Evaluation of the Performance of Clearwave an Electromagnetic Unit, to Prevent Scale Formation in Water and Heating Systems

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BACKGROUND

The Clearwave product is an electro-magnetic device tested in the close loop by The Institut National de la Recherche Sci- entifique (INRS) in Quebec Canada. The INRS is an independent research-oriented branch of the ten provincially run public universities in Quebec, Canada. INRS conducts research in these sectors: water, earth and the envi-ronment.

Professor Patrick Drogui (Ph.D) led the team verifying the performance of the Clearwave product. Dr. Drogui is a well-respected expert in the areas of Electro-Technologies and Water Treatment and is credited with pub- lishing over 120 papers and books. His research interests focus on the troubleshooting and development of new technologies for the elimination of pollutants (inorganic and organic). Among these techniques are electro- technology processes, taking advantage of electrochemical properties and techniques in water treatment. These techniques can be used effectively to improve existing municipal and industrial wastewater treatment systems or to replace conventional inefficient technologies for the removal of specific inorganic or organic contaminants.

RESEARCH PROTOCOL

The test protocol was designed to verify in a laboratory pilot scale, the effectiveness of the Clearwave product against forming scale build up in piping and appliances using various hard water solutions made up of calcium and magnesium under the effect of electromagnetic fields. The tests were divided into two sections using a closed loop test stand (see Figure 1 in Appendix section) with the holding tank filled with one or the other total hardness test solutions (400 ppm, 23.36 gpg)[1]:

i. Experimental Unit – will show the effectiveness of scale build up to the piping and total water hardness measurements with and without the Clearwave product active in the circuit at a water temperature of 70° C (158°F) and at flow rates between 3 and 7 gpm.

ii. Analytical Methods – will show the characterization of carbonate deposits using a scanning electron microscopy (SEM), X-ray diffraction (XRD) to quantify the percentage of each allotropic forms of calcium carbonate present. Two allotropic forms of $CaCO_3$ were identified (aragonite and calcite).

