Chemistry of Cleaning

The basic selection of what cleaner to use is primarily a determination based upon the soil to be removed and the surface from which the soil must be removed. The three basic types of cleaners (acids, alkalis, and solvents) are designed to work primarily on certain soils and upon certain surfaces.

SOIL

Choosing the right cleaner begins by analyzing, the soil and matching it to the cleaner best designed to remove it. Some of the common forms of soil best removed by one of the basic cleaners are as follows:

Acids	Alkalis	Solvents	Neutral
mineral deposits, such as: iron, lime buildup, uric acid stains, rust, scale, water spots, soap deposits	most common forms of soil including dirt, soot, fats, cooking oils, food stains, baked on grease	heavy grease and oil including machine grease, engine oils, sludge, paint and varnish	light duty clearing

SURFACE

Choosing the right cleaner also demands an analysis of the surface to be cleaned. The three basic cleaners are designed on different surface areas. The surfaces commonly cleaned by the basic cleaners are as follows:

Acids	Alkalis	Solvents	Neutral
vitreous china metal, glass cement, quarry tile, plexiglass glass	resilient flooring metal, porcelain, china, fabrics, formica, vinyl, concrete, quarry tile, removing floor finish films	engines, machine parts, metal, machinery	all water washable surfaces, floors coated with finish

Function of a Cleaner's Components In order to understand cleaning chemistry, it is necessary to know the functions or properties of the components of a cleaner. These are defined as follows:

1. **Sequestration or Chelation** - The removal or inactivation of water hardness particles by the formation of a soluble complex.
2. **Wetting** - The action of water contacting all surfaces of soil or equipment enhanced through the use of a surfactant.
3. **Penetration** - The action of a liquid entering into porous materials or into crevices, joints or seams enhanced by the use of a surfactant.
4. **Emulsification** - The action of breaking fats and oils into very small particles, which are uniformly mixed with the water, used.
5. **Deflocculation or Dispersion** - The action of breaking up aggregates of flocs into individual particles.
6. **Suspension** - The action which holds up insoluble particles in a solution.
7. **Rinsing** - The condition of a solution or suspension which enables it to be flushed from a surface easily and completely.
8. **Saponification** - The action of changing insoluble animal fats and oils into a soluble soap.

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How Cleaners Work

- By conditioning the water so there is no additional soil added to surfaces and so that the effectiveness of the cleaner is not reduced by hardness in the water.
- By penetrating the soil or wetting it with the water.
- By dissolving as much of the soil as is possible by the use of an acid, alkali or solvent.
- By dispersion or emulsification of the remaining soil.
- By holding the soil in suspension until it is rinsed away.

Factors affecting cleaners the performance of any selected cleaner may be altered significantly by any one or a combination of the following factors:

Water Temperature - Although most detergents are designed to work in hot or cold water, the performance of a cleaner can be enhanced by employing warm to hot water. Extremely hot water should not be used on highly finished floors or on carpeting.

Time - The length of time a cleaning solution is allowed to remain on the surface to be cleaned can affect the performance of that cleaner. Typically, the longer the contact time of a solution the better that solution performs. Never, however, allow a dirty cleaning solution to dry on a surface before it can be rinsed.

Chemical Strength - The optimum use dilution varies with different detergents. Also, the effect of a reduction in dilution is different with each detergent. It is Important that the proper dilution be maintained, and that you understand how this dilution can be changed for specific applications.

Mechanical Action - The type of agitation used may have a direct impact on the cleaner's ability to perform and the use dilution employed. Machine scrubbing, pressure rinsing and abrasive pads can improve the cleaners ability to break up soils and reduce the amount of cleaner needed or the time to complete the job.

Procedures - The skill level of the user can also affect the choice of cleaner to be used. A properly trained staff may be able to use one cleaner in a variety of applications or more aggressive cleaners for special cleaning tasks.

Safety - You should also consider the safety of employees, equipment and surfaces to be cleaned in the choice of the cleaner to be used. For example, strong, acid or alkaline solutions may require safety precautions and equipment, as well as care when used on certain surfaces. Always read the product label and refer to the Material Safety Data Sheet before using a new product.

Problem Analysis – When confronted with an unfamiliar cleaning situation, determine the following:

1. The most predominate soil.
2. The most difficult soil to remove.
3. The composition of the surface to be cleaned.
4. The equipment available.
5. The types of cleaners already in use.

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From this information and the product labels, you can select a range of cleaners that best meet the conditions. As a general rule of thumb, select the least aggressive of the cleaners and test to see if it will remove the soil. If not, move to the more aggressive cleaners. Remember that you can improve the ability of any cleaner by increasing the water, contact time and agitation. Also, depending on the cleaner, increased water temperature may help.

Always dilute and use the product according to label instructions.

Whichever cleaner you select, observe safety precautions at all times and see that the staff is properly trained in the use of the cleaner.

TYPES OF CLEANERS

Glass cleaners contain high levels of solvents (alcohol, glycol ether, and ammonia) and low levels of non-volatiles. This combination of materials results in good wetting, good oily soil removal characteristics and non-streaking properties.

Neutral "Neutral" cleaners are not necessarily chemically neutral. Typically, they have a use solution pH in the range of 7-9.5. Neutral products are light duty cleaners designed for use on any water washable surface. Floors coated with a floor finish must be maintained with a neutral cleaner. All-purpose cleaners typically are moderately alkaline products (pH 9 -11), usually containing a water miscible solvent glycol ether) for superior oily soil removal properties. Most spray bottle applications involve either all purpose or class cleaners. All-purpose cleaners are generally recommended for any water-washable surface. However, because of the higher pH and the solvent content, this type of cleaner should not be used on a routine basis on floors containing a floor finish.

All-purpose cleaners are sometimes called "butyl cleaners". Technically, butyl cleaners contain diethylene glycol monobutyl ether ("butyl cellosolve"). However, cleaners containing any member of the glycol ether family are often referred to as "butyl cleaners".

Heavy-duty degreasers contain high levels of alkaline builders and/or solvents, which make them suitable for, use aggressive grease/oily soil removal operations. As a typical example, heavy-duty degreasers may be used in conjunction with autoscrubbers to clean concrete floors.

Acid Cleaners are routinely used to remove mineral and soap deposits typically found in bathrooms. Acid products are also useful in removing mineral deposits from quarry tile floors. The use of hydrochloric (muriatic) based products is normally limited to heavy build-ups (iron) in toilet bowls. Products based on safer acids, such as phosphoric, are commonly used for all other cleaning applications that require acid treatment.