BASIC

# Aquaset®

Set of 9 tests
for measurement
of water parameters
in aquariums

# directions for use

ZOOLEK®

# Aquaset 1 BASIC

## Introduction

**Aquaset 1 basic** is a set of 9 tests for measurement of important water parameters in aquariums.
The set allows the following tests:

- pH in two ranges: 4.5-9.0 and 6.0-8.0 (2x100 tests)
- general and carbonate hardness GH-KH (approximately 2x30 tests)
- ammonia $NH_3$ content in the range of 0-10 mg/l (30 tests)
- nitrite $NO_2^-$ content in the range of 0-1.5 mg/l (50 tests)
- nitrate $NO_3^-$ content in the range of 0-150 mg/l (50 tests)
- phosphate $PO_4^{3-}$ content in the range of 0-5 mg/l (30 tests)
- iron $Fe^{2+}$ ions content in the range of 0-1.5 mg/l (30 tests)

The set contains reagents, three glass test tubes, directions for use and colour charts.

Measurement of water parameters allows to control its quality to ensure appropriate conditions for plants and animals in aquariums. Regardless of the way in which the water is prepared (reverse osmosis, tap water), it undergoes natural changes over time due to the chemical and biological transformations that take place in it. Most of these changes cannot be seen "with the naked eye". Regular measurement of water parameters help to avoid biochemical imbalance in an aquarium and provide proper conditions for fish and plant growth.
**Aquaset 1 basic** allows you to control the most important parameters of aquarium water. Aquatest pH and KH allows to obtain water with proper pH and acid capacity (alkalinity). The value of total hardness - also a very important factor influencing plant growth, can be measured using Aquatest GH. The set also includes reagents for the measurement of ammonia, nitrates and nitrites content which are an indication of biological water pollution, phosphates, which in elevated concentrations can cause a massive algae bloom and, indirectly, $CO_2$, as well as an element classified between micro and macronutrients - iron

## Remarks

A spoon or spatula is assigned to each test that contain a powder reagent.

$PO_4$ test - blue spatula
$NO_3^-$ test - yellow spatula
Fe test - white spoon

# pH

pH test
for quick measurements
in fresh water
in the ranges of
4.5-9.0 and 6.0-8.0

## General information

pH value is a measure of hydrogen ions ($H^+$) concentration:

**pH=7** - water has a neutral pH

**7<pH<14** - alkaline pH, the higher the pH value, the stronger the alkalinity

**0<pH<7** - acidic pH, the lower the pH value, the stronger the acidity

Water pH-value is one of the most important parameters determining possibility and conditions of biological life in aquariums and garden ponds. For various species of fish water pH in aquarium should be similar to the pH value in their natural environment. pH value in range of 6.0-7.5 is suitable for majority of fish; however some species require more acidic water - for example: Characidae and Ciprinidae - pH 5-6. Other may require more alkaline water, for example: Cichlids from the African lake of Malawi require pH of 7.7-8.6. Maintaining proper water pH value is especially important during reproduction period and for fry. Too low water pH may cause acidosis, and too high alkalosis. Generally, improper pH level increases fish susceptibility to diseases. Majority of water plants require pH value close to neutral (approximately pH 7), in conditions of pH under 5 or over 8.5 the growth become inhibited and plants die.

Water pH value has a crucial influence on action effects of some harmful substances such as: ammonium ion $NH_4^+$ in pH below 7.5 does not have any toxic influence, and in alkaline pH - over 8.5, a transition into a highly toxic ammonia $NH_3$ occurs.

Water pH value in aquarium or garden pond is influenced by the following factors: components of substrate that may react with carbon dioxide dissolved in water, substances from humus, products of biological decomposition, remains of organic food, droppings, etc.

