A Detailed Analysis of Cleaning Agents

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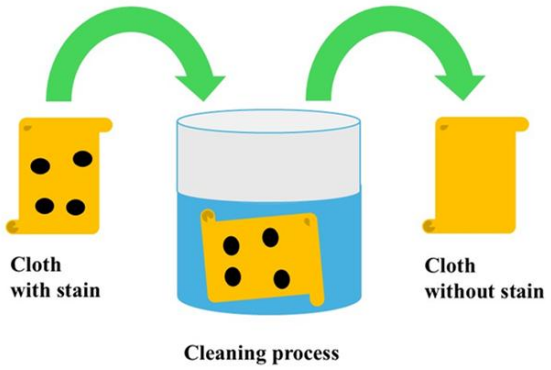
***Abstract*—Cleaning agents are essential for removing dirt, stain, germs, and grease. It helps maintain hygienic environments, prevent the spread of disease, and keep living spaces neat and clean. The cleaning agent interacts with the contaminant to loosen and remove it. Cleaning agents, such as acidic cleaners, alkaline cleaners, detergents, solvents, and disinfectants are categorized in different classes based on their chemical properties and functions. Cleaning agents are prepared using both synthetic and naturally available resources. Synthetic cleaning agents are non-biodegradable. Therefore, adverse effects on the environment are observed during the disposal of synthetic cleaning agents, especially in aquatic environment. Currently, these synthetic cleaning agents are replaced by green cleaning agents manufactured using natural ingredients. Green cleaning agents are biodegradable and nontoxic. Green chemicals improve indoor air quality, minimize pollution of water bodies and soil and reduce the risk of skin irritation.**

***Index Terms*—Soap, Detergent, Stain, Biosurfactant, Biodegradable**



Graphical Abstract

I. INTRODUCTION

Cleaning is the process of leaving things better than they are in the initial stage. In this process, we removed dirt, leftovers of food, viruses, bacteria, and many other elements that we did not want to see on the surface of the articles. Generally, we clean everything that we touch, starting from our body to our washroom and all the things in between. Cleaning is necessary not only in our homes but also in schools, colleges, universities, hotels, restaurants, buses, stations, airports, and particularly in hospitals.[1-6] The more humans or animals visit a place, the more frequently it is necessary to clean it. Cleaning agents play an important role in our everyday life. They are able to remove dirt and stains from their clothes. Cleaning agents can remove dirt from cooking utensils and dishes. They also can remove germ from our hands. Cleaning agents, such as soaps and shampoos, are used to clean the skin and hair to maintain our personal health. Soaps remove dead skin cells and other impurities from the human body. Shampoos remove dirt and oil from the scalp and hair. Shampoos also help hair look shinier. Cleaning is the process of removing dust and dirt. Dust is formed by loose particles and is removed relatively easily. The dirt is tightly bound to the surface with the help of moisture or grease. To efficiently remove dirt cleaning agents must be used. Cleaning agents may be either natural or synthetic. Natural cleaning agents can be manufactured using renewable resources. The manufacturing process of natural cleaning agents requires less energy and reduces waste. Being nontoxic, natural cleaning agents help to protect aquatic life and wildlife. These eco-friendly cleaners decrease indoor air pollution by eliminating volatile organic compounds (VOCs).

II. RESULT AND DISCUSSION

A. History of cleaning

According to the historical data, it has been established that ancient Babylonians were able to make soap around 2800 BC. Archeologists discovered soap-like materials in ancient clay cylinders. These clay

cylinders were inscribed with some words whose English meaning is “fats boiled with ashes”. This is a part of the soap-making process. According to the records, ancient Egyptians bathed regularly. The Ebers papyrus is one of the oldest Egyptian medical documents, published at approximately 1500 BC. From this document, we know that ancient Egyptians mixed the common salt with animal or vegetable oils to form soap-like substances that were used not only for washing purposes but also for the treatment of skin diseases. Several ancient civilizations have also used soap-like materials. The term soap comes from the ancient Roman myth of Mount Sapo. Within the 7th century, Spain, Italy and France also started soap manufacturing. These countries have produced soap using oil from olive trees.

