GMX Magnetic Science

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by GMX INTERNATIONAL

Frequently asked questions about the science of magnetically conditioning water:

1. *What determines the "quality" of liquid water?*
2. *Why does hard lime scale grow in water containers?*
3. *What is magnetic water treatment?*
4. *How does magnetic* water treatment work?
5. *Do we have any evidence for successful treatment?*
6. *How can some agencies insist that magnetic water treatment does not work?*
7. *Is there a quick and easy test to measure the effect of Magnetic water treatment?*
8. *Can the effectiveness of magnetic water treatment be demonstrated in a convenient way?*
9. *Will permanent magnets keep their strength for any length of time?*
10. *Can the performance of a magnetic water treatment device be predicted with certainty?*

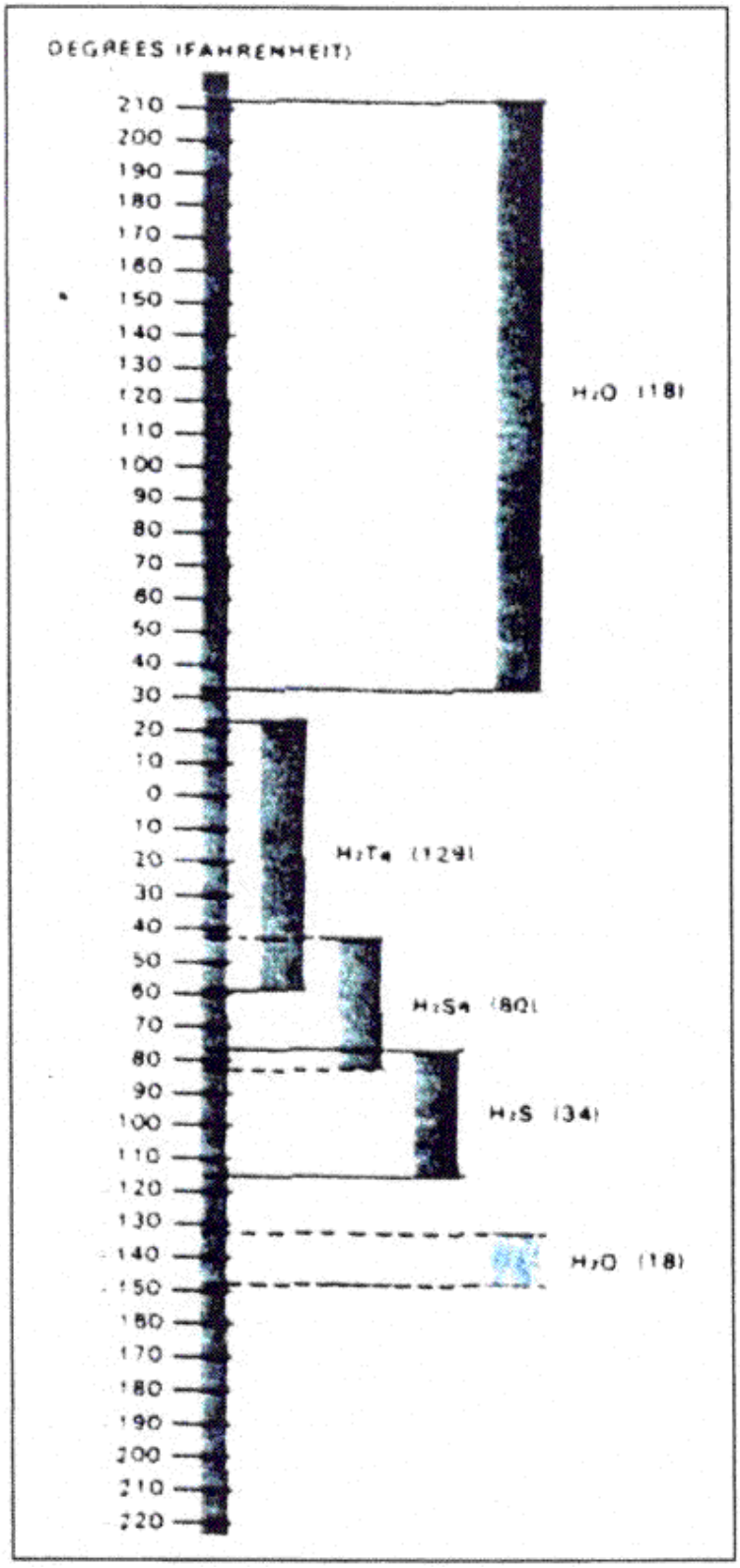
The Answers

1. What determines the "quality" of liquid water?

The physical structure of the super-molecules*(H2O)n.*

Contrary to common belief liquid water Is NOT a mass of separate HO molecules.

