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Editorial

Contents

Mini Review Section: Staining is an auxiliary technique used in microscopy to enhance contrast in the microscopic image. Stains and dyes are frequently used in biology and medicine to highlight structures in biological tissues for viewing, often with the aid of different microscopes. Stains may be used to define and examine bulk tissues (highlighting, for example, muscle fibers or connective tissue), cell populations (classifying different blood cells, for instance), or organelles within individual cells. Let us see the various applications of Biological stains in this issue.

Current Trends: Water, the liquid commonly used for cleaning, has a property called surface tension. In the body of the water, each molecule is surrounded and attracted by other water molecules. However, at the surface, those molecules are surrounded by other water molecules only on the water side. A tension is created as the water molecules at the surface are pulled into the body of the water. Surfactants perform other important functions in cleaning, such as loosening, emulsifying sinkdishes (dispersing in water) and holding soil in suspension until it can be rinsed away. Surfactants can also provide alkalinity, which is useful in removing acidic soils.

In Profile: Salvador E. Luria was an Italian microbiologist who jointly won the Nobel Prize in Physiology or Medicine in 1969 with Max Delbrück and Alfred Hershey, for their discoveries on the replication mechanism and the genetic structure of viruses.

Bug of the Month: ***Propionibacterium freudenreichii*** is a Gram-positive, non-motile bacterium that plays an important role in the creation of Emmental cheese. Propionibacteria are commonly found in milk and dairy products, though they have also been extracted from soil. *P. freudenreichii* has a circular chromosome about 2.5 Mb long. When Emmental cheese is being produced, *P. freudenreichii* ferments lactate to form acetate, propionate, and carbon dioxide ($3\ C_3H_6O_3 \rightarrow 2\ C_2H_5CO_2 + C_2H_3O_2 + CO_2$).

Best Practices: Inhalation is the most dangerous and common route of exposure to fumigants. Most are highly toxic so breathing even small amounts can cause serious illness or death. Exposure also can occur thorough your eyes, mouth, or skin. The label will list the personal protective equipment (PPE) that the manufacturer requires. Know what to do in case of an exposure.

Unwind your mood with our Relaxed Mood section.

We would like to take this opportunity to thank all our esteem readers for their continuous support & encouragement in making this Journal a successful effort.

Looking forward for your feedback & suggestions.

Biological Stains and its Applications (Issue-3)

Differential Staining

Staining process which uses more than one chemical stain is referred as Differential Staining. Using multiple stains can better differentiate between different microorganisms or structures/ cellular components of a single organism.

Differential staining is used to detect abnormalities in the proportion of different white blood cells in the blood. The process or results are called a WBC differential. This test is useful because many diseases alter the proportion of certain white blood cells. By analyzing these differences in combination with a clinical exam and other lab tests, medical professionals can diagnose disease.

One commonly recognizable use of differential staining is the Gram stain. Gram staining uses two dyes: Crystal violet and Fuchsin or Safranin (the counterstain) to differentiate between Gram-positive bacteria (large Peptidoglycan layer on outer surface of cell) and Gram-negative bacteria.Acid-fast Stains are also differential stains.

1. Gram staining

Developed by Christian Gram in 1884; by using this procedure, bacteria are subdivided by their reaction to this stain into those which retain it, termed Gram-positive, and those which are decolorized, termed Gram-negative. Gram staining requires 4 different solutions:

Basic Dye: Crystal violet is a basophilic stain.

Mordant: Increases the affinity between cell and dye, e.g. Iodine.

Decolorizing agent: It removes dye from a stained cell, e.g., alcohol.

Counter stain: Basic dye of a different colour than initial one, e.g., Safranin.

Principle

The differential response towards Gram reaction is attributed to the difference in the cell wall of these bacteria. Gram negative bacteria have cell wall generally thinner than those of gram positive bacteria. Gram negative ones have higher lipid content than the gram positive bacteria. During staining of gram positive bacteria, the alcohol treatment extracts the lipid, which results in increased porosity or permeability of the cell wall. The CV-I (crystal violet iodine) complex can be extracted and the gram negative organism is decolorized. These cells subsequently take the colour of the safranin a Counter stain. The cell walls of gram positive bacteria, due to their different composition (lower lipid content) become dehydrated during treatment with alcohol presumably causes diminution in the pore diameter of the walls of peptioglycan and CV-I complex is trapped in the wall following ethanol treatment. The pore size decreases, permeability is reduced, and CV-I complex cannot be extracted. Hence these cells remain purple violet. While in gram negative bacteria the amount of peptidoglycan is very low hence the cross linking is reduced thus making space for crystal violet iodine complex to escape (Figure 1).

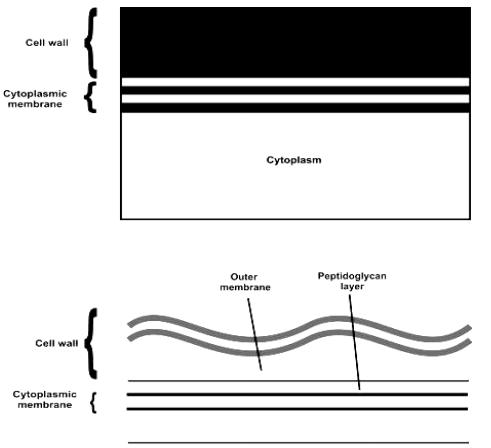

Fig. 1 Cell wall of Gram positive and Gram negative bacteria

Simple Gram staining procedure is illustrated in Figure 1.2.

Table 6.1 Steps in Gram Stain

Step	Process	Results	
		Gram+	Gram-
Initial stain Mordant	CV for 30 sec.	Stains purple	Stains purple
Decolorisation	12 for 30 sec.	Remains purple	Remains purple
Counterstain	95% alcohol for 10-20 sec. Safranin for 20-30 sec.	Remains purple	Becomes colourless Stains pink

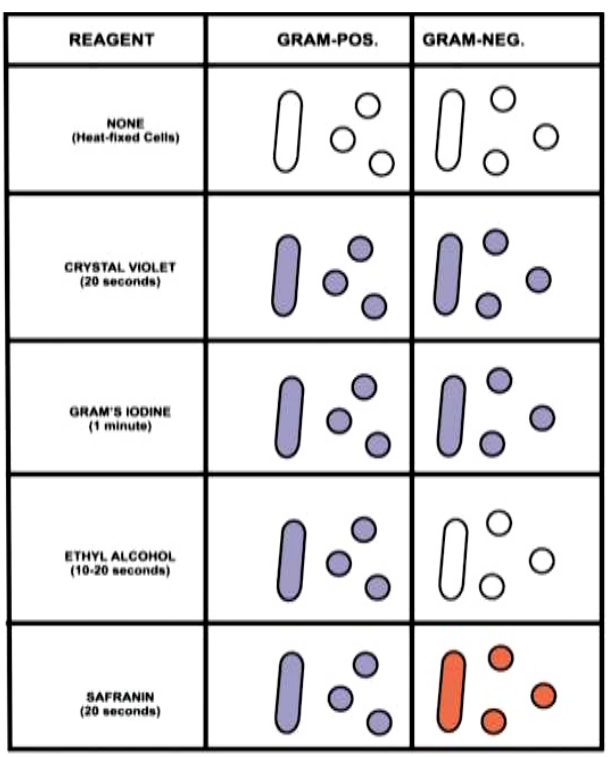

Fig. 1.2 Gram staining steps of bacteria

2. Acid fast stain

The Ziehl–Neelsen stain method employs carbol fuchsin, acid alcohol and a blue or green counter stain. Acid fastness is a phenomenon that is found in certain types of bacteria where they resist the process of de-colorization that occurs when acid is used to wash a sample that contains these bacteria. These bacteria also resist staining and it may require heat and concentrated staining to colorize them. Once this colorization has taken place, it becomes difficult to decolorize using acid, or stain them with another color unless the heat and concentration technique is used. This is why the term given to them is 'acid fast' just like one would use the term 'color fast' for cloth that does not leak color when washed (Figure 2).

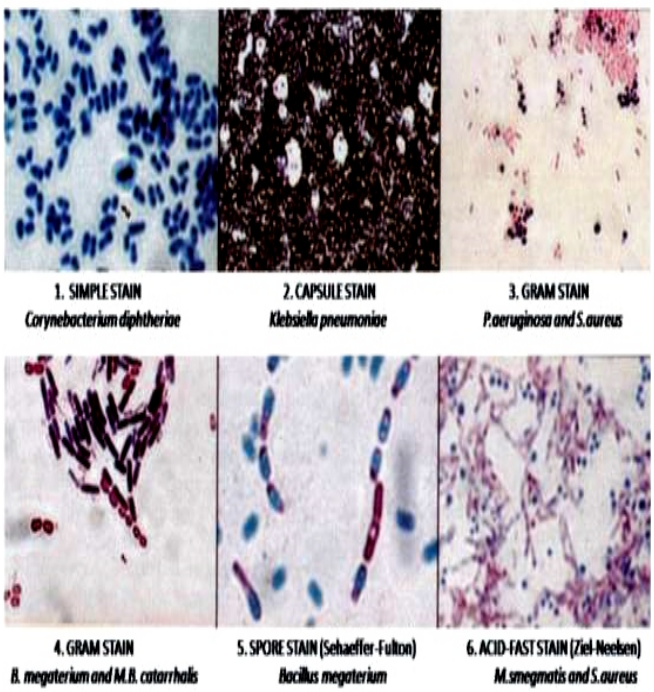

Fig. 2 Differentially stained microorganisms

The most common type of acid fast bacteria is mycobacteria. A strain of mycobacteria is responsible for the disease tuberculosis. In diagnostic medicine, the acid fast test may be used on a person in order to detect the existence of the bacteria that can cause tuberculosis. It is therefore used as a diagnosis of the disease because other symptoms of tuberculosis are not useful as they overlap with other conditions. Acid fast stain results can confirm the presence of the bacteria known as mycobacteria tuberculosis which is the bacteria responsible for causing tuberculosis (Figure 2.1).