However, after the collapse of Rome in 467 AD, bathing practice decreased throughout Europe, resulting in a state of being unhygienic in the Middle Ages. The unsanitary conditions of that time played a significant role in illnesses, such as the Black Death that occurred in the 14th century. However, there were some areas of the Middle Ages where personal hygiene remained vital. Regular bathing was a general tradition in Japan throughout the Middle Ages. Moreover, in Iceland, pools of warm water from hot springs are famous gathering places on weekends. English began manufacturing soap in the 12th century. Commercial soap manufacturing began in the American colonies in the 16th century. In the 17th century, sanitation and bathing began to return to fashion throughout Europe, mainly in richer areas. In the 19th century, soap became a highly taxed luxury item in different countries. While the tax was waived, soap became available to the majority of the people, and public health standards all over society improved. In 1791, remarkable success in large-scale soap making was attained when a French chemist, Nicholas Leblanc invented a process of making soda ash from common salt. Soda ash is collected from the ash and react with fat to form soap. This invention made soap-making one of the fastest-growing industries in America in 1850.[7]

The process of soap-making remained almost the same until World War I. During World War I and World War II, there was a huge shortage of animal and vegetable oils and fats, which are raw materials used in soap manufacturing. Then, chemists had to use new raw materials instead of animal and vegetable oils and fats. Chemists then synthesized a new chemical whose properties are almost similar to those of oils and fat obtained from animals and vegetables. This new chemical is known as detergent.

B. Properties of an ideal cleaning agent

Various types of cleaning agents are applied depending on their suitability for cleaning different surfaces. However, the selection of cleaning agents must be based on a few important criteria to obtain optimum results. An ideal cleaning agent must have the following properties. Therefore, it must be easily dissolved in water. Therefore, it must have good wetting and emulsifying properties. It must be cleaned rapidly, with minimal difficulty. It is effective for both soft and hard waters. The rinsing process of the cleaning agent was very easy. Cleaning agents must be harmless to the skin, as well as to the surface of the material where they have been applied. Cleaning agents are biodegradable.[7-12]

III. TYPES OF CLEANING AGENTS

The different types of cleaning agents are as follows.

A. Water

It is a universal, commonly used cleaning agent. Although water can dissolve dirt, it is not a successful cleaner to reach the standards of cleanliness required by our society. Owing to its high surface tension, water cannot wet the surface satisfactorily because the surface tension of water prevents it from spreading easily.

B. Acids

Acids have also been used as cleaning agents. Acids may be weak or strong. Generally, tamarind, vinegar and buttermilk are used as weakly acidic substances during the cleaning process. Strong acids, such as hydrochloric acid, sulfuric acid, and nitric acid are also used in the cleaning process. We can use acids individually or as components of a formulation. Rubber gloves must be worn during the use of acids because of their corrosive nature. Strong acids must be used in small amounts. After the application of acid, it must be rinsed away quickly as it can damage the surface of the materials. Generally, concentrated hydrochloric acid is used for the removal of hard water deposits. Diluted hydrochloric acid is used to clean the sanitary ware. Oxalic acid is also used to remove hard

water deposits. Acetic acid is used to remove tarnish and stain from the surfaces of the materials made of copper or brass.

C. Alkalis

Alkalis have also been used as a cleaning agent. These materials can be used in liquids or powders form. Alkalis are extensively used in laundry environments. Strong alkalis must be used cautiously because of their corrosive and toxic nature. Many alkalis are used as bleaching agents. Caustic soda containing a cleaning agent is used to clear the blocked drains and clean ovens. It is also used to clean industrial equipment. Ammonia is used as a grease emulsifier. Ammonia should be used cautiously because it releases strong fumes. Sodium hydroxide is used to remove strong grease from ovens and various types of industrial equipment. Sodium hydroxide is also used to open the blocking of drains. Sodium carbonate has been used as an alkaline builder in different synthetic detergents. Sodium perborate, sodium hypochlorite, sodium bicarbonate, sodium pyroborate and sodium thiosulfate are used to remove stains.

D. Organic solvents

Organic solvents such as acetone, carbon tetrachloride, methylated spirit, turpentine are very helpful cleaning agents. Grease is soluble in organic solvents. Organic solvents are widely used for dry-cleaning. These are also used to remove grease and stains. These are also used to clean surfaces that may be damaged by water. The organic solvents evaporate rapidly from the surface. Thus, they are perfect for cleaning the glass surfaces such as windows and mirrors. Organic solvents must be used carefully because they are poisonous, flammable and dangerous for the skin.