If it were, it would be liquid only below minus 30 degree Fahrenheit!


DEGREES (FAHRENHEIT)
210
200
190
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110
120
130
140
150
160
170
180
190
200
210
220
H2O (18)
H2Te (129)
H2Se (80)
H2S (34)
H2O (18)

Figure 1

But in fact, water is liquid in a larger range of temperature than other liquids! (See Figure 1.) In addition it has these amazing properties:

- It is able to absorb more heat per gram than other substances. For instance, 10 times as much as iron.

- When it turns solid it becomes lighter. (Ice swims on top *of* liquid water.)

- It *is* chemically neutral, yet it is a universal solvent.

- It has an extremely high surface tension, as anyone can see by observing how hard it is for a drop of water to fall *from* a faucet.

This is only a partial list of the unusual qualities of liquid water. But it seems to indicate that water must contain bigger molecules than H2O.

It is generally known that HO molecules attract one another by their hydrogen bonds. They conglomerate to *form* super molecules, which determine the behavior of liquid water.

However, the size and the shape of these super-molecules are not known whether they are ordered or not, or whether they change constantly or are stable in time is not known!

Known with certainty is that these water super-molecules engulf non-water particles (Figure 2).

The "quality" of liquid water depends on its super-molecules.

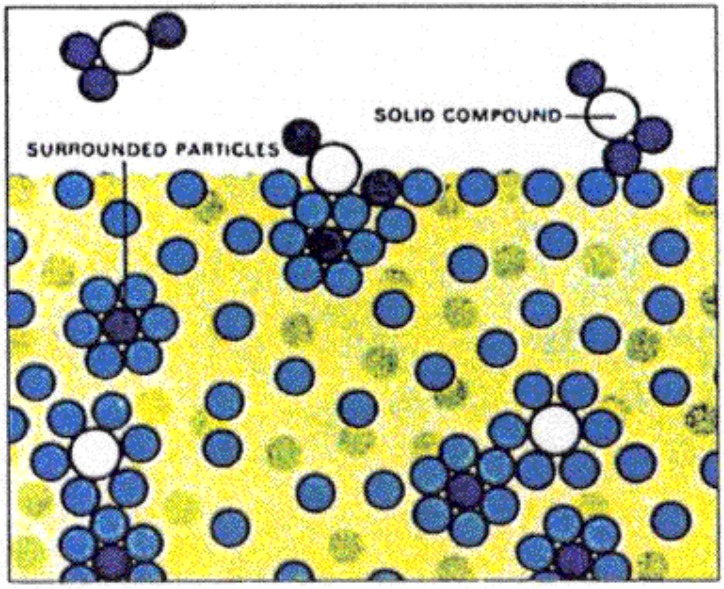


Figure. 2 Blue spheres symbolize water molecules forming super-molecules surrounding all non-water *particles in the water.*

Figures 1 and 2 are from the "Water" volume of the Life Science Library, by L. B. Leopold, Chief Hydrologist of the US Geological Survey.

