Maintaining an Environmentally-Friendly Pure Water Supply

When executing a protocol that requires the highest purity levels, associated costs will increase as a result of the additional removal technologies that need to be employed within the water system. Subsequently, efficiency can be maximised by only producing water to the required level of purity. It is therefore important that the different levels of purity are understood and that the system and applications are accurately matched in accordance with the correct water type for an environmentally friendly and cost-effective performance.

THE THREE R'S OF ENVIRONMENTALLY FRIENDLY WATER

Reduce - As a regularly replaced component within a pure water system, cartridges can be an effective target to minimise waste along with any associated cost. In an effort to reduce waste, high-quality resin cartridges are available, which will not only continually produce exceptionally pure water, but will also extend the life-span of the cartridge. As a result, they can be used for longer than alternative types, minimising the need to ship, handle and dispose of used parts. This reduction has many positive environmental implications, not only saving in shipping costs but also reducing packaging materials and associated vehicle emissions.

Recycle - In the global effort to reduce waste, the effective re-use of materials is extremely important and many laboratories are looking to adopt such approaches. Thus, the ability to reuse components that would normally be discarded is becoming highly desirable. In the case of pure water systems, the plastic cartridge casings and endcaps can be made from virgin polypropylene, which is fully recyclable. Cartridges manufactured within a clean environment, using environmentally friendly techniques without the need for any hazardous solvents and adhesives, enables the plastic and resin to be effectively recovered, re-ground and reused.

WEEE DIRECTIVE

In addition to the ability to reduce waste and improve the environmental performance of pure water systems, many products are now marked with the WEEE (waste electrical and electronic equipment) symbol, meaning they have been designed and built in a way that makes them easier to be disposed of in an environmentally-friendly way. The WEEE Directive also aims to reduce the amount of electronic equipment being produced, encouraging users to reuse and recycle as much as possible.

CONSERVING ENERGY

As a pressing issue in today’s environmentally friendly culture, the reduction of energy consumption is being introduced to almost every aspect of life. This is also possible in the laboratory without affecting sample integrity or research quality, which not only helps the environment, but also cuts down on the associated running costs. Pure water systems are often in continuous use in order to maintain consistent purity levels and suppress bacterial growth. If switched off, the water system would no longer be of the purity level required by the application. Therefore, newer pure water systems have been designed with energy saving modes, which can effectively conserve power, while still providing water of the highest purity.

EFFECTIVE PURIFICATION

Improperly treated water can adversely affect experimental results in many ways. As such, the water needs to be free of contaminants, which can include pyrogens, organic or ionic components, bacteria and nucleases. There are six major technologies that can be used to purify water of such inclusions: filtration, adsorption, ultraviolet radiation, distillation, reverse osmosis, and deionisation (see Table 1 for more information). Pure water systems use a combination of these technologies as different experimental processes require various levels of purity. As a result, a wide range of systems are available to match these broad requirements.

DEFINING PURITY

Reagent grade water has been defined by a number of different agencies, including the American Society of Testing and Materials (ASTM) and the Clinical and Laboratory Standards Institute-Clinical Laboratory Reagent Water (CLSI-CLRW). These organisations have similar but not identical definitions for highly purified water, which are determined based on parameters such as the water’s conductance, total organic carbon and chemical oxygen demand (TOD).

Applications ranging from everyday life-sciences procedures, through to complex automated drug discovery, require highly purified water. This is essential to ensure that analytical detection limits are optimised and reproducible results are obtained every time. The production of laboratory water is therefore a very important process that will, desirably, combine the effective elimination of specified contaminants, with efficiency and cost-effectiveness as well as being environmentally friendly.

Water required for general laboratory purposes, such as autodissolving, humidification and glassware rinsing requires water that is free from particulates, colloids and ions. More sensitive analytical applications should have a water supply that is also free from dissolved gases and organics. These applications include high performance liquid chromatography (HPLC) and mass spectrometry (MS). Furthermore, life science applications such as cell and tissue culture, PCR, cryopreservation and antibody production require water of the highest purity level. It therefore needs to be free from all previously mentioned contaminants, as well as nucleases and pyrogens. This ensures that all importances that have the potential to impact upon experimental results are effectively removed (for full details see Table 2).