E. Abrasives

Abrasives are chemicals, that are used to clean dirt and grit from hard surfaces by rubbing or scratching. It is also used to clean very strong stains on different surfaces. The degree of rubbing or scratching on a surface depends on the characteristics of the abrasive material used as well as the size and shape of the particles. Depending on the level of hardness abrasives can be divided into different categories such as fine, medium, and hard abrasives.

F. Detergents

Detergents are used in combination with water to loosen and remove dirt. It is kept in suspension for a few moments so that loose dirt cannot be re-deposited on the cleaned surface. Detergents must be highly soluble in water. It must have a very good wetting power so that it can decrease the surface tension of water and enable the surface of the article to be wet properly. It should have excellent emulsifying power so that it can break the grease and enable the dirt to be loosened from the surface of the particles. It must have good suspension power so that it can suspend the dirt in solution and restrict the re-deposition of dirt molecules on the surface of the article. Detergents must be effective for both soft and hard waters. Therefore, it must be effective at both low and high temperatures. It must be harmless to the fabrics of clothes as well as human skin. It must be cleaned rapidly with minimal difficulty. A good detergent must have three parts: active ingredients, builders and additives (table 1).

Table 1. Composition of detergents

Composition	Function
Active ingredients	Natural oils and fats are the sources of active ingredients. They are derived from long chain fatty acids. The normally available fatty acids are stearic, palmatic, linoleic and oleic acids which are naturally found as triglycerides. The active ingredients in synthetic detergents are surface-active agents (surfactants). Surfactants are formed from petrochemical products.
Builders	Builders may be either organic or inorganic. It has no surface-active properties. However, builders can improve the efficiency of detergents. It is added to facilitate better handling and improve dilution. In general, the diluent used is water or sodium sulfate.
Additives	Additives can include fluorescent brighteners, bluing agents, bleaching agents, and enzymes. Fluorescent whiteners/optical brighteners prevent the fabric from turning yellowish. These compounds absorb ultra violet light and reflect this light as blue light which creates white images. Some bleaches are photo activated. The fabrics are cleaned through chemical action. When activated by sunlight, they convert oxygen into a nascent form.

	Chelating agents can bind mineral salts that are able to harden the water. The most commonly used chelating agents are ethylene diamine tetraacetic acid and nitrilo triacetic acid. These chelating agents are mixed in small amounts in the detergent. They form chelating compounds with calcium and magnesium salts. Diethylene triamine penta-acetic acid is added to form a chelate compound with iron salts. Moreover, several detergents use zoolites. In the case of liquid detergents, hydrothropes also help to improve solubility. Enzymes such as amylases, lipases and proteases are added to detergents to remove different kinds of statins. These are stable even at 60 ^{0}C temperature as well as in the pH range of 10.5 to 11. However, they act slowly and require approximately 30 min of soaking time.

Surfactants are the main component of detergents. Surfactants are surface-active agents. The surfactant molecule has two parts; a hydrophilic head (water loving) and a hydrophilic tail (water hating). This hydrophilic head is attracted towards water molecules and the hydrophobic tail is attracted towards organic molecules (such as grease). After addition of detergent to the water, the surfactant molecules organize themselves at the water-air interface (surface). The hydrophobic tail groups of the surfactant molecules combine with hydrophobic dirt molecules such as grease and remove them from the surface of the fabric or cloth. As the dirt or grease molecules are trapped by the surfactants, they are unable to contact other surfaces. These dirt molecules are entrapped either in a special aggregate known as a micelle (figure 1), or in a special structure, known as emulsion. Detergents can be classified into various categories (table 2).