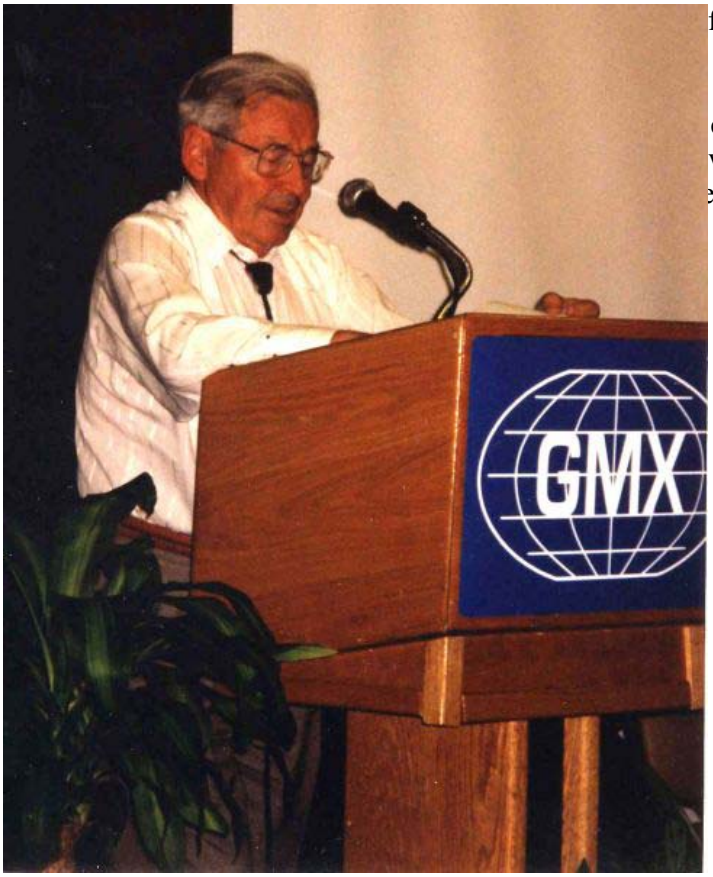
2. Why does hard lime scale grow on the walls of water containers?

Because no other crystallization points are available inside most waters.

Calcium carbonate, also called lime, is in dissolved form in most waters. However, as soon as the concentration increases, due to the evaporation of the water, or if the temperature rises, the lime content may exceed its solubility limit. Then the most basic law of' thermodynamics demands the lime to solidify.

In order to change from a dissolved liquid to a solid material, the dissolved material needs starting points for its crystallization. Only non-water materials can provide such starting points, called *crystallization centers.*

In untreated water, all non-water particles are "encaged" in the super-molecules, incapacitated as starting points in the required phase change.



f *is heated without a boiling*

container. Consequently,
walls. There lime will grow as
walls. The crystals spread out
to form hard lime scale.

It is the lack of available crystallization centers inside most waters which forces the dissolved, over-concentrated calcium carbonate to attach itself

firmly to the container walls.

Lime scale can be prevented by *adding* particles to the water, providing seeding - the necessary starting points *inside the water* for the crystallization of the over-concentrated lime.

(Similarly, the creation of vapor trails by high-flying aircraft results from the provision of necessary crystallization starting points by the exhaust to the over-concentrated moisture in dust-free high altitude.)

A method of providing crystallization centers in the water is to activate particles already existing inside the water but formerly incapacitated by being encaged inside the super-molecules of the water.

This is the method used by the magnetic water treatment.

3. What is magnetic water treatment?

Activating crystallization starting points inside the water.

It is known that the super-molecules encircle the water particles in the water (Figure 2). They literally encage non-water particles, rendering them unavailable as crystallization centers.

Physical treatment of liquid water results in the fracturing of some of the super-molecules.

This releases some formerly encaged particles, which are set free inside the water. They may then serve as crystallization centers for the solidification of calcium carbonate.

Magnet water treatment does **not** change the chemistry of the water. It alters the structure of **liquid water**.

Similar changes of the structure of liquid water occur as the result of mechanical disturbances, such as falling in rain or being centrifuged.

Electrical fields and electric sparks can have similar effects, and electromagnetic fields can also he used fur the physical treatment of water.

The reason for using the magnetic fields of permanent magnets is their convenience and economy. They deliver magnetic fields dependably without any power source, without maintenance, without wear, and without ever weakening from outer influences.

4. How does magnetic water treatment work?

It cracks open some of the water super-molecules, which sets the formerly encaged

non-water particles free, making them available as crystallization starting centers.

According to physical laws, "flow rate," the interaction between magnetic fields and water molecules, is weak. There would not be any *effect* on standing water. However, in a magnetic treatment device, the water passes through alternating magnetic fields with a certain speed. All super-molecules vibrate. The ones with a vibration frequency close to the frequency of the magnetic field sequence come into resonance with the magnetic field sequence. This will intensify the internal vibration of these super-molecules to the breaking point. These super-molecules fracture and release their encaged particles.

A freed non-water particle is surrounded by countless calcium carbonate molecules in need of a crystallization center. They stream from all sides to the freed particle and form concentric rings around it. Within a few minutes many rings grow around one another and form a solid disc. These discs are not attached to anything. They flow with the water. The discs contain in solid form the lime which had been dissolved in the water and would otherwise attach to the walls of the container. Compared to untreated water, the hard lime scale in magnetically-treated water has been substantially reduced.