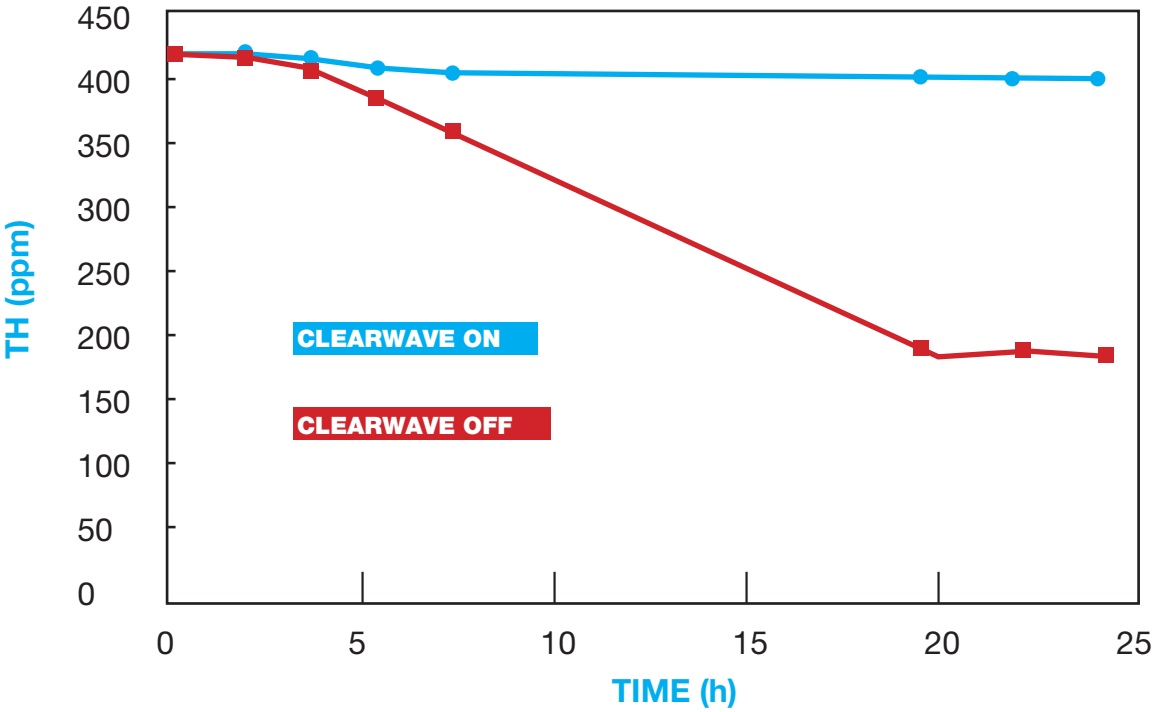
RESEARCH RESULTS

Experimental testing has proven that calcium and magnesium content in a water solution which are the two major causes of scale build up in pipes and appliances CONTINUES to stay in solution form as shown in Graph 1: Total Hardness when the Clearwave is TURNED ON.

Graph 2: Total Hardness shows scale build up on a clean pipe over a 24-hour time period (0-24 hours) then shows total hardness increasing once the Clearwave is TURNED ON (24-48 hours). The increase in Total Hardness is because the calcium and magnesium scale build up is being removed from the pipe thus cleaning the inside of your pipes and appli- ances. Once the scale changes back to aqueous solution, these minerals simply pass through your pipes and appliance without causing additional scale build up (according to the tests carried out in the close loop).

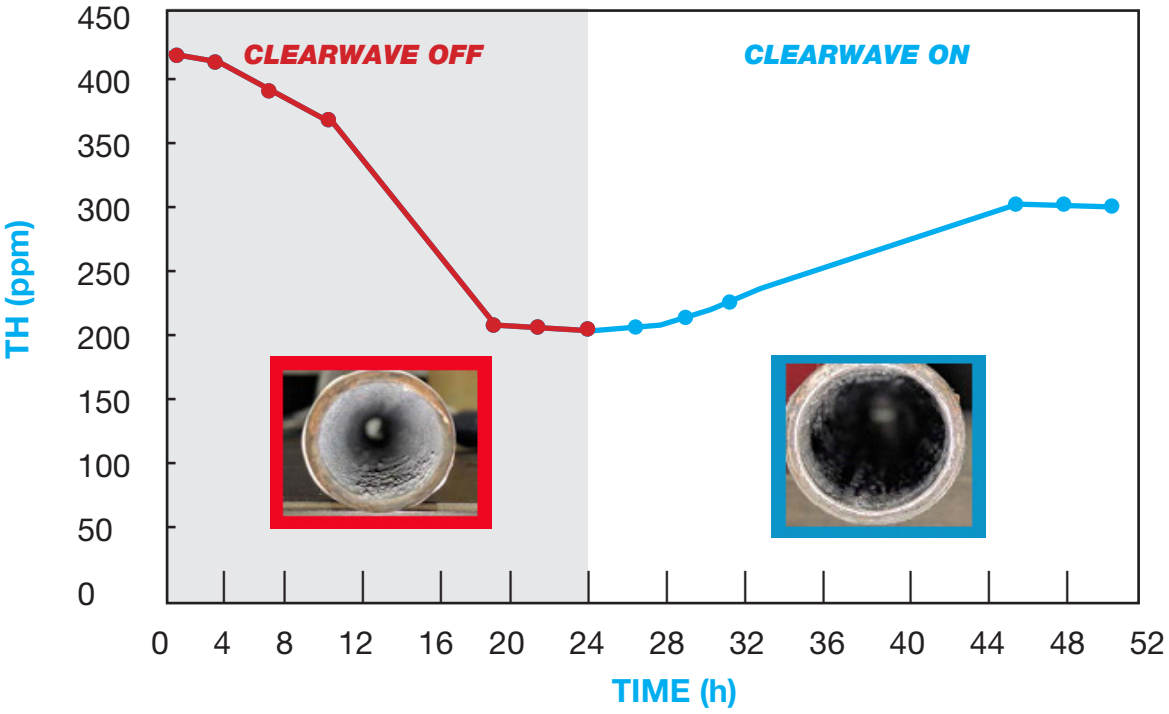
Analytical Method has proven that with Clearwave under SEM review that the makeup of calcium carbonate in aragonite form is much smaller due to the electro-technology incorporated in the Clearwave product and the calcium carbonate in calcite form is much larger. Thus, the calcium car- bonate in calcite form has a much lower scale forming tendency.

