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Electrolytic Silver Ion Cell Sterilizes Water Supply

An electrolytic water sterilizer has been developed for control of microbial contamination in manned spacecrafts. Individual sterilizer cells are self-contained and require no external power or control. The compactness and light weight of the units (measuring 2.5 inches in diameter x 4 inches in length and weighing 0.6 pound) and absence of external mechanisms make it possible to integrate such sterilizers with the potable water supply or waste water system in confined areas.

The sterilizer generates silver ions in concentrations of 50 ppb (parts per billion) to 100 ppb in the water flow system, the desired concentration being adjusted as a function of the average water flow rate. After installation of a unit, no maintenance is required. Operation of the unit is self-limiting, precluding damage to the system if water ceases to flow. A shunt is provided for on-off functions and monitoring of current flow. Unit life expectancy is 9000 hours without a change of the power supply batteries.

Laboratory tests of the sterilizer under simulated conditions have demonstrated essentially complete kill within 8 hours of *Staphylococcus aureus* and *Escherichia coli* bacteria present in initial concentrations of approximately 5×10^3 organisms per milliliter.

Silver ions in concentrations of 50 to 100 ppb, which are nontoxic when ingested, have been recognized for many years as an effective bactericide. Since a sterilization unit for spacecraft water systems must operate in zero gravity, consume little electrical power, and require

no heat, elaborate controls, or material replacement, the use of silver ions in a spacecraft sterilizer has many advantages over other possible sterilization methods. Many of the advantages of the new sterilizer, including the advantage that the silver ions do not impart an unpleasant taste to the water, can be realized also in non-space applications. This water sterilizer should also be of value to biological laboratories, pharmaceutical companies, and underwater craft.

Note:

Design details and test results are contained in Report NASA-CR-65738 which is available from:
Clearinghouse for Federal Scientific and Technical Information
Springfield, Virginia 22151

Reference: B68-10555

Patent status:

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Source: J.B. Gillerman and C.F. Albright of The Garrett Corporation (AiResearch Mfg. Div.) under contract to Manned Spacecraft Center (MSC-11827)

QUALITY CRITERIA FOR WATER
U.S. ENVIRONMENTAL PROTECTION AGENCY

COPPER
CRITERIA
1.0 mg/l for domestic water supplies (welfare).
Copper occurs as a natural or native metal and in various mineral forms such as cuprite and malachite. The most important copper ores are sulfides, oxides, and carbonates. Copper has been mined and used by man in a variety of products since prehistoric times. Uses for copper include electrical products, coins, and metal plating. Copper frequently is alloyed with other metals to form various brasses and bronzes. Oxides and sulfates of copper are used for pesticides, algicides, and fungicides. Copper frequently is incorporated into paints and wood preservatives to inhibit growth of algae and invertebrate organisms such as the woodborer, *Teredo*, on vessels.
Copper is an essential trace element for the propagation of plants and performs vital functions in several enzymes and a major role in the synthesis of chlorophyll. A shortage of copper in soil may lead to chlorosis which is characterized by yellowing of plant leaves. In copper-deficient soils it may be added as a trace nutrient supplement to other fertilizers.
Copper is required in animal metabolism. It is important in invertebrate blood chemistry and for the synthesis of hemoglobin. In some invertebrate organisms a protein, hemocyanin, contains copper and serves as the oxygen-carrying mechanism in the blood.
Young children require approx 0.1 mg/day of copper for normal growth and the daily requirement for adults was estimated to be about 2 mg/day (Sollman, 1957). Copper in excess of 1 mg/l may impart some taste to water. Because of a possible undesirable taste in drinking water at higher concentrations, a limit of 1 mg/l is recommended.

SILVER
CRITERIA
50 ug/l for domestic water supply (health).
Because of its strong bactericidal action, silver has been considered for use as a water disinfectant. Dosages of 0.001 to 500 ug/l of silver have been reported sufficient to sterilize water (McKee and Wolf, 1963). At these concentrations, the ingestion of silver has no obvious detrimental effect on humans.
The 1962 USPHS Drinking Water Standards contained a limit for silver of 0.05 mg/l.