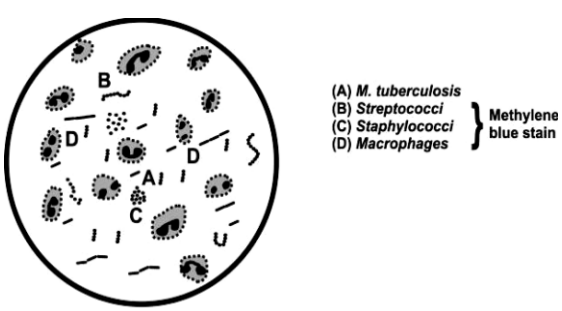

Fig. 2.1Acid fast organisms, e.g. *Mycobacterium tuberculosis* and *M.leprae* stain well.

In laboratories where large number of sputum, gastric washings, urine, and other body fluid samples are tested for pathogenic mycobacteria, fluorochrome acid fast staining is used in conjunction with the Ziehl–Neelsen method. The advantage of using a fluorescence method is that fluorochrome stained slides can be scanned under lower magnification, while a Ziehl–Neelsen prepared slide must be examined under oil immersion (1000X magnification), fluorochrome stained slides can be examined with 60X or 100X magnification.

Structural Staining

Structural staining allows you to observe certain structures on bacteria. This is important because certain structures on bacteria can be antigenic or act as an endotoxin. Structural stains are more complex than simple ones and use more than one stain to differentiate cellular components. They are used to examine structural differences between bacterial groups or to provide contrast to different structures within the same organism. Some of these stains are explained below:

1. Endospore stain

Species of bacteria, belonging principally to the genera Bacillus and Clostridium produce extremely heat resistant structures called endospores. In addition to being heat-resistant, they are also resistant to many chemicals that destroy non-spore forming bacteria. This resistance to heat and chemicals is due primarily to a thick, tough spore coat. They resist staining and, once stained they resist decolorization and counter staining. Several methods are available that employ heat to provide stain penetration. However, the malachite green-Schaeffer and Fulton and Dorner methods are commonly used by most bacteriologists(Figure 3 and Figure 3.1). Thus endospore stains green but rest of the cell or a cell without endospore stains light red (Figure 3.2).

Fig. 3 Steps in Endospore Stain

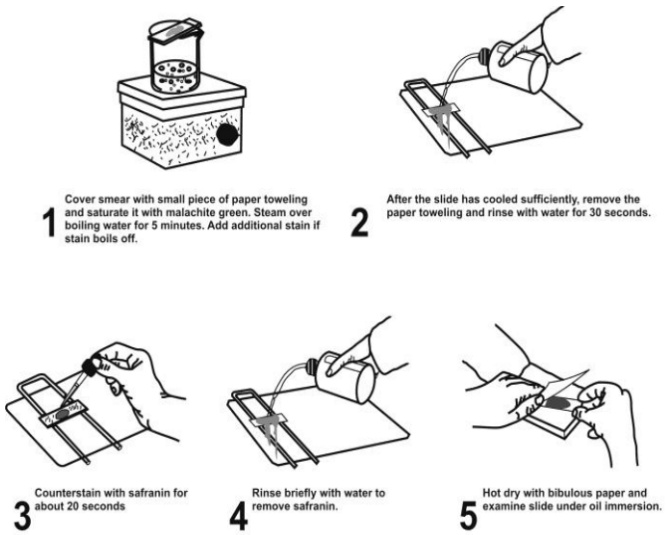

Fig. 3.1 Malachite green - Schaeffer and Fulton Stain Method

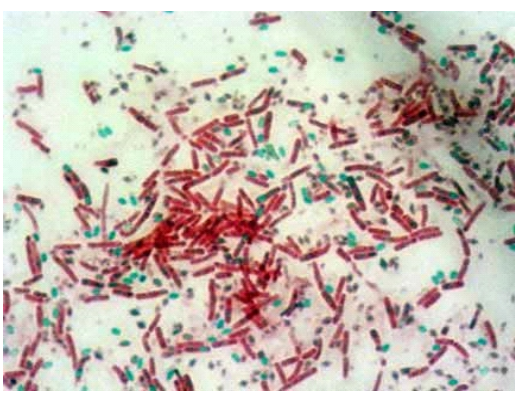

Fig. 3.2 Endospore Stain

2. Dorner method

The Dorner method for staining endospores produces a red spore within a colourless sporangium (Figure 4). Nigrosine is used to provide a dark background for contrast.The sporangium and endospore are stained during boiling in step 3; however, the sporangium is decolorized by the diffusion of safranin molecules into the nigrosine. The six steps involved in this technique are illustrated above (Figure 4.1).

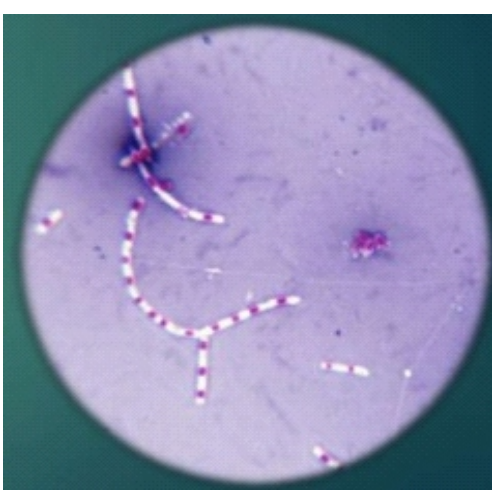

Fig. 4 Endospores – stained Red, Vegetative cells remain colourless

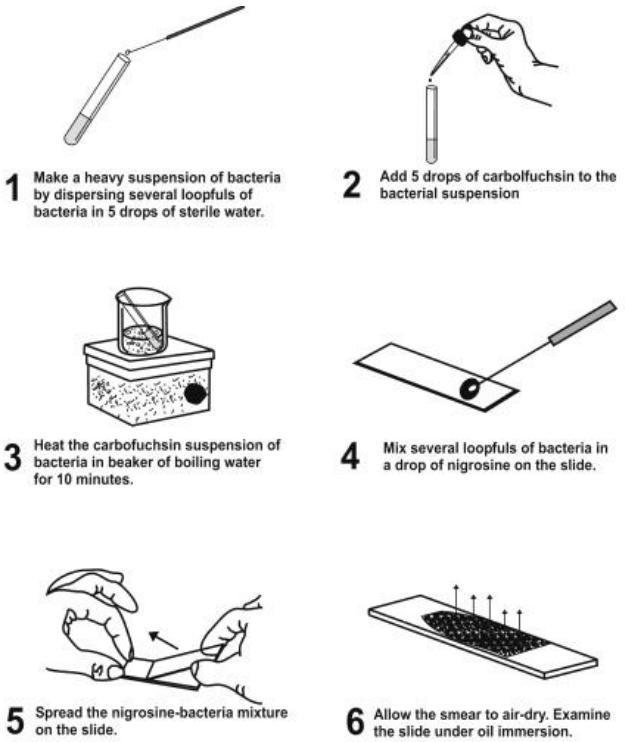

Fig. 4.1 Dorner method of staining

3. Capsule stain

Place a small drop of Indian ink on a clean slide. Mix into it a small loopful of bacterial culture. Drop a cover glass and blot off excess ink. Examine.

For dry preparations mix one loopful of Indian ink with one loopful of suspension of organism in 5% dextrose solutions at one end of a slide. Allow to dry and pour a. few drops of methyl alcohol on it keep the slide over the flame to fix. Stain for a few sec. with 0.5.% aq. solution of methyl violet(Figure 5). The capsule will appear as haloes in blue cell of bacterium under microscope (Figure 5.1).

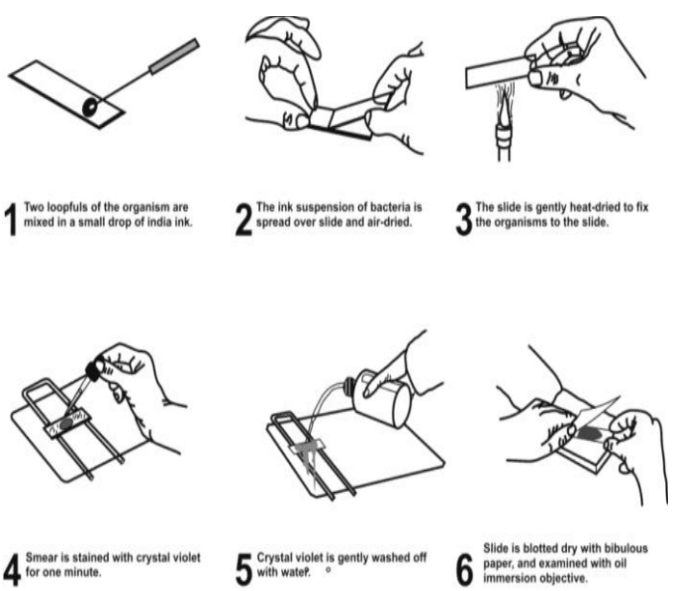

Fig. 5 Process of Capsule staining

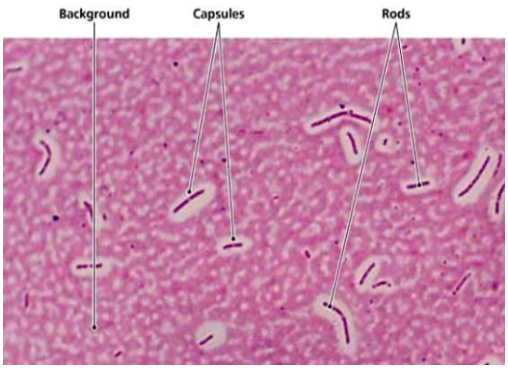

Fig. 5.1Capsule staining

4. Flagella stain

The flagella stain allows observation of bacterial flagella under the light microscope. Bacterial flagella are normally too thin to be seen under such conditions. The flagella stain employs a mordant to coat the flagella with stain until they are thick enough to be seen(Figure 6).

