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TEST REPORT ON THE EVALUATION OF THE CAPACITY OF A TREATMENT UNIT OF WATER TYPE NEW ARA IN REDUCING THE FORMATION OF LIMESCALE DEPOSITS IN A PLANT OF SANITARY HOT WATER

REALIZED BY CSTC
(SCIENTIFIC AND TECHNICAL BUILDING CENTER)

TRANSLATION OF THE ORIGINAL FRENCH

Laboratory	CH - BUILDING CHEMISTRY
N/References	**DE 670X702 Labo CH 17/6957**
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References	Procedure EVACODE developed by the CH laboratory

This test report contains 9 pages. This test report can not be reproduced in its entirety. On each page there is the lab's stamp (in red) and the signature of the head of the laboratory. The results and findings are valid only for the tested samples.

☐ no sample

☑ sample(s) after a destructive test

☑ samples will be retained by the laboratory for 30 calendar days after the report has been sent, except for any written request from the applicant.

Technical cooperation « Building chemistry »	Laboratory Manager « Building chemistry »
Joëlle Van Nijlen	Pascale Steenhoudt, ir

1. PURPOSE OF THE TEST

The purpose of the test is to evaluate the capacity of a **New Ara** water treatment device to reduce the formation of limestone deposits in a hot water system and to submit the unit to a test method carried out in a laboratory and reproducing the use of the real world.

2. DESCRIPTION OF THE TESTED APPLIANCE

The tested device is a **New Ara** of the **Vosges** brand. This device is a device composed of a powerful permanent magnet designed to be integrated into a water distribution circuit in order to limit the formation of calcium carbonate and magnesium carbonate, usually called scalding or limestone, inside the installation.

This unit is shown below :

3. TESTS AND MEASUREMENTS

3.1 Principle of the EVACODE test method

The test for this evaluation method was developed by the “Chemistry of the Building” laboratory (Evacode - Convention of Office Rules - CC CCN/PN/NBN - 917).

This method evaluates the effectiveness of anti-lime water treatment equipment by comparing the amount of limestone deposits formed by treated water and untreated water, each water being transported simultaneously to an individual sanitary water circulation system, called station test.

Each test station includes the following :

- *A particle filter*
- *An arrival and exit counter of water*
- *Various solenoid valves*
- *A 15 liter electric water heater including a stainless steel electric resistance and a temperature probe*
- *A recirculation pump*
- *A transparent sleeve*

Test station A includes the New Ara device from the test immediately located downstream of the water meter and upstream of the water heater.

The city water distributed in the two test stations here is enriched in a controlled manner of sodium bicarbonate and calcium chloride in order to make the water more encrusting. In the end the water is evenly distributed to the test stations A and B.

The experimental conditions are listed below :

- *Water temperature : ± 60°C*
- *Daily consumption : 130 liters (regularly taking 5 and 10 liters for 16 hours and with a stagnation period of 8 hours)*
- *Duration of test : 21 days*
- *Total consumption : ± 2.7 m³*

3.2 Assessment of the actual capacity

After 21 days of hot water production, each test station was stopped and emptied. The water heater has been removed and brought to the laboratory. The deposits present on the wall of the water heater, on the bottom of the water heater and on the electrical resistance were recovered quantitatively. Each fraction was dried at 45°C and weighed. The sum of the mass obtained by the two test stations (M_A and M_B) was compared and the following relationship can be considered as an expression of the actual capacity (called factor E) of the tested device to reduce the formation of limestone deposits.

$$\text{Factor E} = (M_B - M_A)/M_B * 100$$

3.3 Characterization of limestone deposits

The two crystallographic forms present principally in deposits that form within healthcare facilities are calcite and aragonite composed both of calcium carbonate (CaCO3). It is possible to distinguish between these two crystallographic forms of X-ray diffraction (XRD). Thus, the graphs obtained from the XRD analysis of pure calcite and pure aragonite in the figures below show very different diffractograms.