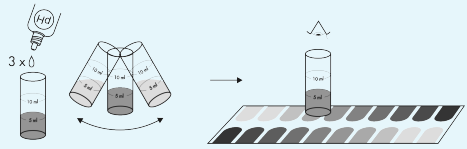
To maintain stability of water pH value (buffering effect) some bicarbonate content is necessary, which means a carbonate hardness should be kept at the level of not less than 3 °dKH. In salt depleted waters, carbon dioxide assimilation by plants leads to increase in pH, and decomposition of organic matter by micro-organisms may cause both acidification and alkalization of water.

## Measuring set

- 2 bottles containing indicator solutions for pH measuring in the range of: 4.5 – 9.0 with an accuracy of 0.5 and 6.0 – 8.0 with an accuracy of 0.2
- syringe for taking the water sample
- test tube
- doubled colour chart with pictorial instruction

## Performing the measurement

1. Rinse the included test tube three times with the tested water, and then fill with the syringe to 5 ml.
2. Add 3 drops of the indicator solution and shake well to obtain uniform colour.
3. Match the obtained colour with a corresponding colour scale and read the result. The colour of the sample should be evaluated in daylight or artificial light similar to daylight.




## Water pH correction

AQUACID is used for water pH lowering, and AQUALKAL for its raising. No violent pH changes should be made in aquarium with fish. If there is no biological balance in an aquarium there is an excessive quantity of organic matter decomposition products, pH correction will not increase water quality and water change is required.

# GH KH

general and carbonate hardness test for quick measurements in fresh and seawater

## General information

Water of natural inland basins contains various quantities of dissolved salts. Those are mainly sodium, calcium, magnesium and potassium salts. They significantly influence life of organisms - biological membranes permeability, osmotic pressure in cells and tissues or mediation in numerous life processes.

Total content of calcium and magnesium salts is defined by general hardness, and contents of bicarbonates and carbonates by carbonate hardness (alkalinity). Non-carbonate hardness is determined by other calcium and magnesium salts, mainly chlorides and sulphates. Maintaining general hardness within a specific, optimal range is very important for fish especially for reproduction. The most frequently used unit of hardness is a German degree °d (dGH).

1°d corresponds to contents of 10 mg of calcium oxide in 1 litre of water

Hardness is also frequently expressed in milligram-equivalents in one litre of water (mval/l).

1 mval/l = 2,8 °d  1°d = 0,357 mval/l

Most frequently general hardness is higher than carbonate hardness, but in case of water containing sodium and potassium carbonates and bicarbonates carbonate hardness may be higher than the total one. This situation occurs frequently also in case of water softened with sodium cation exchanger (exchanging calcium and magnesium cations for sodium cations).

According to the general hardness the following types of water are distinguished:

- very soft - 0.5 °d
- soft - 5 - 10 °d
- medium hard - 10 - 15°d
- considerably hard - 15 - 20 °d
- hard - 20 - 30 °d
- very hard - over 30 °d

## Measuring set

- bottle with the solution for carbonate hardness (KH) determination – contains titrant with alkacymetric indicator
- bottle with the solution for general hardness (GH) determination – contains titrant with complexometric indicator
- syringe
- test tube
- colour chart

## Performing the measurement

1. Rinse the test tube and the syringe three times with the tested water.
2. Dry the test tube by turning it upside down.
3. Before use, bring the reagents and water to room temperature.
4. Take exactly 5 ml of the tested water with the syringe and pour into the test tube.
5. Tilt the bottle diagonally over the opening of the test tube, press the bottle slightly and add the solution drop by drop. The drops should be added directly to the tested water, not down the side of the test vial. After each drop, shake the test tube gently until the uniform colour is obtained. Avoid pouring water out of the test tube. The total number of drops required to obtain the colour change (see enclosed colour chart) is numerically equal to the hardness expressed in German degrees (°d). Only full not aerated drops guarantee accuracy of measurement (not full drops should be removed from the dropper by means of tissue paper).
6. The most reliable results, due to the easy observation of indicator colour change, are obtained from 5 to 20 drops in 5 ml of water. For very soft water (see 'General information'), a sample of 10 ml can be taken with one drop corresponding to 0.5 °d. For hard and very hard water, a sample of 2.5 ml can be taken with one drop corresponding to 2 °d.