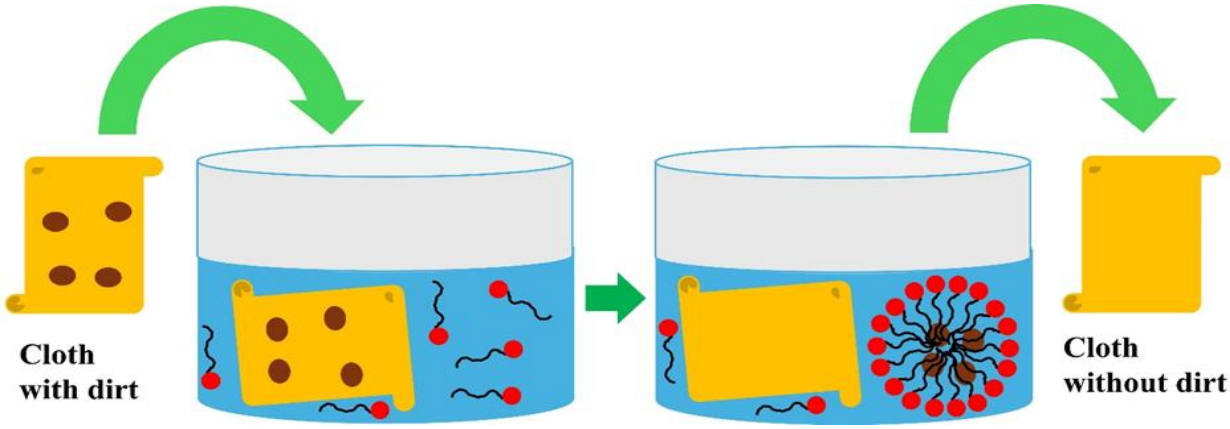


Figure 1: Schematic representation of cleaning process

Table 2. Classification of detergents

Type of detergent	Function
Soapy detergents / Soaps	The soaps are formed via saponification. Saponification is a process in which fat or oil is treated with alkali. Soapy detergents and soaps are mainly anionic surfactants. Generally, soap is cheaper than the other cleaning agents. However, soap is only effective in soft water. In hard water, soap is not as effective because it does not lather easily and forms a scum that is not easy to rinse. To overcome this problem, alkaline builders, such as phosphates or soda, are added because they help to remove the hardness of water as well as to break the grease and oil molecules.
Toilet Soap	Toilet soaps must have perfume. It also contains dyestuffs and antioxidants, such as Vitamin E. However, they do not have any builder molecules because the function of the toilet soap is not so heavy and, in this case, cleaning is performed by a lather only.
Synthetic detergents	These detergents are soap-free and they have replaced the use of normal soaps in various cleaning processes. They are unaffected by hard water. They have very good suspension power. Depending on their chemical nature they can be anionic, cationic or nonionic. They may also be alkaline, with a pH range of 9 - 12.5. These detergents can remove greases. Generally, they foam comparatively less, but require thorough rinsing because of their slippery nature in solution. These detergents are used to remove water-based floor polish. They are also used for heavily soiled surfaces. These detergents have a high pH and are also harmful to the human skin, therefore, they must be protected during their use.

Liquid synthetic detergents	These detergents are mainly solutions of the surfactants. In addition to surfactants, these detergents contain other substances. This mixture forms a microemulsion. Thus, no components will separate from the solution with a change in temperature. These detergents contain both anionic and non-ionic surfactants.
Powdered synthetic detergents	They are strong detergents. Thus, these detergents are appropriate for heavily soiled surfaces and fabrics. It contains various substances, such as anionic surfactants, nonionic surfactants, bleach, alkaline builders, fillers, sodium carboxymethyl cellulose, brighteners and water. By changing the ratio of the components of this detergent, it can be used for various cleaning tasks such as washing floors, basins, bathrooms, fabrics etc.
Solvent based detergents	It contains water miscible solvents and builders. Generally, this detergent is basic in nature. This detergent is appropriate for cleaning kitchens and machinery. It was also used to clean the grease-accumulated areas.
Biological detergents	Generally, these are enzymes containing powdered detergents. These are normally used to remove organic stains at 40-45 ^{0}C temperature.

G. Disinfectants

Currently, to control germ cells, a chemical known as a disinfectant is added to cleaning agents. Disinfectants have a strong odor and must be used in limited quantities. There are various types of disinfectants such as phenols, halogens, quaternary ammonium compounds and natural pine oils. Phenol is used in either diluted or concentrated forms to sanitize the surfaces of hospitals and hotels. Other additives are used to mask the odor of phenol. Halogens such as chlorine and iodine, are also used as disinfectants. Chlorine is commonly used as a disinfectant for different surfaces. Iodine is rarely used as a disinfectant because it can generate additional brown stains. The quaternary ammonium group containing cationic surfactants is used as bactericides. Natural pine oils are germicidal in nature. They are commonly added to cleaning agents because of their pleasant odor. Application of some common cleaning agents are followed (table 3).