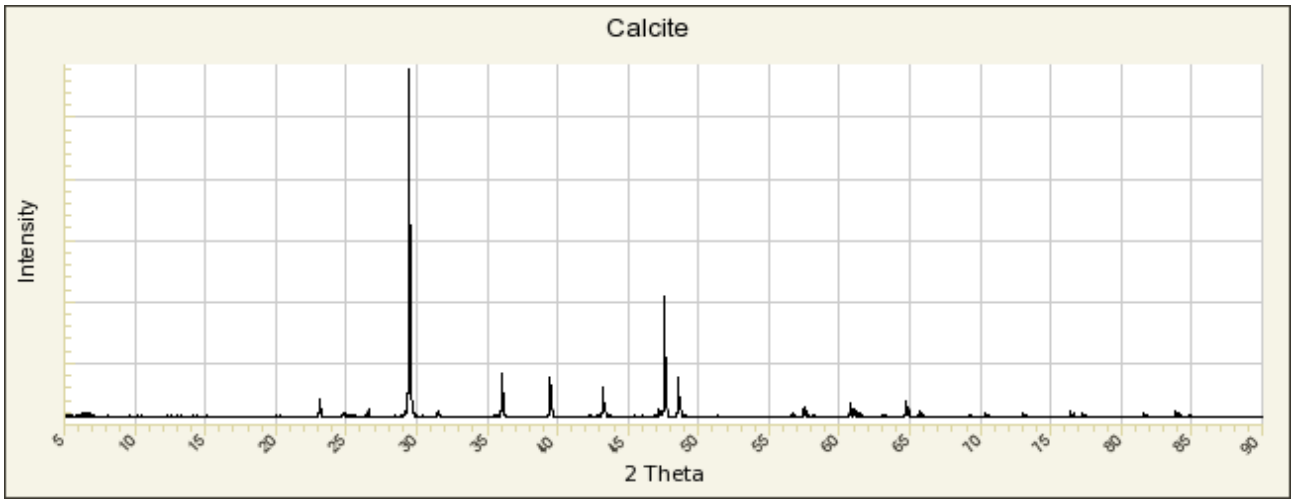


Figure 1 : *Calcite XRD spectrum*

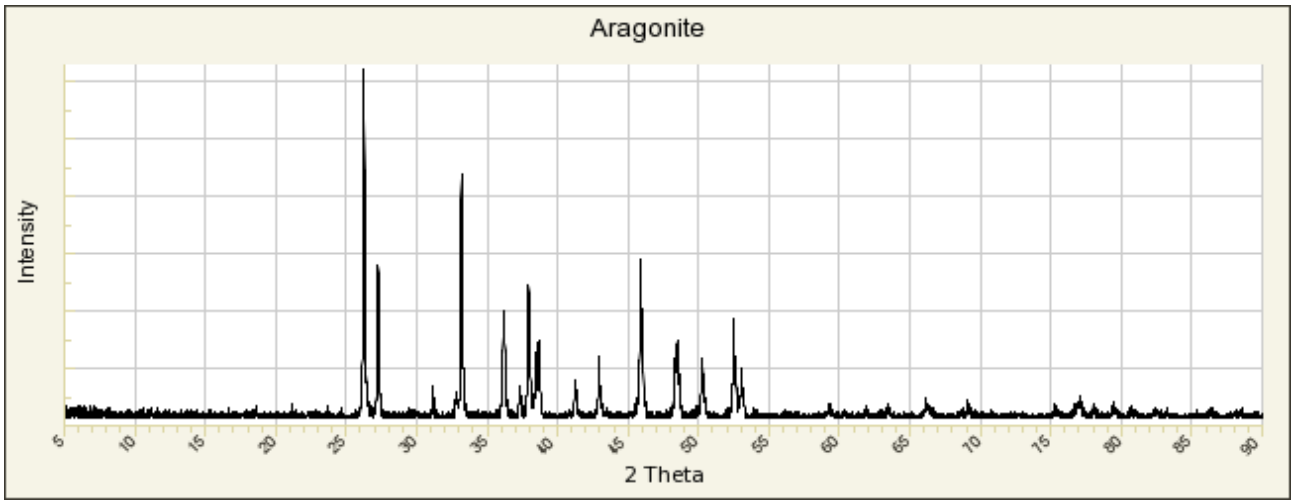


Figure 2 : *Aragonite XRD spectrum*

4. RESULTS

4.1 Observations

During the test, it is noted that when water is treated with the integrated device at station A, no lime deposits are formed on the water heater wall or transparent plastic tubes (photo 1 and 2). Lime deposits are only deposited on the electrical resistance (figures 3A and 4A). On the other hand, in the absence of water treatment, in the early days, the hot water circulating in the station's B water heater generated a deposit on the electrical resistance, but also on the wall of the hot water and on transparent plastic tubes (photo 1B). After a longer period of time, this film disengages from the wall of the water heater and ends at the bottom of the boiler (photo 2B, 3B and 4B - red arrow).

