BULLETIN

AKF engineers

Pure Water

The definition of pure water varies with its usage. Pure water for reagent use may be totally useless for clinical needs.

Pure Water Uses

Laboratories - Pure water is used as a solvent, in the preparation of compounds, tissue cultures, culture medias, analytic work and rinsing of labware.

Hospitals - In clinical laboratories pure water is used for washing and cleaning, preparation of solutions for injectable, irrigation and intravenous solutions, hemodialysis and dilutions. Water must be not only pure, but also sterile and pyrogen-free.

Pharmaceutical Manufacturing - Water for Injection (WFI) is used as a solvent in the preparation of parenteral solutions for injectable, irrigation and intravenous solutions administered by injection. Purified water is used for non-parenteral solutions and some bulk pharmaceutical chemicals.

Standards

In research facilities, the most common standards are defined by the American Society for Testing and Materials (ASTM) and the College of American Pathologists (CAP). ASTM and CAP provide specifications for reagent grade water into three categories. Type I is the highest grade.

In pharmaceutical water systems, specifications are covered by the United States Pharmacopoeia Standards (USP). The primary difference between WFI and purified water is the absence of bacterial endotoxin requirements for purified water, degree of system control and final purification techniques for bacterial removal.

Designing A System

Once the use is determined, then based on the quality of the raw water being purified, and factors such as cost, maintenance and desired bacteria level, a process system can be developed to produce the desired water. There is no one process that can remove all the contaminants in water. A combination of process techniques is utilized to produce the level of purity required.

Processes

Ion Exchange (Deionization/Demineralization) - Removes ionic impurities by passing water through a bed of synthetic resins which have an affinity for dissolved ionized salts and gases. It will not remove bacteria, pyrogens, particulates or dissolved organic compounds. Capable of 0.5 to 18 megohm-cm resistivity.

Distillation - Removes impurities from water by converting a liquid to a gas and then recondensing it as distilled water. Distilled water is free of all pyrogens, bacteria and viruses except dissolved ionized gases. Capable of 0.8 megohm-cm to 1 megohm-cm purity.

Reverse Osmosis - Utilizes hydraulic pressure to force pure water through a membrane. Usually used in waters having high Total Dissolved Solids (TDS). This process removes some bacteria, pyrogens and viruses, but not completely. It will not remove dissolved ionized gases.

Electrodialysis - Separates the components in a salt solution by passing an electric current through one or more ion-permeable membranes. The use of electrodialysis equipment may be suitable where the raw water is in range of 100 to 7,000 ppm TDS and where the desired product water purity is a maximum of 50,000 ohm-cm (10 ppm TDS).

Filtration - Separates suspended particles from water by passing the water through a porous membrane or medium. Types include sand filters, diatomaceous earth, cartridge filters, etc. The prefilter range is usually 5 to 25 mm. Good for bacteria removal but will not remove any dissolved solids, gases or pyrogens.

Ultrafiltration - Capable of bacteria and pyrogen removal and reduction is dissolved organics.

Ozone - Effective cold method of bacterial control. Basic two methods of ozone production are from air and from demineralized water.

Adsorption - Is the adherence of a gas or liquid on the surface of a solid. Most common is the use of activated carbon to remove dissolved organics or for dechlorination.

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