

Classification of Cleaning Agents

Cleaning agents are classified according to the principle method by which soil or stains are removed from the surface. This will be determined by their composition.

The principle classes are:

1. Water
2. Detergents
3. Abrasives
4. Degreasers
5. Acid cleaners
6. Alkalies
7. Organic Solvents
8. Other cleaning agents

1. Water

Water is the simplest cleaning agent and some form of dirt will be dissolved by it, but normally it is a poor cleaning agent if used alone. It becomes effective only if used in conjunction with some other agent, e.g. a detergent.

Water serves to:

- Carry the cleaning materials to the soil
- Suspend the soil
- Remove the suspended soil from the cleaning site
- Rinse the detergent solution from the surface

Water has poor power of detergency because:

- It has high surface tension and forms droplets
- It has little wetting power
- It is repelled by oil and grease
- If shaken within oil the emulsion does not prevent the formation of large droplets
- It has a low surfactant effect (surface active agent)
- Hardness: Hard water contains calcium and magnesium salts which will inhibit the cleaning of material in the following ways – In combination with soap, the salts form insoluble scum which reduces the efficiency of the soap and makes rinsing difficult.
 - Calcium combines with fat in the soil to form a soapy substance which adheres strongly to the surface.
 - The calcium and magnesium salts tend to cause flocculation (tendency to cause soil that is suspended in water, to redeposit on the surface being cleaned)
 - The hardness of water also causes premature aging of fabrics, causes scale and fur to be deposited in machines and pipes.

2. Detergent

Detergents are those cleaning agents, which contain significant quantities of a group of chemicals known as ‘Surfactants’ (chemicals that have water and soil attracting properties). A number of other chemicals are frequently included to produce detergents suitable for a specific use.

A good detergent should –

- Reduce the surface tension of water so that the cleaning solution can penetrate the soil
- Emulsify soil and lift it from the surface
- Be soluble in cold water
- Be effective in hard water and a wide range of temperatures.
- Be hard on the surface that has to be cleaned. Clean quickly and with little agitation.
- Suspend soil in a cleaning solution, and once the soil is removed, to hold it in suspension and not let it redeposit.
- Rinse easily and leave no streaks or scum
- Be economical to user
- Be harmless to the skin and article.
- Be bio-degradable

Chemical composition of detergent: –

1. Surfactants are chemicals, whose molecules when dissolved in water possess, water seeking end (hydrophilic) and a water-repelling end (hydrophobic). They may or may not carry the positive and negative electrical charge. The molecules disperse through water and reduce the surface tension of water by overcoming the forces of attraction between the water molecules, thus allowing the water and surfactant molecules to penetrate the soil and surface.

2. Builders are alkaline chemicals that influence the effectiveness of a cleaning agent in one or both of the following ways –

- i. They sequester (combine with) calcium ions in hard water to form water-soluble salts, thus preventing the adverse effects of calcium.

- ii. They enhance the emulsifying by increasing the pH value of the solution and dispersing properties of the detergent

Builders, in general, can cause a damaging effect on many surfaces, e.g. chrome, aluminium, wool, silk, paint, wood, linoleum. It may constitute up to 30% of heavily built powdered detergents and helps in softening water too.

3. Foaming agents increase or stabilize the foam formed by a detergent. Foaming can be used to surfactant activity, the level of foam depending on the amount of surfactant active in a cleaning solution, e.g. ethanol amides. Alkalomomides derived from coconut oil are frequently used for this purpose. The foam will stick to all non-horizontal surfaces, increasing the contact between the surface and the cleaning chemical.

4. Chelating agents are relatively complex chemicals, which are included in many liquid detergents to sequester calcium ions. They are also frequently used as a descaler, being a more acceptable alternative to strong acids.

5. Suspending agents increase the amount of soil that can be held in suspension in the cleaning solution, e.g. sodium carboxymethyl cellulose.

6. Bleaches will break down with oxidation, those stains that have not been removed from the surface by surfactants or builders. Sodium perborate, oxidizing weak bleach is frequently included in detergents intended for washing textiles.

7. Bulking agents contribute to the volume of detergent powders, e.g. sodium sulphate.

8. Conditioning agents ensure that the granules in the detergent powder are crisp, firm, and dry.

9. Whiteners cause absolute ultra-violet light to transmit as visible white light.

10. Enzymes are complex proteins that break down organic substances, e.g. blood stains, food stains, etc. they are effective at 30 to 50 degrees C and are inactivated at temperatures above 60 degrees C.

