Bio-decontamination with Bioquell HPV
Technology built on a robust scientific foundation

- **Hydrogen peroxide vapor (HPV) surface sterilization**
  - ensuring total elimination of pathogens, verified by 6-log endospore eradication

- **Safe, rapid, repeatable and residue-free**
  - effective against catalase-positive microorganisms (e.g. Gram-negatives)

- **Compatible with a wide range of hospital materials**
  - including sensitive electronics found in ICUs

Effective room bio-decontamination to eradicate HAI

Hospitals with healthcare associated infection (HAI) challenges are increasingly turning to Bioquell to provide room bio-decontamination solutions. Bioquell’s HPV technology is regularly used in the healthcare and life sciences sectors to eradicate microorganisms – comprising bacteria, viruses and fungi – including nosocomial pathogens.

Bioquell HPV bio-decontamination technology is a vapor-phase method for the decontamination of hospital rooms, bays and whole units. Using a unique and patented system, HPV is distributed homogeneously throughout an enclosure so that all surfaces and the air in the room come into contact with the active. Our HPV technology has been demonstrated in the scientific literature to inactivate a wide range of microorganisms. It is safe to use in hospitals and is compatible with sensitive electronics.

Figure 1. HPV cycle schematic

The HPV bio-decontamination cycle

Extensive research and development has demonstrated that micro-condensation of hydrogen peroxide is critical for rapid and repeatable inactivation of microorganisms. To achieve this, Bioquell HPV is first injected into an enclosure – the gassing phase (Figure 1, stage 1). When the air becomes saturated the hydrogen peroxide will begin to condense on the surfaces within the room (stage 2) and the concentration of HPV in the air will begin to plateau (stage 3). Bioquell equipment is configured to deliver a surface micro-condensation in the 2-6 micron range, which is often invisible to the naked eye. Once the micro-condensation has been achieved, the cycle enters a dwell phase during which no more HPV is introduced (stage 4). Maintaining the existing high level of HPV within the room completes the inactivation of the microorganisms. This phase is then followed by an aeration phase where the HPV is actively removed using proprietary catalytic filters (stage 5).
Microbiological efficacy and mode of action

Bioquell HPV achieves a significantly higher level of bio-decontamination than manual cleaning and other aerosol/nebulizer-based methods. It has been scientifically proven to eliminate pathogens from the hospital environment, verified by inactivation of 6-log Geobacillus stearothermophilus biological indicators, the same method used to validate steam sterilizers/autoclaves. The technology also offers real-time cycle monitoring to ensure repeatability and safety. Unlike the application of liquid disinfectants, Bioquell HPV does not rely on the operator to achieve full and even 3D distribution within the room. Our technology also ensures the correct contact time is achieved to provide repeatable biological decontamination.

Hydrogen peroxide, and the hydroxyl radicals that are released as hydrogen peroxide decomposes, are powerful oxidising agents. These oxidising agents damage microbial cell wall/membrane components (such as transmembrane lipids and porin proteins), cytoplasmic constituents (such as enzymes and ribosomes) and the cellular nucleic acid/DNA. The exact mechanism of action varies according to microorganism. This multi-faceted mode of action means that microbial resistance to HPV treatment is unlikely to develop. The process is effective for the elimination of various hospital pathogens including Gram-negative bacteria (e.g. Acinetobacter baumannii, Klebsiella pneumoniae), Clostridium difficile spores, MRSA, VRE and Norovirus. Crucially, because the Bioquell HPV system uses 30-35% w/w hydrogen peroxide solution, it is able to overwhelm the catalase-positive nosocomial pathogens (e.g. MRSA, Gram-negatives). Nebuliser systems which typically use low hydrogen peroxide concentrate (e.g. less than 10% w/w) are not able to fully inactivate these catalase-positive nosocomial pathogens reliably and repeatedly.

Technology description

Bioquell systems generate HPV from high quality 30-35% w/w aqueous hydrogen peroxide solution, and this vapor is distributed throughout the target area to inactivate microorganisms present on surfaces and in the air. It is subsequently removed at the end of the process from the target area via catalytic conversion into oxygen and water vapor.

Bioquell HPV suites typically comprise four key components: a HPV generator, a sensor, an aeration unit and a remote control module. The HPV generator adds a measured amount of liquid hydrogen peroxide to a vaporizer and is flash evaporated providing an instantaneous phase change from liquid to gas. The resulting mixture of hydrogen peroxide and water molecules (in the gaseous phase) is then distributed at high velocity into the room via multi-directional nozzles. Computational fluid dynamics (CFD) modelling has been used to ensure that an even distribution of the vapor is achieved.

The integral sensor system measures the HPV concentration, temperature and relative humidity within the enclosure. This information is relayed to the control module which is located outside the room. A smaller handheld sensor can be used outside the room to check that there is no HPV leakage. This monitors environmental hydrogen peroxide concentration and alerts the user should set levels be exceeded.

The aeration unit consists of a unique activated carbon filter and powerful aeration fans. These catalyse quickly and effectively the breakdown of hydrogen peroxide vapor to oxygen and water vapor at the end of the cycle.

Material compatibility

Bioquell’s HPV technology and Professional Services* have been used extensively in hospitals all over the world, including frequent use in intensive care units (ICUs) that contain sensitive electronics, without any reported damage or malfunction. Successful testing has also been conducted using a wide range of materials and electronic devices to simulate a lifetime of repeated HPV exposure.

* separate Bioquell data sheets are available

Disclaimer: Bioquell Inc or its affiliates, distributors, agents or licensees (together “Bioquell”) recommends that customers ensure that the requisite level of bio-decontamination is achieved using standard biological indicators such as 6-log Geobacillus stearothermophilus spores; and the Bioquell technologies, subject to appropriate cycle development, are designed to be able to provide such levels of bio-deactivation.

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For further information on Bioquell’s technology including an up-to-date listing of the scientific papers supporting the effectiveness of Bioquell technology in the healthcare setting, or to arrange an initial consultation:

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