Table 3. The use of some common cleaning agents

Cleaning agents	Uses
Hydrochloric Acid	It is used to clean bathrooms.
Ammonia	The solution of gaseous ammonia in water is known as ammonium hydroxide. Generally, it is used to soften water and clean window panes.
Borax	This is a white crystalline powder known as sodium borate. It is used to soften hard water and to remove tea and coffee stains.
Soda	It is an emulsifier of grease. It is used to clean dirty pans.
Bath brick	It is found in powder form. The color of the bath brick is reddish brown. Generally, it is used to clean earthenware.
Oxalic acid	It is an organic acid. It is used to remove stains from the fabrics. Oxalic acid has also been used to clean porcelain.
Lemon	It is used for removing the ink stains from the wooden surfaces.
Vinegar	This is a 4% acetic acid solution. It is used for removing stains and tarnishes from metal surfaces such as copper. Vinegar is also used to remove lines from glass surfaces such as mirrors and window panes.
Benzene	Benzene is synthesized from coal tar. It is used to remove stains caused by paint and tar.
Petrol	It is synthesized from petroleum. Petrol is inflammable. It is used in dry-cleaning and to remove grease stain.
Methylated spirit	It is used to clean mirror and window panes.
Paraffin oil	It is synthesized from crude petroleum. It is used to clean greasy iron and steel.
Turpentine	It is used to remove tar stains.
Sawdust	It is a grease absorber.
Fuller's earth	It is an ash- white clay. It can quickly absorb grease. It is used to clean colorful wooden surfaces.
Bran	It is the husk of wheat grain. Typically, it is used to absorb the grease.

H. Stain

A stain is a spot or discoloration created by the absorption or chemical reaction of foreign material with cloth. Staining is the greatest challenge during the cleaning process. Spills such as tea, coffee, fruit juices, curry, etc., on the bed sheets, table cloths, carpets, and furniture by visitors or workers can lead to unwanted marks or spots that can destroy the prettiness of the decoration of the room. If the stain is not removed it will give a very bad reputation to the cleaning standards of the house. Stains can be classified into following categories (table 4).

Table 4. Categories of stains

Type of stains	Description
Inorganic stains	Inorganic stains are generally dissolved in inorganic solvents via substitution or addition reactions. Occasionally, inorganic stains are removed via redox reactions. In the redox reaction, the stain molecules are converted into colorless compounds. Inorganic stains include rust, writing ink, dye-stuffs, tincture of Iodine, urine, perspiration, vinegar, grass, fruit, tomato gravy, and wine.
Organic stains	Organic molecules are generally formed from carbon chains with hydrogen, oxygen and some non-metallic elements. They may be polar or nonpolar, depending on the functional groups attached to them. Before dissolving polymeric organic stains such as polysaccharides, they must be broken down into smaller units or monomers. The organic stains are paraffin, tar, varnish, car grease, paint, oil, butter, curry, and ghee.
Pigment stains	Most pigments contain chromatophores which are molecules consisting of double bonds that can absorb and emit a particular wavelength of light that produces a particular stain color. Taniun is a red-brown pigment found in coffee and red wine. Generally, Tanium does not react with basic solvents and oxidizing agents therefore, it is difficult to remove Tanium from fabrics. Pigment chlorophyll is responsible for the green color of the grass. This is an organic chromophore. Other sources of pigment stains are tea, coffee, chocolate, tobacco, betel leaf, henna, typewriter ribbons, markers, hair dyes, water colors, and plant pigments.

I. Mechanism of strain removing process

The mechanism of strain removal depends on the type of solution and stain. It depends on the size, polarity and solubility of the stain molecules as well as the removal solution. According to the polarity rule, inorganic stains are dissolved in water (inorganic) and organic stains are dissolved in organic solvents. A surfactant is added to the solvent to dissolve any organic compound in water (inorganic solvent) and vice-versa. Water is a universally used solvent. Water dissolves polar molecules and ionic compounds due to the polarity of water molecules. Although water is an inorganic solvent, it can dissolve organic stains using detergents that contain surfactants. Surfactants reduce the surface tension of water or solvent. Surfactants can emulsify compounds that are insoluble in particular media. Surfactants can form micelles that dissolve insoluble hydrophobic particles.

