal, stone, ceramic, vinyl, rubber, carpet, cloth, and wood. The type of the surface determines how it is cleaned. Is it smooth, rough and corroded, or painted? The type of cleaner and/or disinfectant varies depending on the natural texture of the surface. Soft metals, such as aluminum, can be damaged by strong acids or alkali. Plastics provide a challenge because they can crack or even become cloudy from the wrong chemical cleaners. The nature of a surface can be degraded or corroded through misapplication or misuse of cleaning chemicals.

3. THE METHOD OF APPLICATION

The method of application is an important consideration when choosing a cleaner and/or disinfectant. The chemical must be safe for employees to handle. Minimizing exposure to chemicals is critical. Exposure can occur through direct skin contact or inhalation of aerosols. In a manual or hand application where the worker is close to the product, a product pH range of 4-10 is normal. In a spray application, the product is further away from the worker and a more moderate pH range of 2-11 is used and may have a moderate to high foam level. Machine application allows the worker to be even further away from the product and a wider pH range of 1-13 with a low foaming product may be used .

4. ENVIRONMENTAL CONCERNS

All cleaning chemicals used typically drain into private or publicly owned waste treatment facilities. Wastewater concerns vary from area to area. The primary concerns are pH, phosphates, and antimicrobials. The main concern with pH is corrosion to pipes. The product might need to be neutralized to reduce the pH of the wastewater prior to discharge. Chemicals that contain phosphates are restricted in some areas because they affect the surface water. Also, there might be local restrictions on certain disinfectants that inhibit or kill beneficial bacteria used in water treatment. All federal, state, or local regulations must be followed regarding disposal. Under normal use conditions, the effect of pH and antimicrobials is minimal because they are diluted or neutralized by matter in the waste stream.

5. ROLE OF WATER AND pH

The most important chemical property of water is hardness. Calcium and/or magnesium salts form scale and leave a film on surfaces. Hardness can precipitate if in contact with alkali and deposit on the surface to form a scale or films. Water hardness is calculated in parts per million (ppm) of calcium carbonate. One grain per gallon is 17.1 ppm of calcium carbonate.

Water Hardness

Water is considered soft if it has no more than 60 ppm calcium carbonate and very hard if it contains over 180 ppm calcium carbonate. This is interesting because many disinfectants are tested in a challenge of 400 ppm calcium carbonate, which is extremely hard water!

U.S. Geological Survey Calcium Carbonate Scale

Hardness	Grains Per Gallon	PPM
Soft Water	0-3.5	0-60
Moderately Hard Water	3.5-7.0	60-120
Hard Water	7.0-10.5	120-180
Very Hard Water	>10.5	>180

Detergents and disinfectants are designed to work within certain pH ranges, and it is important to understand the effective pH range of any detergent or disinfectant. In general, alkaline and neutral cleaners are among the most effective detergents, while acidic cleaners combat specific problems, such as hard water deposits and soap scum removal. Detergents include any cleaning agent from plain water (least effective) to the latest technological advance in cleaning. Each detergent possesses certain basic properties: wetting, dispersion and suspension, emulsification, and penetration. The degree to which each cleaner has these qualities determines the effectiveness of the detergent and therefore the disinfectant.

Wetting

A wetting agent permits a greater surface area to be cleaned. Water molecules cling together on a surface and occupy the smallest space available. This effect is called surface tension. Wetting agents added to the water cause the water molecules to "loosen" and allow a larger surface area to be cleaned.

Dispersions and Suspension

While the wetting agent permits a greater water penetration on the surface, the detergent disperses and lifts the soil. The detergent holds the soil in suspension so it can be easily removed. This prevents re-deposition on the cleaned surface.

Emulsification

Emulsifiers are added to detergents to dissolve lipids, such as oil and grease, and transform these soils into an easily removable solution.

Penetration

Penetration allows the detergent to get underneath the soiled area to loosen it from the surface. Detergents are typically classified into three types—anionic, cationic, and nonionic.

1. Anionic

Anionic detergents are simple compositions similar to bar soaps used in the home. They do an acceptable job of cleaning surfaces; however, they do not have the ability to kill bacteria as well as cationic agents do. Also, changes in pH impact their effectiveness. Anionics often produce foam that leaves a surface residue and causes surface build-up over time that must be removed. Anionics are used mostly for wetting, detergency, emulsification, and other surface activity functions.

2. Cationic

Cationics are used in germicides and fungicides. They have many of the same properties of anionics, but are not the most effective detergents. Cationics are not compatible with anionics and are usually formulated with nonionic detergents to form a versatile detergent/disinfectant.

3. Nonionic

Nonionic detergents have the best detergency properties and are very stable in hard or acidic water. They are not germicides and have low foaming ability. They do not leave any build-up on surfaces, so there is virtually no rinsing required.

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