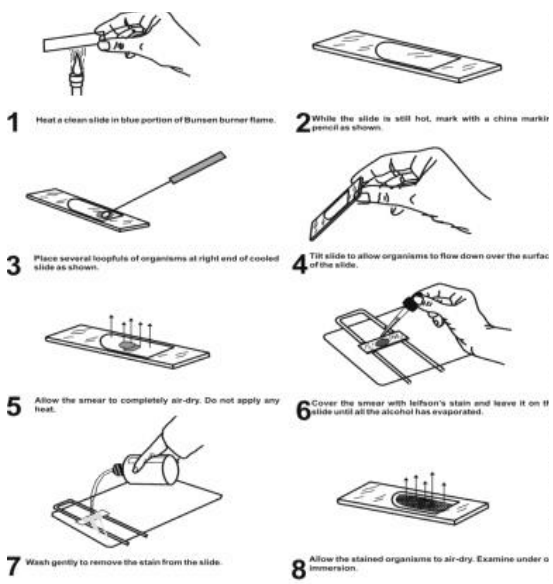

Fig. 6 Demonstration of flagella staining

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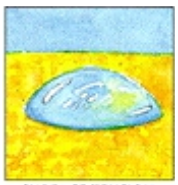
Detergent & Water Miscibility

To understand what is needed to achieve effective cleaning, it is helpful to have a basic knowledge of soap and detergent chemistry.



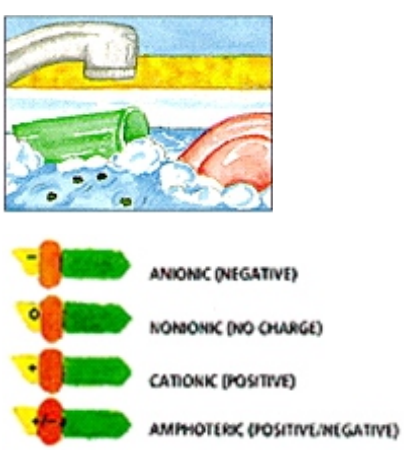
SURFACE TENSION

Water, the liquid commonly used for cleaning, has a property called surface tension. In the body of the water, each molecule is surrounded and attracted by other water molecules. However, at the surface, those molecules are surrounded by other water molecules only on the water side. A tension is created as the water molecules at the surface are pulled into the body of the water. This tension causes water to bead up on surfaces (glass, fabric), which slows wetting of the surface and inhibits the cleaning process. You can see surface tension at work by placing a drop of water onto a counter top. The drop will hold its shape and will not spread.

SURFACTANT

In the cleaning process, surface tension must be reduced so water can spread and wet surfaces. Chemicals that are able to do this effectively are called surface active agents, or surfactants. They are said to make water "wetter."

Surfactants perform other important functions in cleaning, such as loosening, emulsifying sinkdishes(dispersing in water) and holding soil in suspension until it can be rinsed away. Surfactants can also provide alkalinity, which is useful in removing acidic soils.



Surfactants are classified by their ionic (electrical charge) properties in water: anionic (negative charge), nonionic (no charge), cationic (positive charge) and amphoteric (either positive or negative charge).

Soap is an anionic surfactant. Other anionic as well as nonionic surfactants are the main ingredients in today's detergents. Now let's look closer at the chemistry of surfactants.

Soaps

Soaps are water-soluble sodium or potassium salts of fatty acids. Soaps are made from fats and oils, or their fatty acids, by treating them chemically with a strong alkali.

First let's examine the composition of fats, oils and alkalis; then we'll review the soapmaking process.

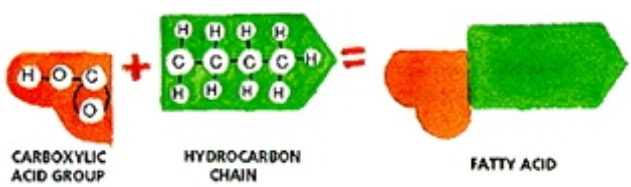
Fats and Oils

The fats and oils used in soapmaking come from animal or plant sources. Each fat or oil is made up of a distinctive mixture of several different triglycerides.

In a triglyceride molecule, three fatty acid molecules are attached to one molecule of glycerine. There are many types of triglycerides; each type consists of its own particular combination of fatty acids.

Fatty acids are the components of fats and oils that are used in making soap. They are weak acids composed of two parts:

A carboxylic acid group consisting of one hydrogen (H) atom, two oxygen (O) atoms, and one carbon (C) atom, plus a hydrocarbon chain attached to the carboxylic acid group. Generally, it is made up of a long straight chain of carbon (C) atoms each carrying two hydrogen (H) atoms.



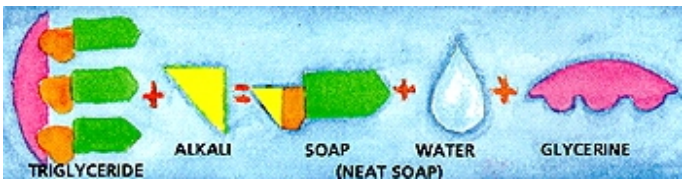
Alkali

An alkali is a soluble salt of an alkali metal like sodium or potassium. Originally, the alkalis used in soapmaking were obtained from the ashes of plants, but they are now made commercially. Today, the term alkali describes a substance that chemically is a base (the opposite of an acid) and that reacts with and neutralizes an acid.

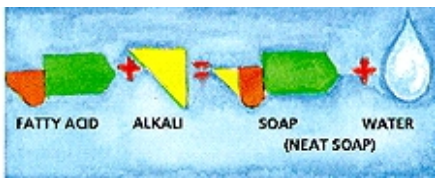
The common alkalis used in soapmaking are sodium hydroxide (NaOH), also called caustic soda; and potassium hydroxide (KOH), also called caustic potash.

How Soaps are Made

Saponification of fats and oils is the most widely used soapmaking process. This method involves heating fats and oils and reacting them with a liquid alkali to produce soap and water (neat soap) plus glycerine.

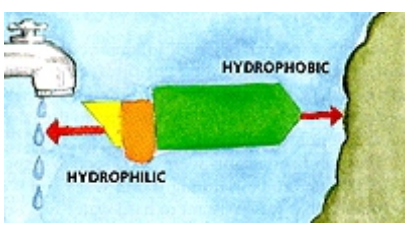


The other major soapmaking process is the neutralization of fatty acids with an alkali. Fats and oils are hydrolyzed (split) with a high-pressure steam to yield crude fatty acids and glycerine. The fatty acids are then purified by distillation and neutralized with an alkali to produce soap and water (neat soap).



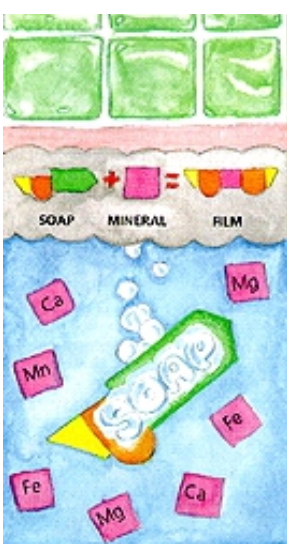
When the alkali is sodium hydroxide, a sodium soap is formed. Sodium soaps are "hard" soaps. When the alkali is potassium hydroxide, a potassium soap is formed. Potassium soaps are softer and are found in some liquid hand soaps and shaving creams.

The carboxylate end of the soap molecule is attracted to water. It is called the hydrophilic (water-loving). The hydrocarbon chain is attracted to oil and grease and repelled by water. It is known as the hydrophobic (water-hating) end.



How Water Hardness Affects Cleaning Action

Although soap is a good cleaning agent, its effectiveness is reduced when used in hard water. Hardness in water is caused by the presence of mineral salts - mostly those of calcium (Ca) and magnesium (Mg), but sometimes also iron (Fe) and manganese (Mn). The mineral salts react with soap to form an insoluble precipitate known as soap film or scum.



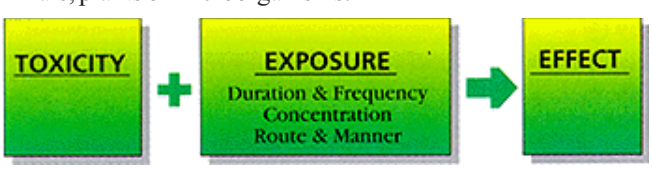
Soap film does not rinse away easily. It tends to remain behind and produces visible deposits on clothing and makes fabrics feel stiff. It also attaches to the insides of bathtubs, sinks and washing machines.

Some soap is used up by reacting with hard water minerals to form the film. This reduces the amount of soap available for cleaning. Even when clothes are washed in soft water, some hardness minerals are introduced by the soil on clothes. Soap molecules are not very versatile and cannot be adapted to today's variety of fibers, washing temperatures and water conditions.

Soaps & Detergents: Human Safety

As consumer needs and lifestyles change, and as new manufacturing processes become available, the soap and detergent industry responds with new products. A commitment to safety is a top priority from the time a company begins working on a new product and continues as long as the product is in the marketplace. Companies evaluate the safety of existing cleaning products by talking with consumers, reviewing scientific developments and monitoring product use data that may affect the safety assessment process.

To determine the safety of a cleaning product ingredient, industry scientists evaluate the toxicity of the ingredient. Toxicity is generally defined as any harmful effect of a chemical on a living organism, i.e., a human, an animal, a plant or a microorganism. Since all chemicals, including water (H2O), are toxic under certain conditions of exposure, scientists must consider a number of factors affecting exposure. These include the duration and frequency of exposure to the ingredient; the concentration of the ingredient at the time of exposure; and the route and manner in which the exposure occurs, e.g., eye, skin or ingestion. This information is essential whether assessing the effect on humans, animals, plants or microorganisms.



