

# Magnetic Water Treatment Reduces Scaling

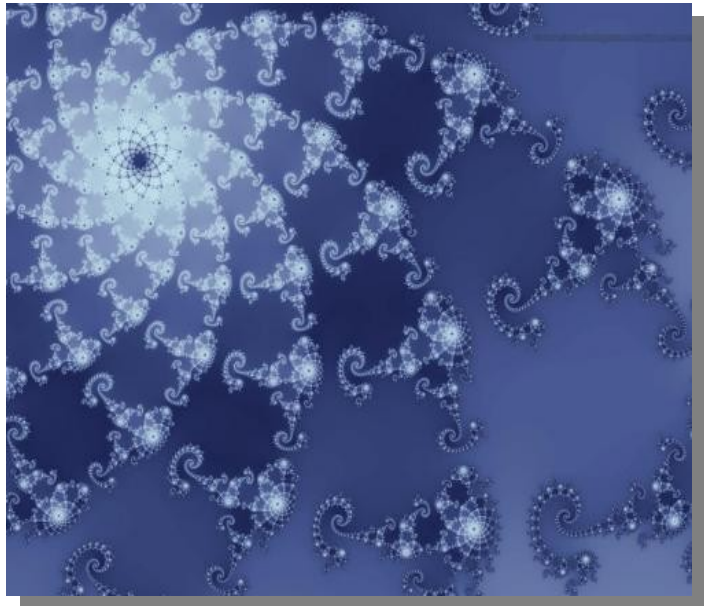
Experimental Evidence for Effects of Magnetic Fields on Moving Water

by Dr. Klaus J. Kronenberg, The full article appeared in the 1984 Institute of Electric and Electronic Engineers (IEEE) Conference transactions: IEEE Transactions on Magnetics, Vol. Mag-21, No. 5, September 1985, pages 2059-2061.

This article corresponds to the presentation by Dr. Kronenberg at the IEEE's International Conference on Magnetism in April 1985 in St. Paul, Minnesota. Only the abstract is included here.

Abstract Observable changes of water by magnetic fields have been investigated in an attempt to contribute to the knowledge of the structure of liquid water. The crystallization mode of the water's mineral content was found to change from a dendritic, substrate-bound solidification habit to the form of separate disc-shaped crystals after the water had moved through a number of magnetic fields. The former scarcity of crystallization nuclei in the water had been turned into an abundance of nucleation centers in the water.

The reduction of the number of the substrate-bound crystals has been used as a quantitative measure of the magnetic effect. A mechanism is suggested assuming that resonance between the time sequence of the magnetic fields and the internal vibratory frequency of the water complexes results in the fracture of some of the complexes. Thereby, the formerly encased foreign particles are released and provide the nuclei for the formation of disc-shaped crystals throughout the volume of the water. Further studies are urged in view of the staggering potential benefits for many water users, such as prevention of hard lime scale build-up, increased effectivity of chemical additions to water for softening, fertilizing, feeding, and cleaning purposes.



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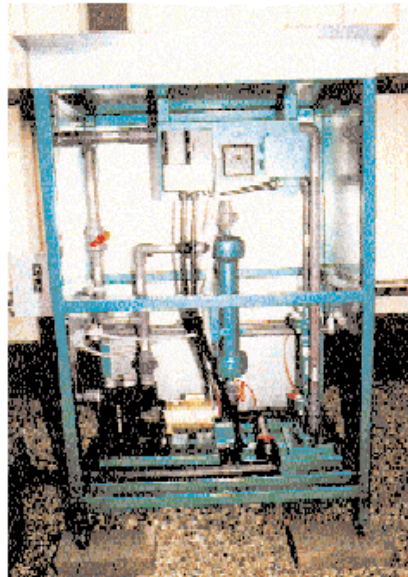
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## Non-Chemical Technologies for Scale and Hardness Control

*Technology for improving energy efficiency through the removal or prevention of scale.*



The technology addressed in this *Federal Technology Alert* (FTA) uses a magnetic or electrostatic field to alter the reaction between scale-forming ions in hard water. Hard water contains high levels of calcium, magnesium, and other divalent cations. When subjected to heating, the divalent ions form insoluble compounds with anions such as carbonate. These insoluble compounds have a much lower heat transfer capability than heat transfer surfaces such as metal. They are insulators. Thus additional fuel consumption would be required to transfer an equivalent amount of energy.

The magnetic technology has been cited in the literature and investigated since the turn of the 19<sup>th</sup> century, when lodestones or naturally occurring magnetic mineral formations were used to decrease the formation of scale in cooking and laundry applications. However, the availability of high-

power, rare-earth element magnets has advanced the technology to the point where it is more reliable. Similar advances in materials science, such as the availability of ceramic electrodes and other durable dielectric materials, have led to the electrostatic technology becoming more reliable.

### Application Domain

The magnetic or electrostatic scale control technologies can be used as a replacement for most water-softening equipment. Specifically, chemical softening (lime or lime-soda softening), ion exchange, and reverse osmosis, when used for the control of hardness, could potentially be replaced by the non-chemical water conditioning technology. This would include applications both to cooling water treatment and boiler water treatment in once-through and recirculating systems. Other applications mentioned by the manufacturers include the use on petroleum pipelines as a means of decreasing fouling caused by wax build-up and the ability to inhibit biofouling and corrosion.

### Energy-Savings Mechanism

The primary energy savings from this technology result from decrease in energy consumption in heating or cooling applications. This savings is associated with the prevention or removal of scale build-up on a heat exchange surface where even a thin film can increase energy consumption by nearly 10%. Secondary energy savings can be attributed to reducing the pump load, or system pressure, required to move the water through a scale-free, unrestricted piping system.

Also US Federal Research showed- strong magnetic field treatment of water- eliminated need for water softener and decrease pipe build up/ scaling. <http://scaleaway.com/IEEEExperimentalEvidence.html>

<http://theimploder.com/news/magnetic-water-treatment-reduces-scaling>