7. For water with a pH below 6, measuring carbonate hardness is pointless, because in this case the result will always be close to zero. In case of very soft natural waters or waters softened with acidic cation exchangers, with pH below 6, before measuring the general hardness, the pH of the water sample should be increased to the value of 8-8.5 (e.g. with diluted Aqualkal).
8. Reading error is ±1 °d of the analysis result.

## Carbonate hardness (KH) test

After adding the first drops of the KH titration solution to the water sample, a slightly bluish-purple colour appears (looking from above at the test tube opening against a white background). After further drops, the colour becomes more intense and easier to observe from the side of the test tube. The colour of the sample turns yellow-green or yellow as more drops are added. The number of drops causing the change of colour corresponds to carbonate hardness expressed in German degrees (°d).

## General hardness (GH) test

After adding the first drops of the titration solution, a slightly pink colour appears, and after the next drops it becomes more intense and turns into red-pink (observe similarly to the measurement of carbonate hardness). Add drops of titration solution slowly, every 3, 4 s. Expecting the end of the titration, slow down dosing to every 6 sec. and mix thoroughly. The colour changes to greenish as more drops are added. The number of drops causing the change of colour corresponds to general hardness expressed in German degrees (°d).

## Remarks

Keep the test locked up in a cool, dark place, out of the reach of children. Storage at 5 -10 °C extends the declared lifetime of the reagent.

# $CO_2$ determination of carbon dioxide content based on **pH** and **KH** readings

## General information

Carbon dioxide is a gas with good water solubility. Since carbon dioxide is used by plants in the process of photosynthesis, measuring its content in aquariums with vegetation is very important. Carbon dioxide content in aquarium water below acceptable levels may adversely affect plant growth, but on the other hand, its elevated concentration poses the danger to fish. To calculate the amount of $CO_2$ in the tank, the relationship between $CO_2$, pH and carbonate hardness can be used. For this purpose, the carbonate hardness (KH) and pH should be measured, and then, using the table, find the $CO_2$ content in the water corresponding to the measured parameters. Adding buffering agents other than carbonates to the water or using peat filters may affect the measurement result.

| °d | pH of water | | | | | |
|---|---|---|---|---|---|---|
| | 6,4 | 6,6 | 6,8 | 7,0 | 7,2 | 7,4 |
| 2 | 25 | 16 | 10 | 6 | 4 | 3 |
| 3 | 38 | 24 | 15 | 10 | 6 | 4 |
| 4 | 51 | 32 | 20 | 13 | 8 | 5 |
| 5 | 63 | 40 | 25 | 16 | 10 | 6 |
| 6 | 76 | 48 | 30 | 19 | 12 | 8 |
| 7 | 89 | 56 | 35 | 22 | 14 | 9 |
| 8 | 101 | 64 | 40 | 25 | 16 | 8 |
| 9 | 114 | 72 | 45 | 29 | 18 | 11 |
| 10 | 126 | 80 | 50 | 32 | 20 | 13 |
| 11 | 139 | 88 | 55 | 35 | 22 | 14 |
| 12 | 152 | 96 | 60 | 38 | 24 | 15 |
| 13 | 167 | 104 | 65 | 41 | 26 | 16 |
| 14 | 177 | 112 | 70 | 44 | 28 | 18 |

*correct concentration* *too low concentration*

*too high concentration*

# $NH_3$

ammonium/ammonia test for quick measurements in fresh and seawater in the range of 0 -10 mg/l

## General information

Ammonia ($NH_3$) and ammonium ion ($NH_4^+$) content is, besides nitrites and nitrates content, an indication of biological water pollution. Decomposition of proteins originating from excess of food, droppings, dead plants and fish leads first to formation of ammonium compounds in water - ammonia and ammonium ions. However, ammonia presents threat for fish health and life with pH values over 7. In pH values below 7 only harmless ammonium ions are formed.