5. Do we have visible evidence for these processes?

Yes, by microscopic observation of water residues.

After 1981 scientific evidence for the processes described in Number 4 was produced. Since 1985 the evidence has been published in scientific and trade journals. (Some of the author's own publications on the subject include: *IEEE* Transactions on Magnctics, Vol. 21, No.5, September 1985; Room and Zeit (in German and English): Der Wasserspiegel (in German); Aqua, August and September 1993; IBZ (in German).)

Normally, this process becomes visible to the unaided eye only after weeks of water use. However, a highpower microscope detects the starting growth of hard lime scale within it few hours.

Measured drops of water are deposited on microscope glass slides, where they must evaporate undisturbed. When dry, they are investigated under a microscope with polarizing light. Because of their optical properties, the polarizing light makes the crystals of calcium carbonate stand out (Figures 3 - 6).

The spots on the slides occupied by the drops of untreated water (Figure 3) reveal their lime content in the form of the typical prismatic crystals of calcium carbonate ("hard crystals"), mainly along the rim of the drop.

The spots on the slides occupied by the drops of water which had been magnetically treated (Fig. 4) are covered with the circular crystal platelets typical seeded crystals.

Figure 3
Untreated water
(Magnified 200 times)

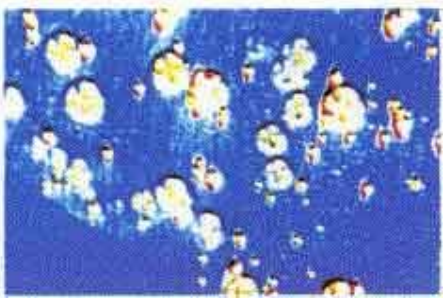


Figure 4
Magnetically treated water
(Magnified 200 times)

The drops of water evaporated side by side on the same glass slide under identical conditions.

The numbers of the hard crystals of drops of the same size are compared. The reduced number of lime crystals along the rim of the treated water drops is used as a direct measure of the reduction of the hard lime scale by the treatment.

In this example the magnetic treatment was about 92% effective. The untreated water produced 220 hard crystals per 50 microgram drop: the treated water, less than 18.

Higher magnification of the evaporated drops reveals that the calcium carbonate of the treated water has formed circular, disc-shaped crystals, which are widely distributed over the surface of the drop, as compared with the large prism-shaped crystals grown in the untreated water on the glass.

These disc shaped crystals with their specific appearance in the polarized light are well known in solid state physics to he "seeded crystals." This means the crystals have grown around a "seed" that became available to the solidifying lime as a welcome starting

center for its solidification.

6. Why do some agencies in charge of water quality insist that magnetic water treatment does not work?

Because they tend to consider & test the chemistry of water - which is not changed by the physical treatment.

The main reason for the discrepancy between the facts I have reported and the claims of those agencies is a matter of nomenclature.

In a number of countries, agencies exist that claim to be concerned about "water quality." They consider water to be H2O molecules containing other substances. They determine water quality by a level of measurable contamination by unwanted chemicals. So, when these agencies test magnetic treatment, they try to determine the effect of treatment by analyzing the water chemically before and after the treatment.

Naturally, they cannot find any difference, because magnetic treatment does not change the amount of chemicals in the water.

Figure 5, Untreated Water
(Magnified 1100 times)