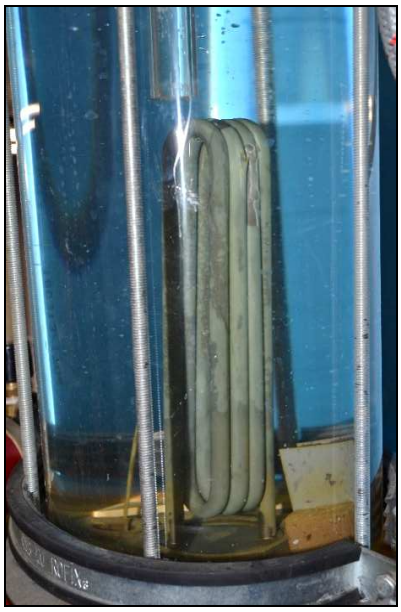
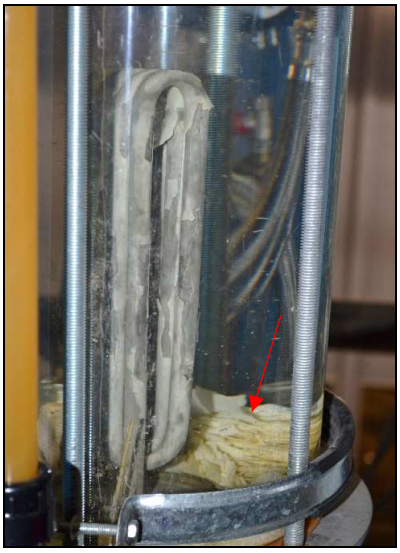
We also note that the limestone deposit covering the electrical resistance of station A comes off much more easily than that which covers the electrical resistance of station B.

After 5 days

Test station A	Test station B
Photo 1A	**Photo 1B**
	

After 21 days

Photo 2A	**Photo 2B**
	

After 21 days	
Photo 3A 	Photo 3B 
Photo 4A 	Photo 4B 

4.2 Assessment of the actual capacity

The following table shows the dry masses of the deposits drawn from the wall, bottom and the electrical resistance of the two water heaters. The actual capacity of the tested device is evaluated by these data.

Table 1 : *Effective capacity of the tested device*

Pickup areao	Dry mass taken out (g)		Illustration
	Station A	**Station B**	
Wall	0.1	51.5	Photo 5
Fund	5.7	4.7	Photo 6
Resistance	45.8	28.2	Photo 7
Total	**M_A = 51.6**	**M_B = 84.3**	
Effective capacity **Factor E = (M_B-M_A)/M_B*100 = 39 %**			

Photo 5 *Depot taken from the wall*

Post A Post B

Foto 6 *Depot taken from the bottom*

Post A Post B

Foto 7 *Depot taken from the resistance*

Post A Post B

4.3 Characterization of the limestone deposits taken

The deposits drawn from the electrical resistance of the two water heaters are analyzed by X-ray diffraction. The spectra obtained are included in figures 3 and 4.

In both cases, the material mainly present in the form of calcium carbonate is aragonite. However, a little more calcite was found in the case of the electric resistance of the boiler fed by untreated water.

