Water Softening Goes Digital

By Jeff Zagoudis

New technologies provide options to combat hard water

Hardness is a common water quality issue that does not pose any direct human health risks. The minerals found in hard water—typically calcium and magnesium—have no ill health effects to speak of.

However, the minerals in hard water can build up in appliances that use water—boilers, washing machines, dishwashers—causing them to break down more frequently. This also leads to a side effect of energy inefficiency; less-effective machines use more energy, which in turn leads to higher utility costs. Hard water also leads to soap scum in sinks, showers and bathtubs.

Sodium Concerns

Salt has long been an integral part of water softening technology. Most conventional water softeners function via ion exchange resin systems. When hard water flows into these systems, the calcium and magnesium ions are pulled into the resin and replaced with sodium ions. Salt is the source of the sodium, and is eventually discharged into the water supply. It also helps regenerate the resin when it starts to wear out.

These salt discharges, however, have become a source of concern in recent years. The environment is a large part of that concern, as increased salinity in receiving waters could have adverse effects on plant life.

Sodium is a concern for humans as well: A 2002 study from Kansas State University recommended a daily sodium intake of 1,800 mg, but found that the average American consumes about twice that amount daily. High sodium content in water can be especially troubling for those who have to watch their salt intake due to heart conditions.

Citing these potential environmental and health effects, some municipalities have started regulating or outright banning the use of traditional water softeners. Section 14.12 of the Riverside, Calif., municipal code serves as one example. According to this regulation, citizens may not install new residential water softening devices unless they meet specific standards regarding salt discharge.

New water softening technology uses an electronic system to remove minerals.

Discovering the New

Several approaches have been applied to resolve salt discharge concerns. One solution is to make salt-based water softeners more efficient. A number of studies have been conducted by organizations like NSF Intl. to determine the maximum softening efficiency with the minimum dosage of salt. Based on these studies, NSF and the American National Standards Institute (ANSI) developed Standard 44, which governs the efficiency of residential cation exchange water softeners.

As water softening technology continued to evolve, the NSF/ANSI committee was reactivated in October 2009 to resolve key points not addressed by Standard 44, including:

- Efficiency ratings and how they are determined;
- Capacity ratings;
- Evaluation of algorithm-based, self-adjusting softeners; and
- How to assess new technologies.

Following this trend, the U.S. Environmental Protection Agency's WaterSense program announced in November 2010 that it would begin developing its own specifications for traditional cation exchange water softeners.

Potassium chloride has been studied frequently as an alternative to salt. According to one such study by the Michigan Department of Environmental Quality, it acts in the same fashion as salt, replacing the hard water mineral ions with potassium. This provides benefits to both plant life and humans, especially those on low-sodium diets. However, these systems are more costly than traditional salt softeners, which is why they have not yet been widely adopted.

Others in the industry have proposed magnetic water treatment as an alternative to traditional sodium chloride softeners. The effectiveness of this technology is still being researched, however. Several studies, including one conducted by the U.S. Army Corps of Engineers, seem to indicate no discernible change in hardness levels following magnetic treatment.

Water and Electronics Do Mix

A fourth alternative to traditional ion exchange softeners is electronic water softening. Pentair Inc. recently developed an electronic system applying a low-voltage electric potential to the inflow, which pushes the hard mineral ions toward a pair of electrodes in a straight removal process rather than an exchange. Once the electrodes have achieved their full charge, the polarity is reversed and the ions are flushed down the drain. The company has dubbed this CrossCharge technology.

The electronic system, called the Hybrid DI, was developed in conjunction with Dutch water treatment company Voltea. Pentair developed the module, control valve, system controller, power regulators and sensors, while Voltea created the electrodes and membranes.

The system is intended as a point-of-entry device for residential softening applications. It will hold the same position in the home as a traditional water softener, which was an intentional decision by the design team. The goal was to make it as easy as possible to retrofit the system.

While residential use is the primary focus of the Hybrid DI, electronic softening has numerous applications, according to Dave Averbeck, project leader for Pentair. "Any place you need high-quality, low-TDS [total dissolved solids] water, you can use this type of device," he said. "There certainly will be lots of commercial applications, like car washes, and light industrial applications that need high-quality water."

Another feature of the system is its ability to tailor the amount of hardness removed. Chris Gotwald, senior product manager with Pentair, suggested that some users may choose to leave in beneficial amounts of certain elements such as magnesium.

Ultimately, Pentair sees the Hybrid DI as the next evolution of water softening. "That is one of the real benefits we see in this; it is not necessarily a water softener replacement," Averbeck said. "This is a total water treatment device; you get high water quality delivered throughout the home."

As this and other new technologies develop, water softening will continue to be a hot topic in the future. *wqp*

Jeff Zagoudis is contributing editor for *Water Quality Products*. Zagoudis can be reached at jzagoudis@sgcmail.com or 847.954.7973.

For more information on this subject write in 1003 on the reader service card or visit www.wqpmag.com/lm.cfm/wq031203.