Because human safety and environmental evaluations consider different types of exposures, they are evaluated by different procedures. The principal steps in the assessment process are, however, the same. They involve:

- assembling existing data on toxicity and exposure;
- determining where new information is needed and, if necessary, carrying out appropriate studies; and
- determining whether predicted exposure levels are below levels that cause significant toxic effects.

This safety evaluation process enables scientists to predict the potential risk, if any, associated with the use of the ingredient or product, and determine if it is safe for consumers and the environment.

Medical science has long confirmed the important relationship between cleanliness and health. The regular use of cleaning products is fundamental to the health of our society and the well-being of its people.

Because cleaning products are part of our everyday lives, it is essential that they not present a significant risk to health. In considering the human safety of an individual ingredient or product, toxicologists (scientists who assess the safety of a chemical) are concerned with the effects from two types of exposures: intended and unintended.

Intended exposures occur with use of a cleaning product according to the manufacturer's directions. Unintended exposures can result from misuse, through improper storage or by accidental contact, such as when a liquid detergent is splashed in the eye.

Hazards from these types of exposures are evaluated from information obtained through acute (short-term) and chronic (long-term) tests and through a review of existing data. Expected exposure routes are considered as part of this evaluation.

Human safety evaluations begin with the specific ingredients and then move on to the whole product. The effects for all ingredients are considered as the product is formulated.

Toxicologists compare the expected exposure to the expected effect during both product manufacture and use. How will workers be exposed in the plant? What is the intended use of the product? Is it to be diluted? Undiluted? Used daily in the home? Weekly in the workplace? Toxicologists also consider the expected effect of an unintended exposure. What is the potential hazard, for example, if a child drinks a product directly from the bottle?

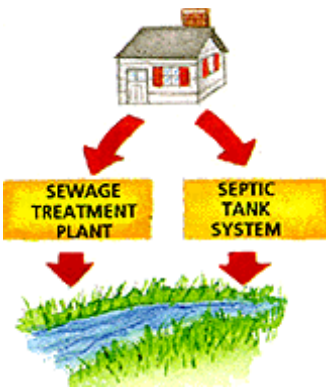
If this human safety evaluation indicates an unacceptable risk, it may be possible to make the risk smaller by changing the manufacturing process; reformulating to reduce or eliminate an ingredient contributing to the toxic effect; or using labeling or a child-resistant closure. If the risk cannot be reduced, the product will not be marketed.

Even though manufacturers formulate cleaning products to ensure that they are safe or have very low risk, human health effects can still result from unintended exposure. To warn consumers about a specific hazard, household cleaning products carry cautionary labeling whenever necessary. For consumers, this is one of the most important features of the label.

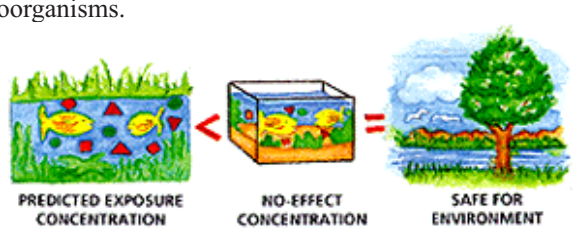
Federal regulations govern how precautionary statements related to human safety are used on household cleaning product labels. The regulations require that statements follow a standard format. There is first a "signal word," followed by a short description of the potential hazard. The following chart shows the signal words - **CAUTION** or **WARNING** and **DANGER** - and what they mean:

Soaps & Detergents: Environmental Safety

Most household cleaning products are formulated to be used with water and "go down the drain" into wastewater treatment systems (municipal sewage treatment plants or septic tank systems). To assure that products are safe for the environment, manufacturers evaluate the impacts of product ingredients in wastewater treatment systems, streams, rivers, lakes and estuaries. Scientific principles that are widely recognized by the technical and regulatory communities are used to assess the risk to the environment of these impacts.



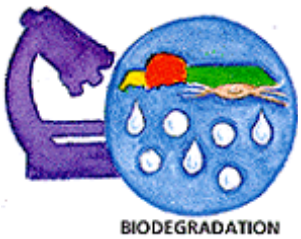
Environmental risk assessment considers the exposure concentrations and effects of individual ingredients. Two sets of information are used in these assessments. One set enables industry scientists to predict the concentration of the ingredient from all sources, including cleaning products, at various locations in the environment (the predicted exposure concentration). The other set is used to find the highest concentration of the ingredient at which no harm will occur to animals, plants or microorganisms living in the environment (the no-effect concentration). Comparing the predicted exposure concentration and the no-effect concentration enables scientists to determine whether the use of an ingredient is safe for the environment. The planned use of a cleaning product ingredient is acceptable if the predicted exposure concentration is lower than the concentration that would harm animals, plants or microorganisms.

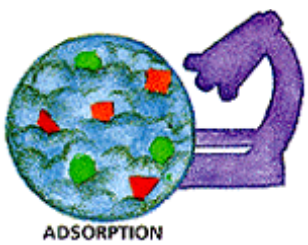


This information applies to ingredients processed through household septic tank systems as well as municipal treatment plants. Two basic steps occur in the treatment of wastewater in both systems. The first step, called primary treatment, consists of the removal of solid material, such as grit or grease, from the wastewater by physical means, i.e., settling and flotation in tanks.

The second step, called secondary treatment, removes the dissolved material by biological means, i.e., consumption by microorganisms. It is in the secondary treatment stage where the most important process in

reducing the exposure concentration of detergent ingredients occurs. This is called biodegradation. Biodegradation describes how organic (carbon-containing) detergent ingredients, like surfactants, enzymes and fragrances, are broken down into carbon dioxide, water and minerals by the action of microorganisms such as bacteria. At this stage, biodegradation reduces the amount of detergent ingredients discharged into the environment to levels that do not present a risk to fish or other aquatic life. Any small amounts of chemicals which are not biodegraded or removed during sewage treatment are diluted in surface waters, soil and the ocean. They continue to biodegrade or be removed from water by attaching to solids, a process known as adsorption.





Some inorganic (not carbon-containing) detergent ingredients, such as phosphates, zeolites and some dyes, also attach to solids, and are further treated during processing of the biosolids (sludge) produced in primary and secondary treatment. Biosolids are often used as fertilizers and soil conditioners.

Because of modern treatment methods, only an insignificant amount of the ingredients used to clean clothes, dishes, home and workplace surfaces actually reaches the environment. And that amount is at such levels as to not cause any adverse effects.

Improving Environmental Quality

The soap and detergent industry is committed to understanding the impact of its products and packages on the environment. With this understanding comes the ability to reduce their impact and improve their environmental quality.

Manufacturers of cleaning products have been leaders in reducing packaging waste and encouraging sound waste disposal practices. Advances in technology have resulted in products that are more concentrated, products that combine two functions in one, products with refill packages and packages that use recycled materials. Concentrated products need less energy to manufacture and transport, and require less packaging. Multifunctional products eliminate the need for separate packages. Refill packages allow consumers to reuse primary packages many times, decreasing the amount of packaging used and the volume of trash generated. Plastic and paperboard that would otherwise be thrown away become usable materials through recycling.

Through education and community programs, the soap and detergent industry helps consumers learn how to reduce waste and how best to dispose of it. Consumers are reminded that the environmentally wise way of handling any household cleaning product is to buy only the amount that can be used; to use it all up or give it away; and, if it must be disposed, to dispose of it properly. As a rule of thumb, products designed for use with water should be disposed of by pouring down the drain; solid products such as scouring pads should be put into the trash.

A promising method under development for improving the environmental quality of a product is life cycle assessment (LCA). LCA describes a "cradle-to-grave" look at all the environmental impacts of a product and its package, from acquiring raw materials through manufacture and distribution to consumer use and disposal. One advantage of LCA is that it can determine whether reducing an environmental impact in one area, such as manufacturing, shifts the impact to another, such as disposal. LCA also helps to identify where environmental improvement efforts should be focused.

Sound scientific information provides the foundation for the soap and detergent industry's commitment to safety. The industry maintains this commitment without compromising product performance, convenience or cost-effectiveness.

The following key indicates the product category in which an ingredient may be used. The key letters appear below each ingredient.

Personal Cleansing	Laundry	Dishwashing	Household Cleaners
PC	L	DW	HC

Ingredient	Primary Functions Comments	Typical Examples
Abrasives PC DW HC	Supply smoothing, scrubbing and/or polishing action	Calcite Feldspar Quartz Sand

Ingredient	Primary Functions Comments	Typical Examples
Acids HC	Neutralize or adjust alkalinity of other ingredients *Some specialty cleaners need extra acidity to remove mineral build-up*	Acetic acid Citric acid Hydrochloric acid Phosphoric acid Sulfuric acid
Alkalis PC L DW HC	Neutralize or adjust acidity of other ingredients Make surfactants and builders more efficient Increase alkalinity *Alkalinity is useful in removing acidic, fatty and oily soils. Therefore, detergents are more effective when they are alkaline.*	Ammonium & nbsphydroxide Ethanolamines Sodium carbonate Sodium hydroxide Sodium silicate
Antimicrobial agents PC L DW HC	Kill or inhibit growth of microorganisms that cause diseases and/or odor	Pine oil Quaternary ammonium compounds Sodium hypochlorite Triclocarban Triclosan
Antiredeposition agents L DW	Prevent soil from resettling after removal during washing	Carboxymethyl cellulose Polycarbonates Polyethylene glycol Sodium silicate
Bleaches L DW HC	Help whiten, brighten and remove stains	
Chlorine bleach	*Also disinfects*	Sodium hypochlorite
Oxygen bleach	*In some products, may be combined with bleach activator for better performance in lower water temperatures.*	Sodium perborate Sodium percarbonate
Colorants PC L DW HC	Provide special identity to product Provide bluing action	Pigments or dyes
Corrosion inhibitors L DW	Protect metal machine parts and finishes, china patterns and metal utensils	Sodium silicate
Enzymes L DW HC	Proteins classified by the type of soil they break down to simpler forms for removal by detergent Cellulase reduces pilling and greying of fabrics containing cotton and helps remove particulate soils.	Amylase (starch soils) Lipase (fatty and oily soils) Protease (protein soils) Cellulase
Fabric softening agents L	Impart softness and control static electricity in fabrics	Quaternary ammonium compounds
Fluorescent whitening agents L	Attach to fabrics to create a whitening or brightening effect when exposed to daylight *Also called optical brighteners.*	Colorless fluorescing compounds
Fragrances PC L DW HC	Mask base odor of ingredients and package Cover odors of soil Provide special identity to product Provide pleasant odor to clothes and rooms	Fragrance blends