11. Anticorrosive agents inhibit the formation of water films on the surface. Chemical reactions resulting in corrosion are generally dependant on the presence of water, e.g. sodium silicate.

12. Perfumes and dyes are included to increase consumer acceptability, but increase the risk of allergic reactions.

13. Germicides are also added sometimes to prevent the growth of bacteria and fungus.

3. Abrasives

The cleaning action of abrasives depends on the presence of fine particles which when rubbed over a soiled hard surface, dislodges the soil, removes tarnishing, and surface scratches from meat surfaces.

Abrasives can be divided into –

- Hard surface cleaners
- Metal polishes

Abrasives depend on their rubbing or scratching action to clean dirt from hard surfaces. The extent to which they will rub or scratch a surface depends on the nature of the abrasive material and on the size and shape of the particles. The use of abrasive will depend on the surface to be cleaned and the type of dirt to be removed. Whenever possible fine abrasives should be preferred to coarser ones. E.g. glass,

sand, emery paper, steel wool, nylon pads, powdered pumice, feldspar, calcite, fine ash, precipitated whiting, filtered chalk, jeweler's rouge (fine abrasive), etc. they are available in natural, liquid, paste or powdered form.

Types of Abrasives:

Based on the scale of hardness for various substances abrasives are classified as;

- I. **Fine Abrasives**: These include precipitated whiting (filtered chalk) and jeweller's rouge (a pink oxide of iron) used for shining silver. They are also constituents of commercial silver polishes.
- II. **Medium abrasives**: these include rottenstone, salt, scouring powder, and scouring paste. Scouring powders are made up of fine particles of pumice mixed with soap/ detergent, and alkali and a little bleach.
- III. **Hard / coarse abrasives**: these include bath bricks, sandpaper, pumice, steel wool, and emery paper. Glass paper, calcite, sandpaper, fine ash, emery powder, and paper, jeweller's rouge, powdered pumice, precipitated whiting (filtered chalk). Ground limestone, sand, steel wool, and nylon scourers are some commonly used abrasives.

Abrasives are usually not used alone in cleaning agents. For example, a cream or paste meant for cleaning utensils contain about 80 % of finely ground limestone, along with other substances such as bleaches, anionic surfactants, alkaline builders, and perfumes.

4. Degreasing agents

They usually consist of strong alkalis, which can dissolve proteins and emulsify and disperse grease and similar substance. They are based on caustic soda or sodium metasilicate. Sodium carbonate (washing soda) can also be used. They are basically used as stain removers and for clearing blocked drains, cleaning ovens and other industrial equipment. Extreme care should be taken in their use as they have high pH.

5. Acids and Toilet Cleaners

Cleaning agents with acidic properties react with water-soluble chemical deposits to produce water-soluble salts. Acids dissolve metals and are hence used to remove metal stains such as water stains in baths, hard water deposits around taps, tarnish on silver, copper, and brass, etc.

Weak acids include citric acid (lemon juice), acetic acid (vinegar). They are used for removing tarnish from copper and brass and mild water stains in baths.

Strong acids are oxalic acid, phosphoric acid, hydrochloric acid, and sulphuric acid.

ACID	pH	USES
Concentrated HCL	1	Removing stubborn hard- water deposits.
Dilute HCL	1	Removing stubborn scales and deposits from sanitary ware. Removing excess cement from newly cemented tiled areas.
Oxalic	2	Removing stubborn hard- water deposits
Acetic acid	3	Removing tarnish and stains from metals such as copper and brass. Neutralizing alkalis are used in cleaning for preventing colors from running during washing.
Sodium and sulphate	5	Removing hard-water deposits and scales from toilets.

Acids can cause further staining on metals if it is not washed off quickly, and may spoil the glaze on sanitary fitments. Toilet cleaners rely on their acid content to clean and keep the W/C pan hygienic and remove metal stains. They can be crystalline, powdered, or liquid.

Powdered toilet cleanser consists of a soluble acidic powder, chlorinated bleach, finely ground abrasive (to help when a brush is used), and an effervescing substance, which helps to spread the active ingredient throughout the water.

Liquid toilet cleaners are a dilute solution of hydrochloric acid and should be used with great care, because the concentration may cause damage to the surface of the pan, its surrounding areas, and to the person using it (if the liquid is spilled).