Most of the soaps contain sodium hydroxide. Sodium hydroxide is an alkali which is also polar and therefore reacts easily with water and can dissolve the basic strain. Citric acid is found in lemon juice. Citric acid is a reducing agent and acidic solvent. Acidic or oxidant stains can be easily removed from the fabric in citric acid solution. If the pH value of a stain is known, then a solution of similar pH is used to remove the stain. Few detergents contain enzymes. Sometimes, molecules of the stain are attached to the active site of the enzyme such as the substrate to form an enzyme-substrate complex. The enzyme then breaks the stain molecule into smaller units which may be dissolved more easily. Enzymes such as pepsin are used to remove protein stains such as eggs, blood, and perspiration. Pepsin shows its maximum activity at 40-50 ^{0}C temperature. There are some common stain removers (table 5).

Table 5. List of some common stain removers

Type of stains removers	Examples
Solvents	Glycerin, acetone, alcohol, kerosene, toluene, benzene, toluene carbon tetrachloride etc.
Oxidizing agents	Potassium permanganate, sodium perborate, hydrogen peroxide, sodium hypochlorite etc.
Reducing agents	Sodium bisulphate, sodium hydrosulphite etc.
Fatty Acids	Oleic acid, coconut il etc.

Emulsifiers	Soaps
Acids	Dilute hydrochloric acid, oxalic acid
Alkalis	Sodium bicarbonate, ammonium hydroxide
Enzymes	Lipase, amylase, protease
Absorbents	French chalk, talc

J. Precautions during handling stain removing process

Organic solvents such as benzene, acetone and spirit are inflammable. Thus, it has never been used near an open flame. Solvents such as trichloroethylene, perchloro ethylene, and carbon tetrachloride are harmful when inhaled. Therefore, these must be used in a well-ventilated area. Generally, fibers and dyes are not damaged by organic solvents. However, spirit can harm rubber-based carpets, trichloroethylene can damage triacetate, and acetone can dissolve rayon acetate. The fibers are generally damaged by acids. Thus, dilute acids may be used on white fabrics but the colored fibers are affected by the acids. Therefore, it is suggested to use a weak solution a number of times than the use of a stronger solution in the first step. Therefore, after treatment, systematic rinsing with a weak alkaline solution is necessary to neutralize the acid and prevent damage to the fabric. Normally, acids are used to remove metal stains such as iron-mould or rust. Alkalis like soda and borax are used to remove old and heavy stains of wine, coffee, and tea from white cotton and linen fabrics. However, animal fibers and dyes are badly affected by alkalis.

The process by which a colored substance changes into a colorless substance is known as bleaching. During bleaching, the fibers become weaker therefore, intense care is required in this process. There are two types of bleaches: oxidizing and reducing. Oxidizing bleaches include sodium perborate, hydrogen peroxide, and sodium hypochlorite. Sodium perborate is generally found in powdered soap, as well as in soapless detergents. It can be safely used on most of the fabrics and its effectiveness is the maximum above 85 ^{0}C temperature. Hydrogen peroxide acts as a slower bleach than the sodium hypochlorite. Hydrogen peroxide is generally used on the white fabrics. The peroxide decomposes more easily if the solution becomes slightly alkaline by ammonia. Sodium hypochlorite is considered to be a normal household bleach. It harms animal fibers. Thus, it should not be used for silk or woolen cloths. It is mostly used to remove the obstinate stains from linen and cotton fabrics. The fabrics must be carefully rinsed after bleaching with hypochlorite otherwise, they will be damaged. Sodium thiosulfate is generally used to rinse the sodium hypochlorite and free chlorine. Sodium hydrosulfite is the most commonly used reducing bleach. Generally, it is used on white fabrics. It is used to remove iron stains and dyes. In general, sodium hydrosulfite is milder in its action than oxidizing bleaches.

If we know the origin of a stain then, the exact stain removing agent can be used directly. However, if the origin of a stain is unknown, then we have to try a number of agents to find the correct one. Usually, safer and milder treatments are applied first and it is always better to repeat the cleaning process at least twice with a weak or mild solution than to use a strong solution at the beginning. The stain removing agents must be fully removed from the fabric by thorough rinsing, washing, neutralization or evaporation.

Stains on colored substances are not easy to remove because several stain removal agents harm the dyes. In the case of upholstery and carpets, stains must be removed because the color on the padding may create huge problems. In this case, aerosol sprays may be used to absorb grease. Owing to the use of a variety of new fibers in modern materials and the unknown nature of some stains, the removal of stains has become a highly skilled job; therefore, it should not be taken very lightly. Here, author has discussed the removal process of some common stains (table 6).