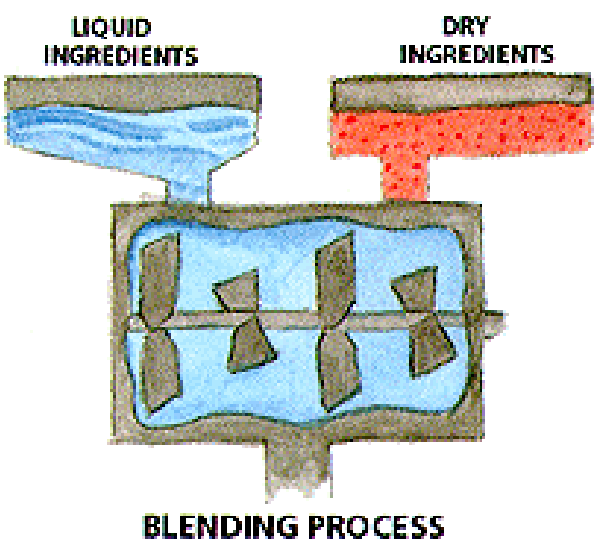
Ingredient	Primary Functions Comments	Typical Examples
Hydrotropes L DW HC	Prevent liquid products from separating into layers Ensure product homogeneity	Cumene sulfonates Ethyl alcohol Toluene sulfonates Xylene sulfonates
Opacifiers PC L DW HC	Reduce transparency or make product opaque Provide a special effect	Polymers Titanium dioxide
Preservatives PC L DW HC	Protect against natural effects of product aging, e.g., decay, discoloration, oxidation and bacterial attack	Butylated hydroxytoluene Ethylene diamine tetraacetic acid Glutaraldehyde
Processing aids PC L DW HC	Provide important physical characteristics, e.g., proper pour or flow, viscosity, solubility, stability and uniform density Assist in manufacturing	Clays Polymers Sodium silicate Sodium sulfate Solvents
Solvents L DW HC	Prevent separation or deterioration of ingredients in liquid products Dissolve organic soils Clean without leaving residue *Solvents used in cleaning products are water soluble*	Ethanol Isopropanol Propylene glycol
Suds control agents	Ensure optimum sudsing (foaming) level needed for a cleaning job	
Suds stabilizers DW HC	Maintain high sudsing where suds level is an important indicator of cleaning power	Alkanolamides Alkylamine oxides
Suds suppressors L DW HC	Control sudsing where suds would interfere with cleaning action	Alkyl phosphates Silicones Soap

LIQUID DETERGENTS

Both batch and continuous blending processes are used to manufacture liquid and gel cleaning products. Stabilizers may be added during manufacturing to ensure the uniformity and stability of the finished product.

In a typical continuous process, dry and liquid ingredients are added and blended to a uniform mixture using in-line or static mixers.

Recently, more concentrated liquid products have been introduced. One method of producing these products uses new high-energy mixing processes in combination with stabilizing agents.



Reference:

https://www.cleaninginstitute.org/clean_living/soaps__detergents_chemistry.aspx

Salvador Luria

Birthday: August 13, 1912
Nationality: Italian
Famous: Biologists Microbiologists
Also Known As: Salvador Edward Luria
Sun Sign: Leo
Died At Age: 78
Born In: Turin, Italy
Famous As: Microbiologist
Spouse/Ex-: Zella Hurwitz
Father: Davide Luria
Mother: Ester (Sacerdote)
Died On: February 6, 1991

Salvador E. Luria was an Italian microbiologist who jointly won the Nobel Prize in Physiology or Medicine in 1969 with Max Delbrück and Alfred Hershey, for their discoveries on the replication mechanism and the genetic structure of viruses. Born in Turin, Italy, into an influential Jewish family, he attended the medical school at the University of Turin following which he served as a medical doctor in the Italian army for some time. He then proceeded to study radiology at the University of Rome where he developed an interest in bacteriophages—viruses that infect bacteria. A brilliant student, he received a fellowship to study in the United States. Italy at that time was under the fascist regime of Benito Mussolini which banned Jews from academic research fellowships. Frustrated, he moved to Paris, France. It was a politically chaotic period in Europe and the Nazi German armies invaded France in 1940, forcing Luria to escape to the United States. He continued his research in the US and soon met Delbrück and Hershey with who he conducted many experiments, including the seminal work which earned the trio the Nobel Prize. He eventually became a naturalized American citizen. Throughout his career, Luria was an outspoken political advocate and vehemently opposed war and nuclear weapon testing.

Childhood & Early Life

- He was born Salvatore Edoardo Luria, in Turin, Italy, on August 13, 1912. His parents Ester (Sacerdote) and Davide Luria hailed from an influential Italian Sephardi Jewish family.
- He went to the medical school at the University of Turin where he became acquainted with two other future Nobel laureates: Rita Levi-Montalcini and Renato Dulbecco. He graduated with an M. D. summa cum laude in 1935.
- He served in the Italian Army as a medical officer during 1936-37 following which he enrolled for classes in radiology at the University of Rome. It was here that he developed an interest in bacteriophages—viruses that infect bacteria—and conducted genetic theory experiments on them.
- In 1938, he received a fellowship to study in the United States. At that time Italy was reeling under the fascist regime of Benito Mussolini which prohibited Jews from academic research fellowships.
- Frustrated at being denied this chance, Luria left Italy for Paris, France. The chaotic situation in Europe continued and the Nazi German armies invaded France in 1940. Luria was now forced to flee France as well. Fortunately he was able to receive an immigration visa to the United States.

Career

- After arriving in the United States he changed the spelling of his name to Salvador Edward Luria. He was acquainted with the physicist Enrico Fermi who helped Luria receive a Rockefeller Foundation fellowship at Columbia University.
- He met Max Delbrück and Alfred Hershey over the course of his research and the trio performed experiments at Cold Spring Harbor Laboratory and in Delbrück's lab at Vanderbilt University.
- Delbrück introduced Luria to the American Phage Group, an informal scientific group dedicated to the study of viral self-replication. Luria was successful in obtaining one of the electron micrographs of phage particles while working with a member of the group.
- Luria and Delbrück formed a very fruitful professional collaboration. In 1943 they performed what became known as the Luria–Delbrück experiment which demonstrated that in bacteria, genetic mutations arise in the absence of selection, rather than being a response to selection.
- From 1943 to 1950 he served as the Instructor, Assistant Professor, and Associate Professor of Bacteriology at Indiana University. Luria became a naturalized citizen of the United States in January 1947.
- In 1950 he was appointed Professor of Microbiology at the University of Illinois at Urbana–Champaign. In the 1950s he discovered that a culture of E. coli was able to significantly reduce the production of phages grown in other strains.
- He took over the chair of Microbiology at the Massachusetts Institute of Technology (MIT) in 1959. During the later years of his career he shifted his research focus from phages to cell membranes and bacteriocins, and discovered that bacteriocins impair the function of cell membranes by forming holes in the cell membrane.
- In 1964 he became Sedgwick Professor of Biology at the MIT and in 1972 he was appointed chair of The Center for Cancer Research at MIT.
- A prominent political advocate throughout his career, he opposed nuclear weapon testing and was a detractor of the

Vietnam War. His political activities led to his being blacklisted from receiving funding from the National Institutes of Health for a short time in 1969.

- He was the Editor or Member of the Editorial Board of several journals including 'Journal of Bacteriology', 'Journal of Molecular Biology', 'American Naturalist', and 'Proceedings of the National Academy of Sciences.' He also authored a college textbook, 'General Virology' (1953), and a popular text for the general reader, 'Life: The Unfinished Experiment' (1973).

Major Works

- Working along with Delbrück he made significant discoveries on the replication mechanism and the genetic structure of viruses, and showed that bacterial resistance to viruses (phages) is genetically inherited. Luria also proved the existence of spontaneous phage mutants.

Awards & Achievements

- Salvador E. Luria along with Max Delbrück and Alfred D. Hershey was jointly awarded the Nobel Prize in Physiology or Medicine in 1969 "for their discoveries concerning the replication mechanism and the genetic structure of viruses".
- Luria and Delbrück were jointly awarded the Louisa Gross Horwitz Prize for Biology or Biochemistry in 1969.
- He received the National Medal of Science in 1991.

Personal Life & Legacy

- Salvador E. Luria married Zella Hurwitz in 1945. His wife was a Professor of Psychology at Tufts University. They had one son, Daniel, who went on to become an economist.
- He died of a heart attack on February 6, 1991, aged 78.

Jokes

Postman: I have to come 5 miles
to deliver you this packet.
Santa: Why did u come so far?
Instead U could have posted it.

" Women wont play football not coz they aren't gud at it..
But coz its against their ego to b dressed up exactly like
10 other women in
front of 10,000 people..

Santa giving exam while standing at the door.
A man asked "Why are you standing at the door?"
Santa: "Idiot, I am giving entrance test."

Question by a student !!
If a single teacher can't
teach us all the subjects,
Then…
How could you expect a single student
to learn all subjects?