6. Alkalies

These are used as cleaning agents in the form of liquids and powders. They are particularly useful in the laundry. Very strong alkalies should be used with utmost caution as they are corrosive and toxic. These are called caustic alkalies. Many alkalies act as bleaches.

Caustic soda-based cleaning agents are used to clear blocked drains and to clean ovens and other industrial equipment.

Alkalies and their use:

ALKALIS	pH	USES
Sodium hydroxide (caustic soda)	14	Removing stubborn grease from ovens and equipment.
Ammonia	11	removing stubborn grease
Sodium carbonate	10	Used as an alkali's builder in synthetic and soapy detergents. Clearing blocked drains.
Sodium Per-borate	10	Removing stains and whitening due to bleaching action at a higher temperature (above 40.C)
Sodium Hypo-chlorite	9	Removing stains and whitening due to bleaching action on various types of surfaces. Acts as a disinfectant.
Sodium Bicarbonate	8	Removing stubborn grease from smooth, delicate surfaces. Removing stains such as tea, coffee, and fruit juice.
Sodium Per-borate (borax)	8	Removing stubborn grease from smooth, delicate surfaces. Removing stains such as tea, coffee, and fruit juice
Sodium Thio-sulphite	7	Removing iodine stains.

7. Organic Solvents

These are chemicals that dissolve fat, oil, grease, wax, or similar compounds from the different surfaces, e.g. methylated spirit, white spirit (turpentine substitute), carbon tetrachloride. The former two are highly inflammable while carbon tetrachloride is harmful if inhaled, and hence should never be used in a closed area. Many are used for routine stain removal. They are harmful to skin and some surfaces and are fire hazards.

8. Other cleansing Agents

Polishes

They do not necessarily clean but produce shine by providing a smooth surface from which light is reflected evenly. They do this by smoothing out any unevenness on the surface of the article, in many cases by forming a thin layer of wax on the surface, thus giving some protection.

- **Metal polishes** – these remove the tarnish resulting from the attack on the metal by certain compounds and some foodstuffs. They are of two basic types, one for hard metal and other for soft. Either type may be liquid or paste. Liquid polish is a fine abrasive waxed with grease solvent, and sometimes with an acid, e.g. plate powder, precipitated whiting, jeweller's rouge, mentholated spirit, and ammonia. Abrasive when rubbed on the surface of the metal provides friction to remove the tarnish and produce a shine.
- **Floor polishes** – They are of two basic types – Spirit-based, Water-based.

Spirit-based polishes contain a blend of mainly natural waxes, dispersed in a spirit solvent. They may be in paste or liquid form and contains silicon, but too high a silicon content makes the floor slippery. The build-up of polish can be removed by losing the wax finish with spirit and slight abrasion, and then picking up the loosened wax with a damp cloth mop. It is suitable for flooring that are harmed by water like wood, cork, linoleum, and magnesite.

Water-based polishes are emulsions in which fine particles of natural and synthetic waxes are dispersed in water. They are suitable for use on thermoplastic, rubber, PVC, asphalt, and combination floors as spirits can affect them. They can also be used on sealed flooring of wood, cork, magnesite, and linoleum. Water-based polishes are always liquid but may be fully buffable, semi-buff able, or dry bright. The build-up polish can be removed by loosening the wax synthetic resin with hot water and alkali – no detergent.

Floor polishes are floor waxes and have to be subjected to rough traffic. A more lasting surface can be obtained by the use of a floor seal, with or without water-based polish applied to it. Seals are semi-permanent materials, which render the floor impermeable and protects it from dirt, stains, and other foreign matter. They are not polishes.

Furniture polishes are intended for wooden furniture and fittings. They are protective finishes, which provide the surface of the furniture with a thin layer of wax or resin. This layer gives protection against abrasion, absorption of spillage, and a smooth surface from which light may be reflected to give a shine or sheen. It consists of waxes dissolved in varying amounts of spirits.

They are of four types –

- I. **Paste wax polish** – a high proportion of wax plus silicon
- II. **Cream polish** – greater amounts of spirit to give a cleaning action.
- III. **Liquid polish** – have a great proportion of spirit requiring no buffing.
- IV. **Spray polish** – also has a high proportion of spirit.

