Serim™ WATER HARDNESS TEST STRIPS

DESCRIPTION

SERIM WATER HARDNESS Test Strips provide a convenient means for indicating the level of hardness in water at the post-softener stage of the water treatment process. Hardness is described as the total concentration of calcium and magnesium, expressed as ppm or grains/gallon of calcium carbonate ($CaCO_3$). In dialysis, softening is a pretreatment process for water which will undergo further purification, such as reverse osmosis. RO membranes can be damaged by scale deposits arising from the use of "hard" water.

SERIM WATER HARDNESS Test Strips have color blocks at levels of 0, 10, 25, 50 and 120 ppm. (This correlates to 0, 0.6, 1.5, 3 and 7 grains/gallon, respectively.)

The test strips are supplied in a ready-to-use form. When placed in contact with the softened water sample according to directions, the indicator pad changes color relative to the level of calcium and magnesium present.

CHEMICAL PRINCIPLES OF THE TEST

SERIM WATER HARDNESS Test Strip chemistry is based on a reaction between the chemical indicator in the pad of the test strip and the calcium and/or magnesium cations in the water resulting in a color change.

WARNINGS AND PRECAUTIONS

- Keep all unused test strips in the original bottle.
- Do not remove the desiccant pack.
- Replace the cap immediately and tightly after removing a test strip; the strips must be protected from humidity.
- Do not touch the indicator pad.
- Do not allow the test strip to come into contact with liquids or with work surfaces that may be contaminated with potentially interfering substances.

STORAGE

- Keep all test strips in the original bottle with the lid tightly closed.
- Do not remove the desiccant pack.
- Store at temperatures between 15°- 30° C (59°- 86° F).
- Use within 6 months after first opening the bottle.
- Always write the date that the bottle is opened in the space provided on the bottle label.
- Do not use a test strip (from an opened or unopened bottle) after the expiration date.

DIRECTIONS

Dip Method:

1. Collect a sample of softened water in a clean container.
2. Immerse the indicator pad into the sample for 1 second and remove. (Do not shake or blot the strip.)
3. Wait 10 seconds and compare the color of the indicator pad to the color chart on the bottle label.

For best results, interpret the results of the test strip **at exactly 10 seconds**. The color of the indicator pad may continue to change after the ten-second read time.

Stream Method:

1. Insert the test strip into the stream of softened water for 1 second and remove. (Do not shake or blot the strip.)
2. Read **immediately** by comparing the color of the indicator pad to the color chart on the bottle label.

RESULTS

The results of SERIM WATER HARDNESS Test Strips can be interpreted by matching the color of the indicator pad to the color blocks on the bottle label. The results can be estimated when the color of the indicator pad is between color blocks. (Accuracy of estimated results depends on an individual's color perception and the ambient lighting conditions.)

NOTE: The color of the indicator pad may continue to change after the read time. Regardless of the method used, it is important to interpret the results of the test strip **at the specified read time** to assure accuracy.

QUALITY CONTROL

Adequate procedures for quality control should be established at each facility. Samples of untreated feed water and water at the post-treatment stage can be used as "reactive" controls. Typically, feed water* will display high levels of hardness in contrast to the purified water at the post-treatment stage. Testing the two samples with several SERIM WATER HARDNESS Test Strips will allow the user to observe and characterize the performance of the strips.

Regular use of QC procedures will increase user proficiency, minimize procedural errors and protect against the inadvertent use of outdated product or product that has deteriorated due to improper storage or handling.

*Note: (In the event that the incoming water supply does not have significant levels of hardness, mineral water from the grocery can be used.)

PERFORMANCE CHARACTERISTICS

The performance characteristics of SERIM WATER HARDNESS Test Strips are based upon analytical studies using samples prepared from AAMI-quality water (RD5)[1]. Test samples (to which calcium and magnesium salts were added at known concentrations) were prepared at five different hardness concentrations. Results from data obtained in a blind study evaluation utilizing 4 readers and 432 observations are summarized below:

BLIND STUDY RESULTS

Total Hardness (as $CaCO_3$)	97% of Readings were between:
0 ppm	0 ppm – 5 ppm
10 ppm	9 ppm – 16 ppm
25 ppm	23 ppm – 32 ppm
50 ppm	45 ppm – 64 ppm
120 ppm	113 ppm – 120 ppm

In 84 observations by 14 different readers, a sample contrived to a hardness level of 5 ppm gave an average reading of 8 ppm with no readings less than 4 ppm.

LIMITATIONS

SERIM WATER HARDNESS Test Strips were developed to measure the total hardness (magnesium and calcium) in potable water and may not be accurate when measuring hardness in other solutions.

The test strips are not affected by the impurities found in most drinking water.

The temperature of the water being tested should be between 15° and 30°C for accurate results. If testing is done in water with temperatures higher than 30°C, the hardness results may be falsely elevated.

When interpreting the color of the indicator pad, the accuracy of estimated results depends on the individual's color perception and the ambient lighting conditions.

REFERENCES

1. *AAMI Standards and Recommended Practices, Volume 3: Dialysis.* American National Standard, *Hemodialysis Systems, ANSI/AAMI RD5-1992.* Arlington, VA: Association for the Advancement of Medical Instrumentation, 1995 Edition.

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