Womens are like Fruits.
Every Woman has her own unique taste and colour…
But
The problem is the Men.
They seem to love Fruit salad..!!

A pizza and an apple were thrown down from the 15th floor.
Which will reach down first?
Ans: The Pizza, as it's fast food!

Teacher: Why are you late?
santa: Because of the sign.
Teacher: What sign?
santa: The one that says,
"School Ahead, Go Slow."

New Teacher: anybody who thinks he is stupid, stand up
pappu stoodup
Teacher: R U stupid?
Pappu: "nhi, Aap akeli khari theen mujhe acha nhi lag raha tha"

Propionibacterium freudenreichii

Propionibacterium freudenreichii is a Gram-positive, non-motile bacterium that plays an important role in the creation of Emmental cheese, and to some extent, Jarlsberg cheese, Leerdammer and Maasdam cheese. Its concentration in Swiss-type cheeses is higher than in any other cheese. Propionibacteria are commonly found in milk and dairy products, though they have also been extracted from soil. *P. freudenreichii* has a circular chromosome about 2.5 Mb long. When Emmental cheese is being produced, *P. freudenreichii* ferments lactate to form acetate, propionate, and carbon dioxide ($3\ C_3H_6O_3 \rightarrow 2\ C_2H_5CO_2 + C_2H_3O_2 + CO_2$).

The products of this fermentation contribute to the nutty and sweet flavors of the cheese, and the carbon dioxide byproduct is responsible for forming the holes or "eyes" in the cheese. Cheese makers control the size of the holes by changing the acidity, temperature, and curing time of the mixture. An estimated one billion living cells of *P. freudenreichii* are present in one gram of Emmental. In contrast to most lactic acid bacteria, this bacterium mainly breaks down lipids, forming free fatty acids. Recent research has focused on possible benefits incurred from consuming *P. freudenreichii*, which are thought to cleanse the gastrointestinal tract. *P. freudenreichii* has also been suggested to possibly lower the incidence of colon cancer. This mutualistic relationship is unusual in propionibacteria, which are largely commensal.

The performance and growth of *P. freudenreichii* is highly dependent on the presence of *Lactobacillus helveticus*, which provides essential amino acids. The degradation of *L. helvecticus* releases a variety of amino acids and peptides. While *P. freudenreichii* has been found to grow even in the absence of *L. helvecticus*, some strains of the bacteria were observed lysing in the absence of glutamine, lysine, or tyrosine. The autolysis of *P. freudenreichii* has been suggested to contribute further to the flavor of the Emmental cheese. The conditions leading to the autolysis of this bacterium are not well known.

History

*P. freudenreichi*i was first discovered and isolated in the late 19th century by E. von Freudenreich and S. Orla-Jensen. They discovered the bacterium while studying propionic acid fermentation in Emmental cheese. Its genus is named after propionic acid, which this bacterium produces. The species freudenreichii is named after the E von Freudenreich.

Features of the bacterium

The cells themselves most commonly take the shape of pleomorphic (able to assume different forms) rods (0.2-1.5 micrometers *, 1-5 micrometers) but they can also be coccoid, bifid, branched, or filamentous. The length of the cell can be as long as 20 micrometers. When grown on solid media the colonies formed can appear smooth, convex, or rough. When grown in liquid media the colonies may be observed, appearing granular and varying in size. The colonies can vary quite a bit in color: they have been observed as being red, pink, orange, yellow, gray, and white. *P. freudenreichii* is gram-positive and non-motile. One discernible feature of this bacterium is that it produces large quantities of propionic and acetic acids. It can ferment sugars and polyhydroxy alcohols, and lactate provided that there are bacteria nearby are producing it by their own fermentative activities (this is known as secondary fermentation). It can also produce iso-valeric,formic, succinic, or lactic acids as well as carbon dioxide (although these are all secreted in lesser amounts than the other substances it produces). Certain strains of the bacterial cells have surface proteins: these act as a starter for cheese ripening. Depending on the strain there are varying cellular appendages that can be present, pili have been found on certain strains.

The value of *P. freudenreichii*'s DNA coding is 2,321,778 bp (87.64% of the genome). The genome itself is circular in shape. Its genome has one finalized chromosome with no plasmids. The genome is 2,649,166 nucleotides in size. The G/C content of the genome is 67.34%.

Health Benefits of *P. freudenreichii*

1) *P. freudenreichii* beneficially Modifies Gut Microbiota

   P. freudenreichii stimulates the growth of Bifidobacteria in the colon in healthy volunteers.

   Bifidogenic growth stimulator (BGS) is a prebiotic preparation produced by *P.freudenreichii* that stimulates the growth of Bifidobacteria.

2) *P. freudenreichii* is Anti-inflammatory

   A component from *P. freudenreichii* suppresses the production of proinflammatory cytokines and attenuates colitis in mice.

3) *P. freudenreichii* May be Beneficial in IBD

   P. freudenreichii was effective in the treatment of mild to moderate ulcerative colitis in a human pilot study.

   P. freudenreichii accelerates the healing in rats with colitis.

   A component of *P. freudenreichii* improved survival rate and reduced damage in mice with colitis, by attenuating colonic inflammation through balancing intestinal bacterial flora and suppressing lymphocyte infiltration.

4) *P. freudenreichii* Relieves Constipation

   P. freudenreichii relieves constipation in young healthy women.

5) *P. freudenreichii* binds Toxins

   P. freudenreichii binds cadmium and lead efficiently at low concentration ranges commonly observed in foods.

6) *P. freudenreichii* Combats Cancer

   P. freudenreichii is able to kill colon cancer cells in rats.

   Propionibacteria induce intrinsic apoptosis of colon cancer cells, via the production and release of SCFA (propionate and acetate) acting on mitochondria.

   Milk fermented by *P. freudenreichii* kills human gastric cancer cells and enhances the cytotoxicity of camptothecin, a drug used in gastric cancer chemotherapy.

Formaldehyde and Cancer Risk

What is formaldehyde?

Formaldehyde is a colorless, flammable, strong-smelling chemical that is used in building materials and to produce many household products. It is used in pressed-wood products, such as particleboard, plywood, and fiberboard; glues and adhesives; permanent-press fabrics; paper product coatings; and certain insulation materials. In addition, formaldehyde is commonly used as an industrial fungicide, germicide, and disinfectant, and as a preservative in mortuaries and medical laboratories. Formaldehyde also occurs naturally in the environment. It is produced in small amounts by most living organisms as part of normal metabolic processes.

How is the general population exposed to formaldehyde?

According to a 1997 report by the U.S. Consumer Product Safety Commission, formaldehyde is normally present in both indoor and outdoor air at low levels, usually less than 0.03 parts of formaldehyde per million parts of air (ppm). Materials containing formaldehyde can release formaldehyde gas or vapor into the air. One source of formaldehyde exposure in the air is automobile tailpipe emissions.

During the 1970s, urea-formaldehyde foam insulation (UFFI) was used in many homes. However, few homes are now insulated with UFFI. Homes in which UFFI was installed many years ago are not likely to have high formaldehyde levels now. Pressed-wood products containing formaldehyde resins are often a significant source of formaldehyde in homes. Other potential indoor sources of formaldehyde include cigarette smoke and the use of unvented fuel-burning appliances, such as gas stoves, wood-burning stoves, and kerosene heaters.

Industrial workers who produce formaldehyde or formaldehyde-containing products, laboratory technicians, certain health care professionals, and mortuary employees may be exposed to higher levels of formaldehyde than the general public. Exposure occurs primarily by inhaling formaldehyde gas or vapor from the air or by absorbing liquids containing formaldehyde through the skin.

What are the short-term health effects of formaldehyde exposure?

When formaldehyde is present in the air at levels exceeding 0.1 ppm, some individuals may experience adverse effects such as watery eyes; burning sensations in the eyes, nose, and throat; coughing; wheezing; nausea; and skin irritation. Some people are very sensitive to formaldehyde, whereas others have no reaction to the same level of exposure.

Can formaldehyde cause cancer?

Although the short-term health effects of formaldehyde exposure are well known, less is known about its potential long-term health effects. In 1980, laboratory studies showed that exposure to formaldehyde could cause nasal cancer in rats. This finding raised the question of whether formaldehyde exposure could also cause cancer in humans. In 1987, the U.S. Environmental Protection Agency (EPA) classified formaldehyde as a probable human carcinogen under conditions of unusually high or prolonged exposure. Since that time, some studies of humans have suggested that formaldehyde exposure is associated with certain types of cancer. The International Agency for Research on Cancer (IARC) classifies formaldehyde as a human carcinogen. In 2011, the National Toxicology Program, an interagency program of the Department of Health and Human Services, named formaldehyde as a known human carcinogen in its 12th Report on Carcinogens.

What have scientists learned about the relationship between formaldehyde and cancer?

Since the 1980s, the National Cancer Institute (NCI), a component of the National Institutes of Health (NIH), has conducted studies to determine whether there is an association between occupational exposure to formaldehyde and an increase in the risk of cancer. The results of this research have provided EPA and the Occupational Safety and Health Administration (OSHA) with information to evaluate the potential health effects of workplace exposure to formaldehyde.

The long-term effects of formaldehyde exposure have been evaluated in epidemiologic studies (studies that attempt to uncover the patterns and causes of disease in groups of people). One type of epidemiologic study is called a cohort study. A cohort is a group of people who may vary in their exposure to a particular factor, such as formaldehyde, and are followed over time to see whether they develop a disease. Another kind of epidemiologic study is called a case-control study. Case-control studies begin with people who are diagnosed as having a disease (cases) and compare them to people without the disease (controls), trying to identify differences in factors, such as exposure to formaldehyde, that might explain why the cases developed the disease but the controls did not.

