What is Scale?
DESCALING....

By Jeffrey M. Conway

Approximately 85% of the United States experiences hard water. Water hardness is a common quality of water which contains dissolved compounds of calcium and magnesium and, sometimes, other divalent and trivalent metallic elements. Hardness prevents soap from lathering by causing the development of an insoluble curdy precipitate in the water. Another problem associated with hard water is scale.

Several new technologies have hit the marketplace in the past few years that claim to soften the water and remove scale. These products have not made the WQA happy campers, yet many manufacturers claim to have thousands of satisfied customers. We will look closer at the cause of scale, common evidence of scale, summarize the four basic technologies available to control the effects of hard water, and review the WQA's position.

What is Scale?

Scale is a coating or precipitate deposited on surfaces that are in contact with hard water. Water that contains carbonates of bicarbonates of calcium or magnesium are especially likely to cause scale. When water is heated or evaporation takes place, scale minerals precipitate layers of rocklike deposits inside pipes, water heaters, equipment, and on fixtures and glassware. While most common scale is a result of calcium carbonate, other combinations of ions commonly found in water offer a variety of scale.

Common Evidence of Scale

Scale is most visually evident as hard white to off white deposits which build-up in faucets, shower heads and drains. Scale leaves deposits on dishes, glassware, sinks, countertops and on vehicles that were just washed. Most scale formations are hard and very difficult to clean. Visual references also include fixtures such as toilets, bath tubs, showers and appliances like coffee and ice makers. Swimming pools and spas can experience scale build up on tile and pump equipment. Cooling towers have tremendous scale problems that cause that industry alone a billion dollars a year to remove. Evaporative coolers, boilers, car washes, irrigation systems, processing equipment, paper pulp mills all experience scale problems. Unfortunately, because scale forms a "coating" it can significantly effect thermotransfer and reduce the flow of fluids. The increase of fuel cost due to scale build-up is astronomical.

COMBATING HARD WATER AND ITS EFFECTS

There are four basic technologies available to control the effects of hard water.

Ion-Exchange - Water softening by ion-exchange removes calcium and magnesium ions and replaces them, usually, with salt. Ion-exchange systems require a tank filled with exchange resins, a mechanism to regenerate the resins and a tank to store salt brine used for regeneration. Ion-

exchange water softeners combat the effects of hard water by removing the calcium and magnesium nutrients.

Phosphates - Polyphosphates are used as a sequestering agent to control iron and hardness, and as coating agents to control corrosion by formation of a thin passivating film on metal surfaces. Polyphosphate crystals are placed inside a filter housing; as water flows through the filter the polyphosphate crystals slowly dissolve and are thereby introduced into the water stream. In essence, polyphosphates bind calcium and magnesium in solution where they are less likely to precipitate and form calcite. Phosphates are preferred food for bacteria which offer greater potential for bacteria growth. Polyphosphate crystals must be regularly replaced as they dissolve into solution.

Permanent Magnets - Of all the products available today in the water industry, none is more controversial than that of magnetic devices. The fact is, permanent magnets use a fixed energy field which, under controlled conditions, effect the crystal structure of calcium. Controlled conditions is the key factor to the effectiveness of permanent magnets. Pipe size, flow rates and levels of hardness may effect the magnets ability to perform if not properly sized.

Historically, the performance of permanent magnets have been ultimately reliant on controlled conditions, such as flow rate; their energy levels and power fields are fixed. Unfortunately, improper sizing has happened more than once, and when coupled with false claims from the manufacturers and dealers, bad word of mouth spreads. The truth is however, magnets have been used widely, and successfully, in the Soviet states and parts of Europe for many decades both in residential applications and in industrial/marine applications. Many manufacturers claim to have thousands of satisfied customers.

Electronic Conditioning - Electronic water conditioning is a relatively new technology which evolved from the use of magnetic fields in water improvement. The advent of these systems introduce both variable energy and frequency changes. Electronic treatment is based on the principal of creating an oscillating field of energy with the use of low frequency radio or square waves. As water passes through a pipe delivering variable frequencies and energy levels, a physical change in the preferred crystal structure of calcium and magnesium occurs changing the crystalline structure of aragonite rather than the random crystalline structure of calcite. Aragonite is a form of calcite crystallizing that stays in solution and does not adhere to surfaces. This action stops any further build-up of scale and because the solubility of the water is increased, existing scale is taken back into the water and gradually removed. Generally, the electronic field in the water is less than 1/1000th of a permanent magnet.

Like the magnets, precise energy and frequency fields are required in order for the electronic water conditioners to work.

Controversy

The use of catalytic, electromagnetic and magnetic devices in the treatment of water is controversial. Unfortunately, any new and relatively inexpensive technology there are those who ride the profit wagon. These entities often make false product claims and then seem to disappear forever - leaving customers very unhappy. Throughout its history, the water improvement industry has certainly fallen

prey to wild marketing tactics and false promises.

The WQA has long maintained that all product performance and benefit claims for all products that purportedly alter the hardness characteristics of water be based on factual date obtained from tests conducted by professionally competent personnel following established test procedures. Such data should be recent, reputable, and verifiable, and should substantiate all product performance and benefit claims. The WQA claims they know of no generally recognized scientific or technical evidence which proves that magnetic, electromagnetic, or catalytic devises sold to treat water have any measurable physical or chemical effect on water quality.

To this date, the WQA is absolutely correct in their position. The DESCALING business has huge potential, but manufacturers should follow the WQA's position and thrive to provide an effective product to the marketplace with responsible marketing practices.

About the author

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