Ammonia content in **fresh water** aquarium:

- from 0.2 to 0.5 mg/l it is harmful for fry and young fish
- from 0.5 to 1.0 mg/l it is highly harmful for fish and deadly for fry
- over 1.0 mg/l it is deadly also for adult fish

Fish and invertebrates in **marine** aquarium require water practically free from ammonia. Taking into account that recommended pH for salt water aquariums ranges from 8.1 to 8.3, total ammonium compounds content determined with the test should be close to zero.

With pH rise over 7, and with temperature rise, percentage of ammonia ($NH_3$) in total ammonium compounds quantity increases (see Table 1).

Table 1

| pH | temperature | | |
|---|---|---|---|
| | 10 °C | 20 °C | 30 °C |
| 7.0 | 0.2 | 0.4 | 0.8 |
| 7.5 | 0.6 | 1.3 | 2.5 |
| 8.0 | 1.8 | 3.9 | 7.6 |
| 8.5 | 5.6 | 11.4 | 20.8 |
| 9.0 | 15.6 | 28.4 | 44.6 |
| 9.5 | 36.8 | 55.6 | 71.4 |

Aquatest **$NH_3$** allows measuring of total ammonia and ammonium ions level. The real ratio of those two compounds depends on pH value. Table 2 presents actual quantities of toxic ammonia in tested total content of ammonium compounds ($NH_3/NH_4^+$) at known water pH value.

One should consider that in presence of ammonium compounds, increase in pH value from under 7 to over 8 may constitute a danger for fish, due to a fast conversion of harmless ammonium ions into toxic ammonia. That is why the ammonium compounds content of over 0.5 mg/l presents already a potential threat.

## Measurement method

The test is based on indophenol colour reaction. According to the method, both free ammonia and ammonium ion content is determined. After mixing a water sample with reagents of the test a characteristic colour develops, from yellow to blue-green, dependent on ammonium compounds concentration.

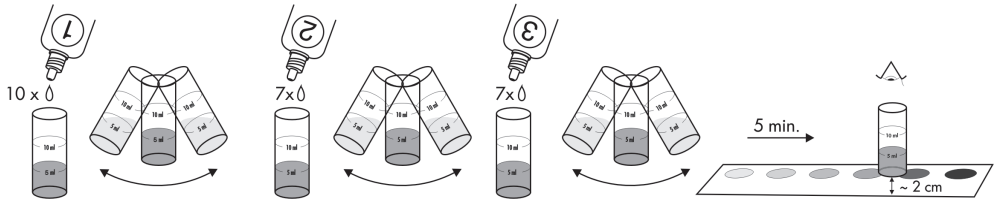


Table 2

| Content of $NH_3/NH_4^+$ in mg/l meas. by Aquatest | water pH | | | | |
|---|---|---|---|---|---|
| | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 |
| 0.25 | 0.0025 | 0.005 | 0.01 | 0.025 | 0.06 |
| 0.5 | 0.005 | 0.01 | 0.02 | 0.05 | 0.12 |
| 1.0 | 0.01 | 0.02 | 0.04 | 0.1 | 0.25 |
| 3.0 | 0.03 | 0.06 | 0.12 | 0.3 | 0.75 |
| 5.0 | 0.05 | 0.1 | 0.2 | 0.5 | 1.25 |
| 10.0 | 0.1 | 0.2 | 0.4 | 1.0 | 2.5 |
| 20.0 | 0.2 | 0.4 | 0.8 | 2.0 | 5.0 |

*harmful values*
*temp. 20 °C*

■ *fish life threatening*

## Measuring set

- bottles with Reagent 1, 2, 3
- glass tube
- colour chart with pictorial instruction
- syringe

## Performing the measurement

1. Rinse the test tube three times with the tested water. Take exactly 5 ml of the tested water with the syringe and pour into the test tube.
2. Add 10 drops of Reagent 1 and mix by shaking.
3. Add 7 drops of Reagent 2 and mix by shaking.
4. Add 7 drops of Reagent 3 and mix.
5. After 5 minutes, at a temperature above 25 °C or after 15 minutes at lower temperatures, compare the colour of the solution in the test tube with the colour chart and read the result corresponding to the concentration of ammonium/ ammonia in mg/l (ppm).