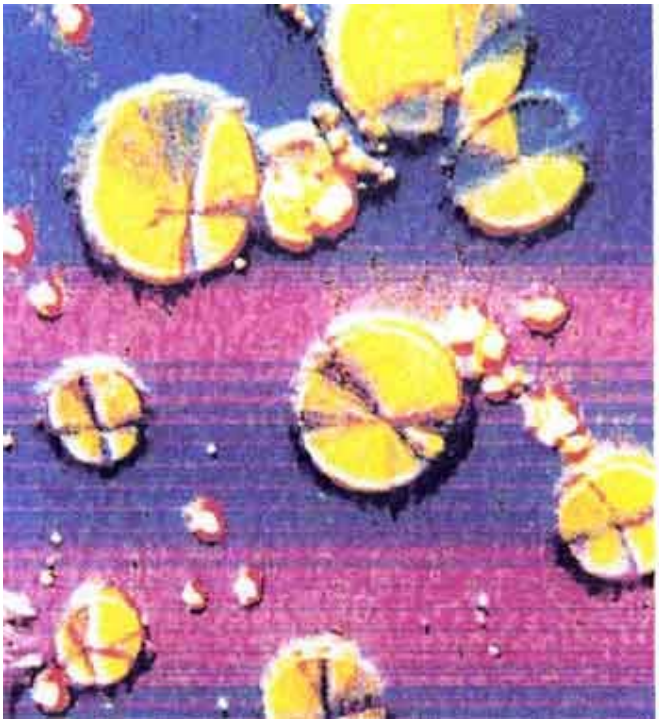


Figure 6, Magnetically treated water,
(Magnified 1100 times)

These agencies are not concerned about the crystalline status of the chemicals within the water, because traditional chemical analysis starts by dissolving all solids. Therefore, they undo the effects of the physical treatment before their investigations. They are correct in their statement that a chance in hardness cannot be found in magnetic treatment, but they are incorrect in their validation of magnetic treatment.

Claims by uninformed sellers of magnetic treatment devices are incorrect when they claim to be "softening the water." The "hardness" of water is defined by the amount of minerals it contains this hardness is not changed by the magnetic treatment.

Consequently, it is most important to clearly deliniate the intent and the expected effects of magnetic treatment. False or misunderstood claims are the main reason or the negative statements by agencies conccrncd about water quality.

7. Is there a quick and easy way to directly measure the effectiveness 0f *magnetic water treatment?*

Figure 7

No, exact measurements are time -consuming and costly.

Unfortunately for testing purposes, the development of hard lime scale is a slow process, usually requiring many weeks to become obvious and years more to become a serious problem.

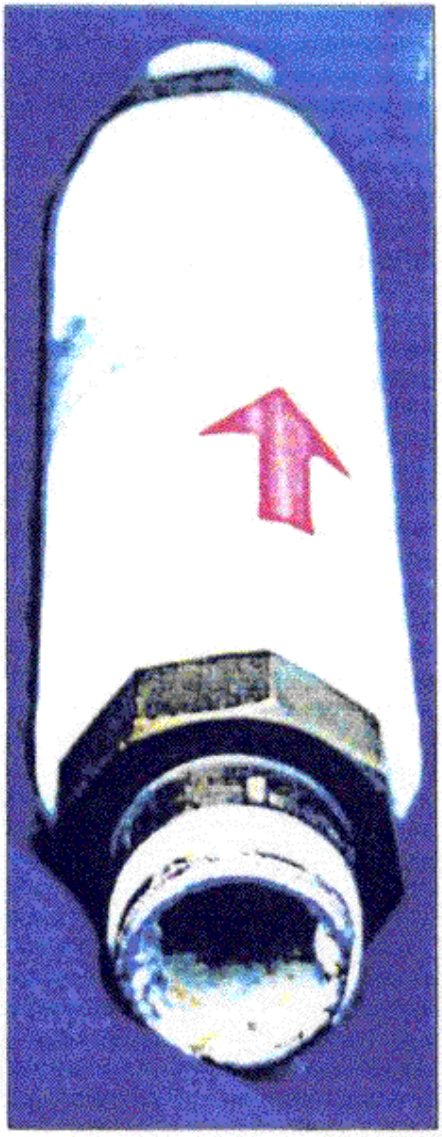
For example, the water supply line of my three bedroom house built in 1962 in Claremont, California, was opened In February 1982 in order to install a magnetic water treatment unit. A part of the 20 year old supply line is shown on the left in Figure 7.

In 1992. the supply line was opened again. Part of the same (then) 30-year-old supply line is shown on the right in Figure 7.

Ten years of magnetically treated water moving through the line cleaned it out and kept it clean, without any residues.