Table 6. Removing process of common stains

Stain	Removing process
Betel leaf	First, the stain is bleached with 1% potassium permanganate solution. The fabric then becomes brown. After soaking in 1% sodium bisulfate or 1% oxalic acid, the brown color disappeared.
Chewing gum	It can be removed by ice-cold water.

Chocolate	It can be removed by enzymes containing detergent or by soaking in acetic acid followed by neutralization with ammonia solution.
Tea and coffee	These are removed by warm water or glycerine or borax solution.
Curry	Curry (Turmeric and oil) is removed by soap.
Egg	It can be removed by enzymes containing detergent.
Fruit and wine stain	These are removed by sodium hypochlorite for the white fabric. These stains from the color fabric are removed using borax solution.
Ghee and oil	These are removed by soap and warm water.
Grass stain	To remove the grass stain, it is soaked in glycerin or methylated spirit. The solution was then, bleached using hydrogen peroxide.
Grease	It is removed by hot water and detergent.
Gum or glue	It is removed by hot water containing glycerine.
Ice cream milk	After washing with cold water, carbon tetra-chloride or petrol is added. Then the stains caused by the ice cream milk are removed.
Iodine	It is removed by 1% sodium thiosulphate solution and ethyl alcohol.
Henna	It is removed by soaking in warm milk.
Medicine	Depending on the nature of the stain, it is removed using warm water, soap, oxalic acid, borax solution and methyl alcohol.
Blood	Blood can be removed by enzymes containing detergent. It may also be removed by soaking the stain in acetic acid followed by neutralization with ammonia solution.
Perspiration	To remove the stain caused by perspiration, first it must be soaked in oxalic acid solution. Subsequently, it is rinsed with water and again soaked in hydrogen peroxide.
Urine	It is removed by a weak solution of ammonia.
Ball point ink	It is removed using cotton pad with methylated spirit, glycerin, or grease solvent.
Ink	Writing ink normally contains a metal and a dye. Ink is treated with oxalic acid to remove the metal and then treated with an alkaline solution to neutralize the acid and remove the dye.
Lipstick	It is removed by using glycerine and methylated spirit.
Nail Polish	It is removed by acetone or amyl acetate.
Perfume	It should be removed by hot water or acetic acid or ethyl alcohol.
Paint varnish	The paints containing linseed oil are removed using turpentine. The stain with cellulose paints is removed using grease solvent. Varnish lacquer paints can be removed using methylated spirit. Some stains can also be removed using kerosene.
Rust	The stain with rust is removed using oxalic acid solution followed by rinsing with dilute borax solution.
Sealing wax	It is removed by methylated spirit and perchloroethylene.
Shoe polish	It is removed by either liquid detergent or carbon tetrachloride or turpentine or glycerin.
Soot	It is removed by starch.
Tar	It is removed by oil and grease.

K. Green cleaning agents

Cleaning agents are manufactured using either naturally available ingredients or synthetic materials.[13] The most commonly used synthetic cleaning agents are soap, detergent, hand wash, and shampoo. Generally, synthetic cleaning agents are non-biodegradable. Normally, these cleaning agents are directly disposed through sewage lines. Sewage lines are normally connected to rivers, lakes or the sea. Therefore, these cleaning agents badly affect the environment. Therefore, it is necessary to replace these harmful non-biodegradable cleaning agents with greener chemicals to reduce environmental pollution. The main component of the detergent is surfactant. Therefore, it is necessary to use greener surfactants, such as bio-surfactants or plant-based surfactants. Other green cleaning agents include natural soaps, lemon juice, different fruit extracts, vegetable oils, and baking soda.

Green cleaning agents are biodegradable, nontoxic, and generate less waste. However, the cost of these green cleaning agents is a slightly higher. Consumers are still unwilling to buy green cleaning agents because they have a lack of trust in the effectiveness of green cleaning agents. Another reason for consumer unwillingness is the higher prices of green products[14].

However, consumers concerned about the environment, use green products and realize the effectiveness of green cleaning agents.

Therefore, green alternatives should be used instead of harmful cleaning agents. Instead of sodium hydroxide, sodium silicate, and sodium sulfate seeds of the African copaiba balsam tree, shea tree, common basil and seeds of the drumstick tree are used. These are economical as compared to synthetic soaps and detergents. These ingredients have also been used to prepare biodegradable herbal medicated soap[15].