Figure 1: Clearwave Effect on Scale Formation



Note on Figure 1: Two 24-hour tests were conducted to prove Clearwave's effectiveness in reducing scale formation in pipe systems. With Clearwave turned off (the red line) shows total hardness measured in the recirculated water reduces dramati-cally. This is due to hard scale coming out of the water and attaching to the pipes as pictured. With Clearwave turned on (the blue line) shows no change in hardness as the scale is not forming on the pipe as shown in photo.

Figure 2: Clearwave Effect on Scale Reduction



Note on Figure 2: **A 48-hour test was conducted to test Clearwave's effectiveness on scale reduction. With Clearwave turned off for the first 24 hours, the red line shows hardness dropping due to hard scale coming out of the water and forming on the pipe as in figure 1. After 24 hours, the Clearwave is turned on and the blue line shows an increase in the total hardness of the water because scale is being pulled off the pipe and back into the water.**

Appendix:

Calcium and magnesium ions present as sulfates, chlorides, carbonates and bicarbonates cause water to be hard. Water chemists measure water impurities in parts per million (ppm). For understandability, hardness ordinarily is expressed in grains of hardness per gallon of water (gpg). The two systems can be converted mathematically.

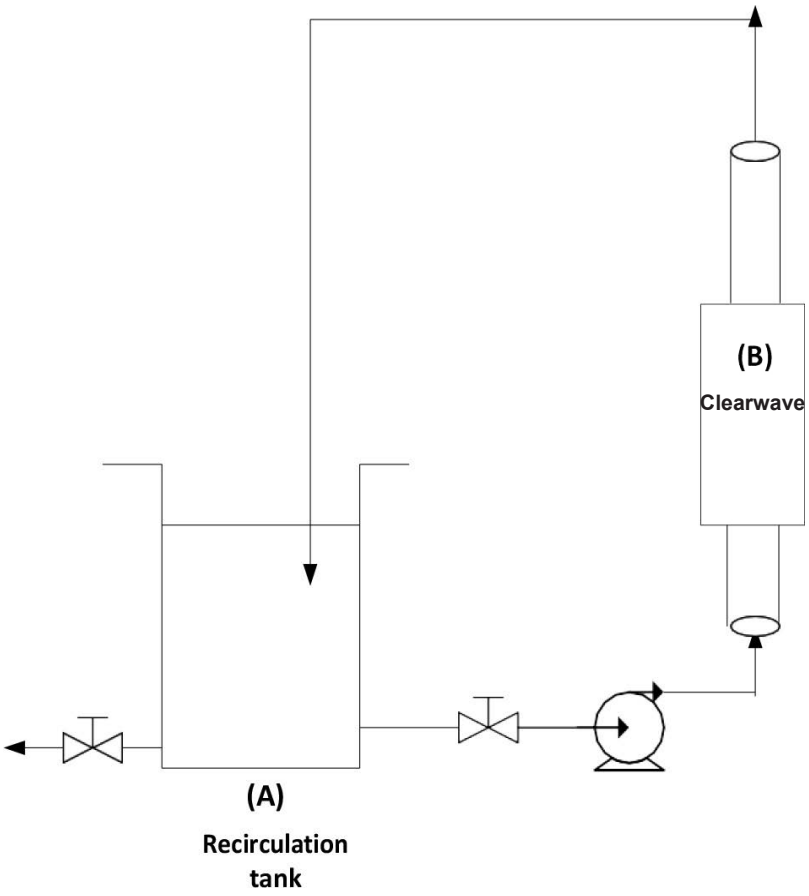


Figure 1: Test Loop Set Up

Photo of Actual Test Loop

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