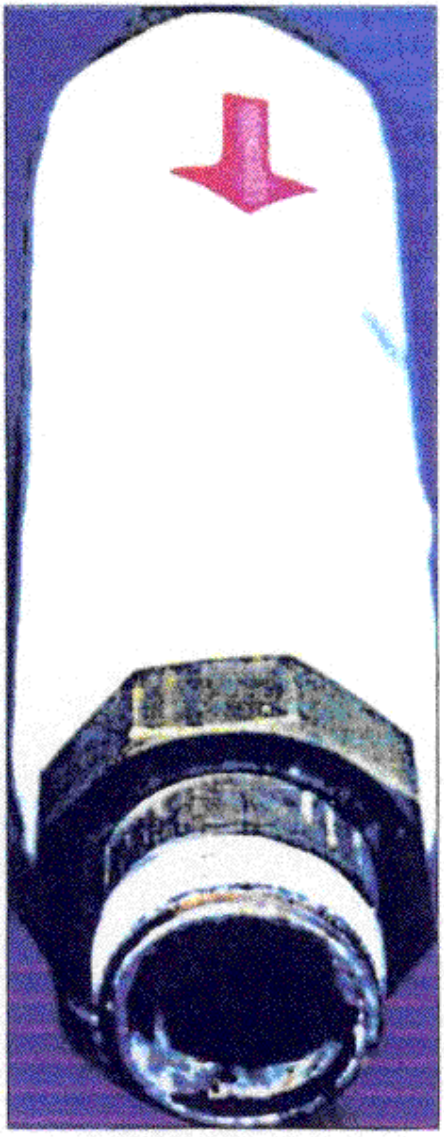
An experienced plumber had to see this pipe, because he did not believe that a 30 year old water supply line with its outside heavily corroded could be without any internal sediments.

An effective magnetic water treatment device may show its own effectiveness alter one month of use by the difference in sediments at its inlet and outlet



Outlet of the same device

Inlet after one month



Testing Protocol

An effective treatment device may reduce the amount of hard sediment by half or more. It transforms part of the lime content into loose particles, which flow with the water.

In order to evaluate the effectiveness of the treatment, one has to compare the amount of lime in the form of' loose powder with the *lime* deposited on the container walls. (A layer of loose powder resting on a place of' flow can be mistaken for hard sedimentation. This may lead to an erroneous analysis.)

This obviously presents technical problems. It also takes a long time to produce enough lime for accurate weighing and analysis.

Another method of' testing uses miniature units of heaters or heat exchangers which can be weighed precisely enough after a few days of operation.

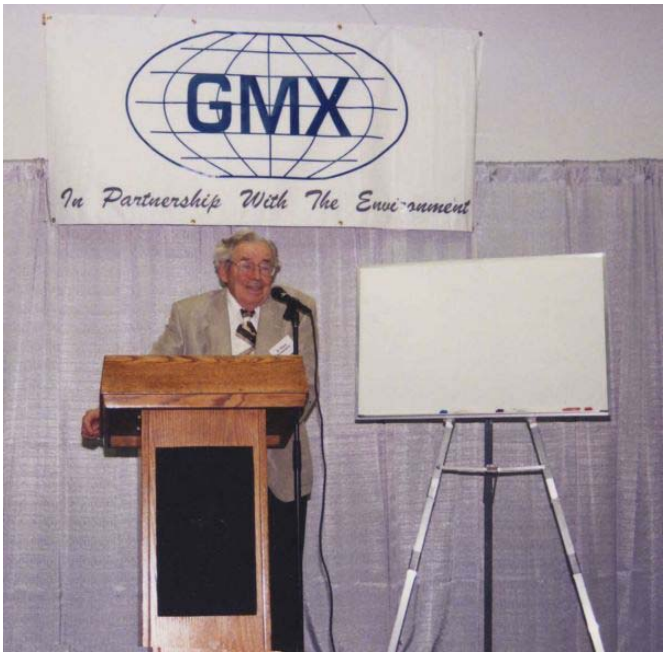
(This process is routinely followed by the Steinbeis Institute in Reuttingen. Germany.)

One method of' quantitative testing uses the visible turbidity produced in the treated water by the produced seeded crystals. Their platelet shape reflects the light, and this produces a slight, but measurable diffusion of that light. (Attempted by Professor Dr. Frahne Germany.)

The fracturing of "a number of super-molecules of the untreated water decreases the surface tension. Measurements of the change of surface tension with the necessary accuracy are not simple. The changes effected by the magnetic treatment are minute.

Any measurement requires a long time (several weeks) of water running in separate fines for the comparisons. Capable teams of scientists have to make measurements consistently over this time. Few laboratories are equipped to provide such amounts of streaming water and the necessary manpower.

In conclusion, exact measurements of, the treatment effectiveness are difficult and costly.