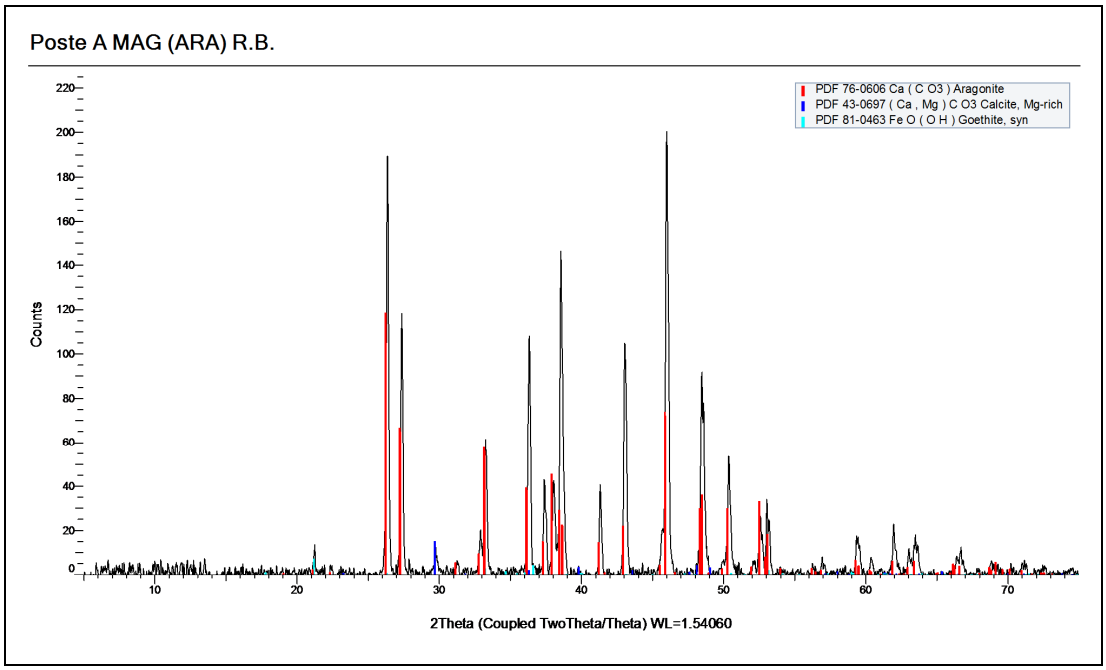


Figure 3 : *XRD spectrum of the deposit taken by the electrical resistance post A*

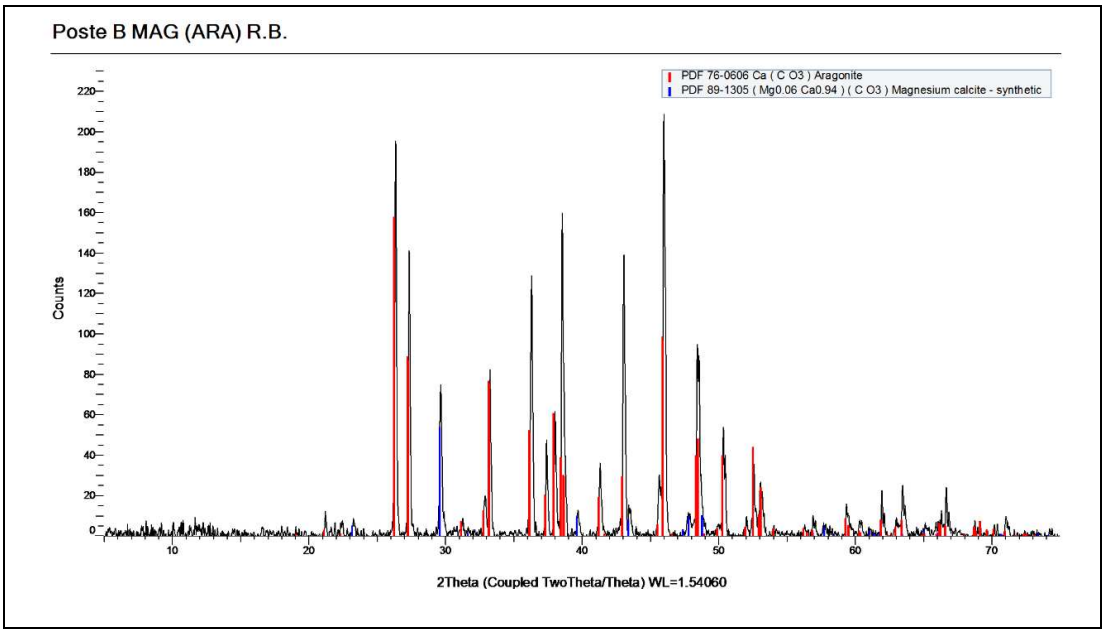


Figure 4 : *XRD spectrum of the deposit taken by the electrical resistance post B*

5. CONCLUSION

Subjecting to the capacity assessment test actual anti-lime devices for installation of domestic hot water (EVACODE test), the device **New Ara** of the **Vosges** brand allowed **to reduce more or less than 40% the formation of deposits** inside a water heater with water at 60°C. In addition the deposit is solely formed on the electrical resistance, due to its high temperature favoring calcium carbonate encrustation. Unlike the case of untreated water, no deposits on cold walls such as the wall of the water heater are formed.

Add that, when the water flows through the device **New Ara**, the deposits that form on the electrical resistance are poorly adherent and easily disconnect from the same.