What really kills those germs?

By Anne Dantz

In choosing a disinfectant, cleaning managers first need to know what microorganisms they must reduce or eliminate. Disinfecting chemicals generally are used to reduce a specific microbial population, which may or may not result in sterilization.

Disinfectants are classified by the specific action they perform on different forms of microorganisms. Bactericides kill vegetative microorganisms, sporocides destroy spores, viricides kill viruses and fungicides eliminate fungi.

An antiseptic chemical can be safely used to disinfect skin and mucous membrane surfaces. A bacteriostatic substance prevents the reproduction or multiplication of bacteria without actually killing them.

Chemical agents can affect cells in a variety of ways:

* Protein coagulation. Most of the proteins in a cell are enzymatic, and exist in a finely dispersed state within the cell. Disinfecting chemicals that cause these proteins to precipitate and coagulate make the cell non-functional and it dies.

* Disruption of cell membrane. The cell membrane acts as a selective barrier, allowing some solutions to pass through and other to be adsorbed onto the cell wall. Substances that concentrate at the cell membrane may alter the physical and chemical properties of the membrane, preventing its normal function. This may result in inihibition or death of the cell.

* Removal of free sulphydryl groups. Many of the enzyme proteins in a cell contain cysteine (an amino acid) and have side chains terminating in sulphydryl groups. These enzymes cannot function unless the sulphydryl groups remain free and reduced. If the sulphydryl groups are tied down -- for example, by an oxidizing agent such as chlorine -- widespread damage to the cell occurs, and death may result.

* Chemical antagonism. Enzymes perform their catalytic function through their affinity for specific chemical compounds normally found within cells, referred to as their "natural substrates." If a disinfecting compound structurally resembles a substrate in its essential aspects, the enzyme will have an affinity for that compound.

If this affinity is strong enough, the compound will take the place of the normal substrate of the enzyme and prevent the proper reaction from occurring -- thereby inhibiting the

reproduction of the cell.

Ethyl alcohol (ethanol) and isopropyl alcohol are frequently used for chemical disinfection. They are mainly used as skin antiseptics and act by "denaturing" or altering the molecular structure of bacterial proteins, destroying the cell. Alcohols kill vegetative forms of bacteria but have no action on spores or viruses.

Aldehydes -- such as formaldehyde-- are active against amino organic compounds in protein molecules and are bactericidal and sporicidal, also exerting a lethal effect on the influenza and poliomyelitis viruses.

All metallic salts in solution are germicidal to a certain extent, depending on the concentration. In general the salts of heavy metals are more toxic than those of lighter metals.

The salts mainly used as disinfectants are derived from mercury, copper and silver. When used at high concentrations they function as protein coagulants. At lower concentrations -- as they are generally used -- metallic salts belong to the group of chemical disinfectants that combine with the free sulphydryl groups of cell enzymes.

Chlorine has been used for many years as a disinfectant and has generally been associated with treatment of swimming pool water and water supplies. Chlorine gas reacts with water to form hypochlorous acid (HOCl). Hypochlorites are salts of this acid and represent the form in which chlorine is most commonly used. Chlorine and hypochlorites are bactericidal and act by oxidizing the cell membrane.

Iodine is most often used as a skin disinfectant. It combines with cell protein and is an active germicidal agent with a moderate activity against spores. It is effective against the tubercle bacillus and many other viruses.

Phenol (an acidic compound) was the forerunner of a wide range of phenolic compounds developed as disinfectants. The activity of phenolic compounds against microorganisms depends upon the type of compound used. Organic matter tends to absorb phenol and lowers the concentration available to kill microorganisms.

Phenol, a corrosive substance, is toxic to living tissues and act on the bacterial cell by denaturing and coagulating the protein within the cell. In low concentrations, phenol disrupts the cell wall, allowing leakage of cellular constituents.

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