8. Can effects of magnetic water treatment be simply demonstrated rated?

Yes, by observations of changes of water behavior due to slight decrease of surface tension such as wetting and drying.

The surface tension forces the water to form drops and prevents it from wetting dry surfaces and powders.

A minor decrease of surface tension changes the action of water in many ways which are easy to observe.

Observation I
Place two small, measured amounts of any detergent into two test tubes and half'-fill both with water: one with untreated; the other with physically

treated water. Shake vigorously. The test tube with untreated water will have a layer of foam on the surface of' the water; the one with the treated water will he filled to the top of the test tube with *foam.*

The foam on top of' the Untreated water disappears after an hour. The foam oil top of' the treated water will hardly diminish. A repetition of the same experiment the next day will give similar results. After three days no difference of' the water call be found.

Observation 2
Freshly developed photographic film watered in nontreated water dries within 20 minutes; washed in treated water it dries in 12 minutes under the same conditions.

Observation 3
A car hosed off with untreated water may be covered with water spots if it is not wiped dry. Well-treated water leaves no water spots.

Observation 4
Ice cubes produced in any standard freezer turn out differently when they are made from magnetically treated water.

Untreated water makes ice cubes that look opaque and that can he removed from the freezer trays easily in whole blocks. Magnetically treated water makes ice that looks as clear as glass. When removed from the freezer trays it tends to shatter into ice splinters.

Observation 5
Ordinary soap leaves a soapy ring on the line of untreated water in the bath tub. No such ring can he found when the water is treated.

A ring of hard lime scale baked firmly on a porcelain dish by long-time use with untreated water can he removed with an acid bath. Or the lime scale on the same dish can he wiped off easily *after 15 to 20 minutes under a stream of treated water.*

Observation 6
The hard lime scale deposit on the tiles of a swimming pool filled with untreated water can be removed only by scraping with pumice stone or with acid. Or, if the pool water is magnetically treated, the lime deposit becomes soft after three days and can he wiped off by hand.

9. How long will permanent magnets keep their strength?

Modern magnets are truly permanent!

During the last century and up to 1940, all magnets were made from steel. Steel receives its desired qualities by a quenching process which preserves its magnetic structure to room temperature where its desirable structure deteriorates to a less useful quality very slowly. Also, magnets made from steel lose strength very slowly over years. This

"aging" process had to he taken into account by all industries up to about 1950.

This changed with the invention of alni and alnico magnets. Their material did not change with age. They lose their magnetic strength only by energy interventions, such as strong currents nearby or lightning strokes.

With the introduction of ceramic magnets, even such energy interventions do not change the *magnetic* strength, They are magnetically weaker than the alnicos but they cannot be de-magnetized except by high temperature.

After 1970, the invention of the magnets containing "rare-earth" like samarium and neodymium made available extremely powerful magnets that have not shown any evidence of losing strength with time.

Magnetic treatment devices may lose their effectiveness by becoming contaminated or plugged up by ironous materials. But they cannot lose their effectiveness by any weakening of the strength of permanent magnet.

10. Can the performance of a magnetic water treatment device be predicted with certainty?

No, the device will perform perfectly, but some types of water may not be responsive to treatment, such as rainwater and mountain spring water.

Different types of water respond differently to any type of treatment. The reason is the difference of the physical structure of the water. Water delivered by community water systems may be a mixture of waters from different sources.

Example: The water of the city of Claremont.
Located at the foothills of the San Gabriel mountains the city water is often mainly the water coming directly from the mountains. Weeks later it may he mixed with ground water pumped from the San Gabriel river. For the rest of the year it may contain more and more water from the Colorado River.

Depending on the supply-demand balance, the response of the water may differ from hour to hour from the same faucet. The official "quality" of the water as quoted by the water district may he kept at a constant level by controlling the mixtures of the water.

As long as nothing more is known about the physical structure of the water - the size, form and number of its super-molecules - the response of the water to any treatment and its performance for different activities cannot he predicted.

International scientific literature contains many hundreds of scientific reports from all over the world which report observations identical to the ones given here. It is difficult to explain why so many scientific publications which consistently report identical results can he ignored by a few "water quality" organizations in the USA. Perhaps it is because much of the research from foreign countries is untranslated. Nevertheless, it takes a gross arrogance to insist that only such results that have been achieved in one's own laboratory

can be accepted!

** END **