Synthetic antioxidants used in cleaning agents can be replaced by natural antioxidants such as quinces and flakes of cranberry fruit.[16]

Palm kernel oil and shea butter are used as green antibacterial agents. Neem oil and betel plants have been used as green antimicrobial agents. Instead of using synthetic fatty acid, we can use fat and flesh obtained from the tannery industry, beef tallow, waste cooking oil, olive oil, neem oil, rapeseed-palm fried oil, orange peels, almond shells, guava leaf, basil, aloe vera and avocado. Again, avocado can act as an emulsifier. Toilet soaps can be prepared using aleo vera, guava leaves and basil. These soaps have antioxidant properties and are suitable for the human skin. Moreover, these soaps are economical. Green soap can be prepared from the peels of orange fruit the hull of almonds. This soap is economical and eco-friendly. Rapeseed-palm fried oil and olive oil are used to produce low priced natural soap. These soaps can be used to treat waste water. Neem oil is also used to produce low-cost toilet soap. This soap is suitable for treating allergic skin diseases such as psoriasis, eczema, and acne. To produce soaps, if we use the fat and flesh obtained from leather industries, we can reduce the leather waste.[17-20] For fragrances maize oil, olive oil, pignut oil, palm fruit oil and coconut oil should be used. These oils are harmless and also eco-friendly.[21]

L. Zeolites

The porous, crystalline aluminosilicate are known as Zeolites. The three-dimensional structure of zeolites contains interconnected channels and cavities. The pores of the zeolites are uniform in size, so small molecules can pass through it, but larger molecules are blocked. Therefore, zeolites have been used as ion exchangers. Calcium and magnesium ions can be removed from hard water using the ion exchange method if zeolites are used in detergent. It acts as an ecofriendly-builders. Zeolites are used instead of phosphate. Phosphate which is used in detergents, finally enters into the water body. This leads to the excessive growth of algae and aquatic plants. Consequently, the amount of dissolved oxygen decreases creating a dead zone for fish or other aquatic animals.

M. Biosurfactants

The surfactants produced by living organisms are known as biosurfactants. These are biodegradable and less harmful to aquatic life. These are obtained from plant extracts and different organisms such as yeast and bacteria. Generally, microorganisms generate biosurfactants during their metabolic processes. Sophorolipids are obtained from Candida bombicola and rhamnolipids are obtained from Pseudomonas aeruginosa. Biosurfactants have several applications. Now, it is also used in the cleaning industry. It can act as a foaming agent, emulsifier, solubilizer and wetting agent. Biosurfactants are appropriate for sensitive skin because it is less irritating. It rapidly breaks down in nature. Biosurfactants can detoxify certain pollutants owing to their complex molecular structureds. Some biosurfactants exhibit antimicrobial properties. Due to its antimicrobial properties, it can resist the growth of harmful bacteria in cleaning agents. Thus, it can enhance the efficiency of the products. Rhamnolipids can effectively remove dirt and oil by maintaining skin hydration. Biosurfactants can function over a wide range of pH and temperatures. With constant innovation, rising consumer demand for green products, and increasing awareness, biosurfactant-based cleaning agents are gaining significant importance in our daily life.[22-25]

IV. CONCLUSION

By reading this article, people can understand the role of cleaning agents in maintaining health and hygiene. Cleaning agents are essential for the removal of harmful pathogens such as viruses and bacteria. This minimized the transmission of infection. By removing dirt and unpleasant odors, cleaning agents create sanitary environments in homes, schools, offices, hospitals, roads and food service areas. By cleaning surfaces and equipment, cleaning agents can prevent contamination during the production of food, medicine

and other healthcare products. In this way, it secures the safety of products and patients. Various types of cleaning agents have been manufactured to remove specific dirt or stains, for example acids are used to remove mineral deposits and rust, and degreasers are used to remove oils and fats. This helps preserve the durability of the equipment and the resolution of different surfaces. Here, the author has discussed various types of cleaning agents. A few of these cleaning agents may be harmful to the human skin and even corrosive. Precaution must be taken during using those cleaning agents. Biosurfactants are gaining importance in the detergents industry because they are ecofriendly, biodegradable and less harmful than synthetic surfactants. Biosurfactants are produced from renewable resources, therefore, it is fulfilling the criteria for sustainable development.

V. DECLARATION OF COMPETING INTERESTS

The author declare that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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