Several NCI surveys of professionals who are potentially exposed to formaldehyde in their work, such as anatomists and embalmers, have suggested that these individuals are at an increased risk of leukemia and brain cancer compared with the general population. However, specific work practices and exposures were not characterized in these studies. An NCI case-control study among funeral industry workers that characterized exposure to formaldehyde also found an association between increasing formaldehyde exposure and mortality from myeloid leukemia. For this study, carried out among funeral industry workers who had died between 1960 and 1986, researchers compared those who had died from hematopoietic and lymphatic cancers and brain tumors with those who died from other causes. (Hematopoietic or hematologic cancers such as leukemia develop in the blood or bone marrow. Lymphatic cancers develop in the tissues and organs that produce, store, and carry white blood cells that fight infections and other diseases.) This analysis showed that those who had performed the most embalming and those with the highest estimated formaldehyde exposure had the greatest risk of myeloid leukemia. There was no association with other cancers of the hematopoietic and lymphatic systems or with brain cancer.

A number of cohort studies involving workers exposed to formaldehyde have recently been completed. One study,

conducted by NCI, looked at 25,619 workers in industries with the potential for occupational formaldehyde exposure and estimated each worker's exposure to the chemical while at work. The results showed an increased risk of death due to leukemia, particularly myeloid leukemia, among workers exposed to formaldehyde. This risk was associated with increasing peak and average levels of exposure, as well as with the duration of exposure, but it was not associated with cumulative exposure. An additional 10 years of data on the same workers were used in a follow-up study published in 2009. This analysis continued to show a possible link between formaldehyde exposure and cancers of the hematopoietic and lymphatic systems, particularly myeloid leukemia. As in the initial study, the risk was highest earlier in the follow-up period. Risks declined steadily over time, such that the cumulative excess risk of myeloid leukemia was no longer statistically significant at the end of the follow-up period. The researchers noted that similar patterns of risks over time had been seen for other agents known to cause leukemia.

A cohort study of 11,039 textile workers performed by the National Institute for Occupational Safety and Health (NIOSH) also found an association between the duration of exposure to formaldehyde and leukemia deaths. However, the evidence remains mixed because a cohort study of 14,014 British industry workers found no association between formaldehyde exposure and leukemia deaths.

Formaldehyde undergoes rapid chemical changes immediately after absorption. Therefore, some scientists think that formaldehyde is unlikely to have effects at sites other than the upper respiratory tract. However, some laboratory studies suggest that formaldehyde may affect the lymphatic and hematopoietic systems. Based on both the epidemiologic data from cohort and case-control studies and the experimental data from laboratory research, NCI investigators have concluded that exposure to formaldehyde may cause leukemia, particularly myeloid leukemia, in humans.

In addition, several case-control studies, as well as analysis of the large NCI industrial cohort have found an association between formaldehyde exposure and nasopharyngeal cancer, although some other studies have not. Data from extended follow-up of the NCI cohort found that the excess of nasopharyngeal cancer observed in the earlier report persisted.

Earlier analysis of the NCI cohort found increased lung cancer deaths among industrial workers compared with the general U.S. population. However, the rate of lung cancer deaths did not increase with higher levels of formaldehyde exposure. This observation led the researchers to conclude that factors other than formaldehyde exposure might have caused the increased deaths. The most recent data on lung cancer from the cohort study did not find any relationship between formaldehyde exposure and lung cancer mortality.

What has been done to protect workers from formaldehyde?

In 1987, OSHA established a Federal standard that reduced the amount of formaldehyde to which workers can be exposed over an 8-hour workday from 3 ppm to 1 ppm. In May 1992, the standard was amended, and the formaldehyde exposure limit was further reduced to 0.75 ppm.

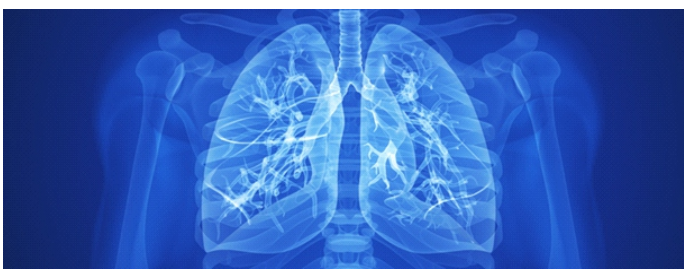
How can people limit formaldehyde exposure in their homes?

The EPA recommends the use of “exterior-grade” pressed-wood products to limit formaldehyde exposure in the home. These products emit less formaldehyde because they contain phenol resins, not urea resins. (Pressed-wood products include plywood, paneling, particleboard, and fiberboard and are not the same as pressure-treated wood products, which contain chemical preservatives and are intended for outdoor use.) Before purchasing pressed-wood products, including building materials, cabinetry, and furniture, buyers should ask about the formaldehyde content of these products. Formaldehyde levels in homes can also be reduced by ensuring adequate ventilation, moderate temperatures, and reduced humidity levels through the use of air conditioners and dehumidifiers.

Best practices to have healthy lungs for inhalation

Fumigation Safety

Inhalation is the most dangerous and common route of exposure to fumigants. Most are highly toxic so breathing even small amounts can cause serious illness or death. Exposure also can occur thorough your eyes, mouth, or skin. The label will list the personal protective equipment (PPE) that the manufacturer requires. Know what to do in case of an exposure.



Inhalation is the most common route of exposure to fumigants (levitt-safety.com)

Mild inhalation exposure can cause a feeling of sickness, ringing in the ears, fatigue, nausea and tightness in the chest. Exposure to fresh air will usually relieve these symptoms.

Moderate inhalation exposure can cause weakness, vomiting, chest pain, diarrhea, difficulty breathing and pain just above the stomach.

Symptoms of **severe inhalation** exposure may occur within a few hours to several days after exposure. Severe poisoning may result in fluid in the lungs. This can lead to dizziness, blue or purple skin color, unconsciousness, and even death.

Do not attempt to rescue someone in an enclosed area if you are not wearing the proper respiratory protection.

A **fumigant exposure limit** is the highest level of fumigant that you may be exposed to without being required to use any controls to reduce your exposure. You also can reduce your risk of inhalation overexposure by monitoring fumigant concentrations during treatment and aeration. Be sure your exposure stays below established exposure limits.

The three most common terms used to express the exposure limit of a fumigant are the:

- **Threshold limit value** - Time weighted average (TLV-TWA) refers to the average concentration of a fumigant to which most workers may be repeatedly exposed for 8 hours a day, 40 hours a week without adverse effects. Concentrations at or below the TWA represent conditions that you may be exposed to on a daily basis. These levels are considered safe. Concentrations above the TWA may lead to "overexposure" to a fumigant, which can cause discomfort, sickness or even death.
- **Threshold limit value** - Short term exposure limit (TLV-STEL) is the concentration of fumigant to which most workers can be exposed continuously for a short period without suffering from:
  - Irritation
  - Chronic or irreversible tissue damage
  - Narcosis (drunkenness) that may increase the chance of accident or injury

  Exposure to concentrations at the STEL should not be longer than 15 minutes and should not occur more than four times per day.
- The **permissible exposure limit (PEL)** designates the maximum exposure permitted as an 8-hour TWA. Refer to the fumigant label information to find out what the different exposure limits are for each product you use.

Personal Protective Equipment

Personal protective equipment (PPE) is clothing and devices that minimize your exposure to a pesticide. The label lists the minimum required PPE. Federal and state laws require pesticide users to follow all instructions on the product label, including wearing the appropriate PPE.

Respirators

The main types of respirators are:

1) atmosphere-supplying respirators and

2) air-purifying respirators.

They must be approved by NIOSH (National Institute of Safety and Health). The specific type of required may vary depending on applicator health, type of fumigant used, and working conditions. Atmosphere-supplying respirators use canisters to supply breathable air or draw air from outside the fumigation area.

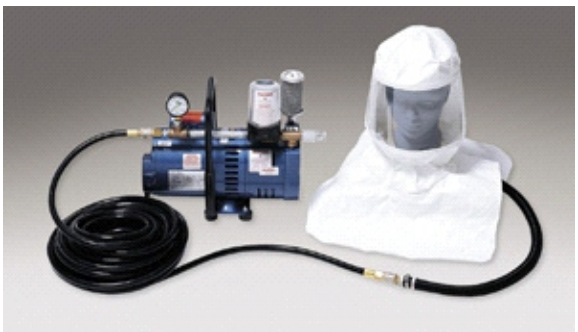
Atmosphere-Supplying Respirators

The two main types of atmosphere-supplying respirators are the self-contained breathing apparatus (SCBA) and the supplied-air respirator (SAR).

SCBA (photo: scottsafety.com)

Self-contained breathing apparatus (SCBA) consists of a full-face mask attached to a tank of compressed air. The face piece

must fit snugly to keep out contaminated air. There is an alarm to warn when the air supply is low. Movement is not restricted with this system. However, the weight and bulk of an SCBA often makes strenuous work difficult.



Supplied air – air line respirator (PK Safety)

Supplied-air respirators have a full-face mask that delivers air from a compressed air tank or an outside air pump. The air tank or pump is located outside the fumigation area.

Air-Purifying Respirators

Air-purifying respirators combine a face piece with a specific filter media. Outside air is drawn into the mask through a filter media. The filter absorbs impurities in the air.

Air purifying respirator (Fastenol.com)

Fit testing respirators (photo: IrwinsSaferty.org)

Respirators should be fit-tested and approved by a licensed health care professional. In addition, be sure that all parts and replacement parts meet manufacturer specifications.

How long a canister will last depends on several things:

- The type of canister
- The size of the canister
- The type and concentration of gas in the surrounding air
- The length of exposure
- The rate of breathing
- Whether there is more than one gas present
- The temperature and humidity at the time of use.

Other Protection Equipment

Fumigant labels also may require other types of PPE, including protective clothing and gloves. Requirements vary so read the label information carefully. Labels recommend loose-fitting clothes, long-sleeved shirts, long pants and socks for skin protection. Others do not specify.