Floor Seals

These are applied to flooring surfaces as a semi-permanent finish that acts as a protective barrier by preventing the entry of dirt, gems and liquid, grease, stains, and bacteria. They prevent scratching and provide an easily maintainable surface. The right type of seal should be applied to each type of floor for effective protection and an attractive appearance. According to their functions, floor sealers can be finishing protective or combination of both.

Types of floor sealers:

- I. **Oleo-resinous sealers:** they are used for imparting an attractive surface gloss penetrating the floor darkening the color and highlighting the grain of wood floors.
- II. **One-pot plastic sealers:** they are used on wood, wood-composition, cork, and magnesite floors.
- III. **Two-pot plastic sealers:** they are also used on wood, wood-composition, cork and magnesite floors.
- IV. **Pigmented sealers:** these may be used on concrete, wood, wood-composition, magnesite, asphalt, and stone floors.
- V. **Water-based seals:** these may be used on marble, terrazzo, magnesite, linoleum, rubber, thermoplastic tiles, PVCs, asphalt, concrete, stone-, and quarry tiles.

Bleaches

Bleaches used for cleaning purposes are generally alkaline stabilized solutions of sodium hypochlorite and are useful for stained sinks, W/C pans, etc, but they must never be mixed with other types of toilet cleaners. They whiten and have germicidal properties. Great care should be taken to prevent spots on other surfaces.

Disinfectants and De-odorants

Disinfectants, antiseptics, and deodorants are not strictly cleaning agents, but are often used during the cleaning operations.

Disinfectants kill bacteria; antiseptics prevent bacterial growth and are frequently diluted disinfectants. The use of disinfectants should not be necessary if the cleaning methods are correct.

Types of disinfectants:

Disinfectants can be categorized in terms of their chemical action and compositions

- I. **Phenols:** these are hydroxyl derivatives of the aromatic hydrocarbon benzene. They are used in dilute or high concentrations to disinfect surfaces in hospitals especially .in hotels, diluted phenols are used with their sharp smell masked by other additives.
- II. **Halogens:** the elements chlorine and iodine may be used as disinfectants. Chlorine is used both as bleach and as a disinfectant on many surfaces. Iodine is not often used to disinfect surfaces because it tends to leave brown stains.
- III. **Quaternary ammonium compounds:** these are cationic surfactants useful as bactericides. Natural pine oils: pine oils are obtained from pine trees. They are germicidal to some extent but are mainly added changing formulation for their pleasant smell.

Deodorants mask unpleasant smells by either combining chemically with the particle causing the smell or by their smell being predominant. This is not required where there is good ventilation and thorough cleaning.

They are used in restrooms, guestrooms, guest bathrooms, cloakrooms and public areas such as lobbies. Some deodorizers leave no trace of a perfume cover-up. They are usually available as aerosol sprays, liquids, powders, and crystalline blocks.

Window or Glass Cleaners

Window cleaners consist of water-miscible solvents, often isopropyl alcohol, to which small quantities of surfactants and possibly an alkali is added to improve the polishing effect of the cleanser. Some also contain fine abrasives. Most glass cleaners are available as sprays or liquid. They are sprayed directly onto windows, mirrors and other glass surfaces or applied on with a soft cloth and rubbed off using a soft, lint-free glass cloth. An inexpensive glass cleaner that can be readily made in the housekeeping department is soft water to which some vinegar is added can be used with an old newspaper.

Absorbents

They carry out the action by absorbing the stain or grease. They are used only when the quantity of strain is too much. E.g. starch powder, fuller's earth, bran, French chalk powder, etc.

Storage of Cleaning Agents

Cleaning agents with a longer shelf life are usually bought in bulk because of the reduced costs that accrue from the economics of scale. Other agents are bought and replenished periodically. Storage of cleaning agents is crucial and the various points to be kept in mind. The points are listed below:

1. Ensure that the storage racks are strong and with shelves.
Heavier containers must be kept on the bottom shelf.
2. The store should be kept clean and well-ventilated at all times.
3. Ensure that the lids are tightly fitted.
4. When issuing cleaning agents use appropriate dispensers and measuring apparatus.
5. Ensure that no residual deposits of the cleaning agents are left around the rims of the containers.
6. Avoid spillage, if a spill occurs, clean it up immediately.
7. Follow a systematic procedure for rotating stocks.
8. Organic solvents, strong reagents, polishes should be kept away from heat sources.
9. Check stock regularly. The store should be locked when not in use.