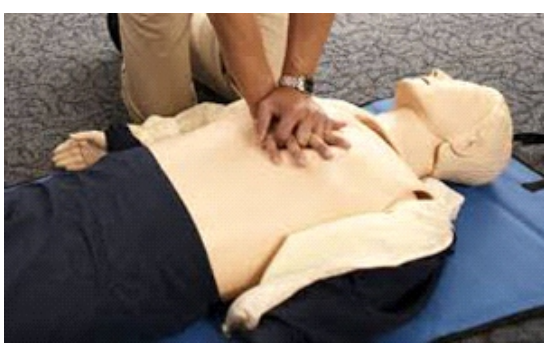
The need for gloves also varies. Applicators must wear gloves because of possible skin irritation some solid fumigants. Labels of liquid products do not require gloves and may prohibit wearing them. Learn which items are required for the product you plan to use.

Whenever possible, provide two-way radio communication between workers applying fumigants and those outside. Also, keep on hand:

- An **emergency air-supplying respirator**, especially if canister-type respirators are being used
- **Antidotes** where applicable
- A **safety harness or rescue belt**
- **Basic first aid** equipment

First Aid for Fumigant Poisoning

Human exposure can occur even when you take all of the proper precautions. Unusual behavior by you or your fumigation partner could be a sign of exposure. Know what to do. The label information is your best source of information. First aid procedures on it usually are specific to the product. If you suspect fumigant exposure, remain calm, get to fresh air, and call for help immediately. Take a product label and Safety Data Sheet with you to the emergency room.



CPR (photo: aacc.edu)

If you are with someone suffering from inhalation exposure, carry him or her to fresh air immediately. Then:

- ✓ **Call for help – 911.**
- ✓ **Loosen all tight clothing.**
- ✓ **Give artificial respiration if breathing has stopped or is irregular.**
- ✓ **Keep the victim as quiet as possible.**
- ✓ **Prevent chilling by wrapping the victim in blankets. Do not to overheat the victim.**

- ✓ **If the victim is convulsing, protect his or her head from striking the floor or wall.**
- ✓ **Begin CPR if the victim does not have a pulse. Keep the victim's chin up so that the air passage remains free. Do not put anything in the mouth of an unconscious person.**
- ✓ **Get medical attention right away or take the victim to a doctor or emergency facility.**

Liquid and solid pesticides are most often the cause of skin exposure. However, some fumigant gases can injure the skin. Clothing or jewelry can hold the gas against the skin, causing burns or blisters. Fumigants absorbed through the skin can enter the bloodstream, causing systemic effects. Most fumigant labels suggest that you remove all jewelry and wear loose-fitting clothes. Some labels prohibit the use of gloves. Always consult the label to determine what precautions you should take.

If skin exposure does occur, take the following steps:

- ✓ **Get to fresh air.**
- ✓ **Remove contaminated items (clothing, jewelry, gloves, shoes, bandages, etc.) immediately.**
- ✓ **Drench the skin with water.**
- ✓ **Wash the skin, hair and fingernails with soap and water.**
- ✓ **Rinse thoroughly and wash again.**
- ✓ **Dry and wrap the affected skin in a blanket.**
- ✓ **If exposure causes a burn, cover the area loosely with a clean, soft cloth. Avoid using ointments, powders and other medications.**
- ✓ **Do not wear contaminated clothes again until you wash and air them for several days.**

Protecting the Public and the Environment

Reading the label is the most important thing you can do to ensure personal and public safety. Labels may include both an abbreviated sticker label and an extended label booklet. It may list specific sites that you should avoid or application methods that are not permitted. There will be storage and specific safety precautions.

Monitoring for the Fumigant

There is always a risk that fumigant gas will escape from a treatment area. Monitoring for these leaks is critical. Be sure to take air samples when treating commodities that are next to work areas. Use appropriate gas detectors to verify that fumigants are not leaking. This is particularly important during indoor treatments.

(photo: vikingfumigation.com)

Transporting a fumigant is dangerous. Leaks and spills caused by accidents can be beyond your control.

You can prevent many accidents by taking the following precautions and using common sense.

- ✓ **Do not carry fumigants with people in a closed vehicle and do not take fumigants through tunnels without permission from the Kentucky Department of Transportation (KDOT).**
- ✓ **Have the required driver's license with appropriate endorsements for the specific fumigant you plan to transport.**
- ✓ **Read the label information and/or the Safety Data Sheet (SDS) to determine the signage requirements for transporting each fumigant that you use. You can also contact the fumigant manufacturer for more information on placarding for transportation.**
- ✓ **Be sure cylinders are upright, secured, and protected from rear-end collision.**
- ✓ **Do not remove protective valve covers until just before use.**
- ✓ **Follow federal and state department of transportation regulations.**

NOTE: **It is illegal to transport goods over public roads or highways if those goods are undergoing fumigation or have not been completely aerated.**

Storing fumigants is hazardous; when possible, buy only what you need. Store fumigants on sturdy shelves in an area apart from feed or seed. **A separate building that is well-ventilated or has a mechanical exhaust system is best.** Be sure that all fumigant storage areas are locked and posted as pesticide storage sites. Warning signs should indicate the presence of fumigants.

Check valves and containers regularly for leaks. Fumigants can escape from faulty valves or damaged or corroded cans. Leaks can cause dangerous concentrations to build up in closed storerooms. Before entering any storage area, run an exhaust fan to remove vapors that may have built up inside.

Do not risk contamination of water supplies. Dispose of all empty containers, residues and rinsates according to state waste management procedures. Keep all pesticides and their empty containers out of the reach of children.

Proper aeration is important for the safety of you, your crew, and your clients. Poor aeration is one of the most common problems associated with fumigation. When treating raw agricultural products, be sure the rate of air exchange during the aeration

phase will adequately remove the fumigant. If necessary, use fans or other ventilation equipment.

Preparation and planning will help to prevent public and environmental exposure. How well have you sealed an area? Have you inspected all equipment thoroughly? Are you applying the fumigant at or below the label rate? Have you set aside enough time to aerate the site or item completely? Have you set up fences and posted warning signs to keep people, livestock and pets out of the treatment area?

Spilled aluminum or magnesium phosphide may generate high levels of phosphine gas so all personnel must wear SCBAs during the cleanup. **DO NOT USE WATER AT ANY TIME** to clean up these spills; water speeds up the production of phosphine gas, which could result in the release of toxic gas or produce a fire hazard.

If aluminum flasks have been damaged enough to leak, repair them temporarily with aluminum tape, or transfer the undamaged product to a sound metal container and label it.

Pre-Fumigation and Fumigation Application Procedures

- ✓ **READ AND FOLLOW THE LABEL DIRECTIONS.**
- ✓ **Post areas to be treated immediately before fumigation. Use bilingual placarding if workers or neighbors do not read English.**
- ✓ **Apply fumigant from the outside where appropriate.**
- ✓ **Only allow entry into fumigation area in extreme emergencies, and only with mandatory respiratory protection.**
- ✓ **When fumigating, consider prevailing wind and other factors that may affect the fumigation.**
- ✓ **Post warning signs.**
- ✓ **Provide guards where required. This is necessary unless the fumigated area is completely locked or enclosed by a locked fence.**

Post-Application Operations

- ✓ **Provide guards where required and/or necessary.**
- ✓ **Allow adequate aeration time for the structure / commodity.**
- ✓ **Turn on all ventilating or aerating fans where appropriate.**
- ✓ **Before re-entry, use a suitable gas detector to determine fumigant concentration so appropriate precautions may betaken. Most fumigants do not provide adequate odor warning.**
- ✓ **Check for gas concentrations in areas that aerate slowly.**
- ✓ **Remove warning signs when aeration is complete.**
- ✓ **Dispose of empty containers and used canisters.**
- ✓ **Return unused chemicals in properly and clearly labeled containers to storage area**

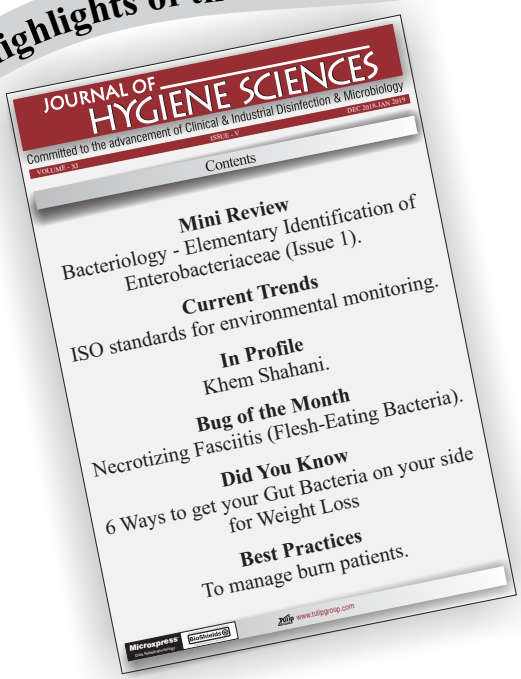
Handling of fumigated containers at the port and at the end-user is regulated by the Framework Directive on OSH (89/391/EEC) and Chemical Agents Directive (98/24/EC), which stipulate that a risk assessment must be carried out by the employer and, depending on the results, that appropriate measures must be taken before work starts.

References:

http://pest.ca.uky.edu/PSEP/fumsafety.html

file:///D:/Downlods/Health_risks_prevention_practices_during_handling_of_fumigated_containers.pdf

Highlights of the coming issue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Contents

Mini Review
Bacteriology - Elementary Identification of Enterobacteriaceae (Issue 1).

Current Trends
ISO standards for environmental monitoring.

In Profile
Khem Shahani.

Bug of the Month
Necrotizing Fasciitis (Flesh-Eating Bacteria).

Did You Know
6 Ways to get your Gut Bacteria on your side for Weight Loss

Best Practices
To manage burn patients.

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