The colour of the sample should be evaluated in transmission daylight or in artificial light close to the natural one.
In order to determine the actual content of free ammonia, determine water pH using the Aquaset **pH** and read ammonia concentration from the table 2. In case the admissible ammonia concentration is exceeded, water pH should be possibly quickly lowered to the level of approx. 7, using **AQUACID.** If pH lowering is not advisable due to the type of fish kept, it is necessary to exchange most of the water.

# $NO_2^-$

nitrite test
for measurements
in fresh and seawater
in the range of
0 - 1.5 mg/l

## General information

Nitrites ($NO_2^-$) are toxic and dangerous to fish, and to an even a higher extend to invertebrates and many marine organisms. Nitrites are formed in the first step of the oxidation of ammonium compounds by aerobic bacteria as intermediate products of the nitrogen cycle. Waste proteins accumulating in the aquarium are decomposed into ammonium compounds, which are then oxidized to nitrites, and in the next stage to nitrates.

Dangerous nitrite levels arise when they are not oxidized to much less harmful nitrates. This situation occurs when the desired bacterial flora has not developed sufficiently, such as in newly established "immature" aquariums, and also when the bacteria have been destroyed by medications or disinfectants.

The reason for high nitrites concentration in water is excessive concentration of nitrogen compounds resulting from decomposition of biological substances, for example: residues of food, dead plants, droppings, dead fish, with simultaneous oxygen deficiency in water or unfavourable bacterial flora.

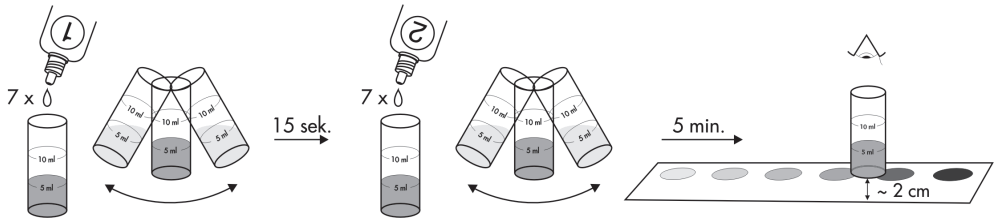
Nitrite content below 0.1 mg/l is not dangerous to fish in a freshwater aquarium, but for animals in marine aquarium, nitrites can be harmful already at the level of above 0.05 mg/l. Nitrite content exceeding 0.3 mg/l becomes dangerous and a significant part of the water must be replaced. Above 1.0 mg / l nitrite pose a threat to even large freshwater fish.

## Measuring set

- bottles with Reagent 1, 2
- test tube
- syringe
- colour chart with pictorial instruction

## Performing the measurement

1. Rinse the test tube and the syringe three times with the tested water. Before use, bring the reagents to a room temperature.
2. Take exactly 5 ml of the tested water with the syringe and pour into the test tube. Make sure no air bubble is present in the syringe.
3. Add 7 drops of Reagent 1 to the test tube with water and mix by shaking.
4. After about 15 seconds, add 7 drops of Reagent 2 and mix.
5. After 5 minutes compare the colour of the solution in the test tube with the colour chart and read the result corresponding to the concentration of nitrites expressed in mg/l.



# $NO_3^-$

Nitrate test
for quick measurements
in fresh and seawater
in the range
of 0- 150 mg/l

## General information

Nitrates accumulate in water as a result of protein substances decomposition and constitute a final product of this transformation. The following concentrations of nitrates:

- up to 40 mg/l - are harmless for fish and improve plant growth
- from 40 to 80 mg/l - cause algae growth
- from 80 to 150 mg/l - inhibit plants growth and cause rapid algae growth. With this concentration, nitrates become harmful for fish - water replacement is necessary
- above 150 mg/l - are dangerous for fish and plants - immediate water replacement is necessary

## Measuring set

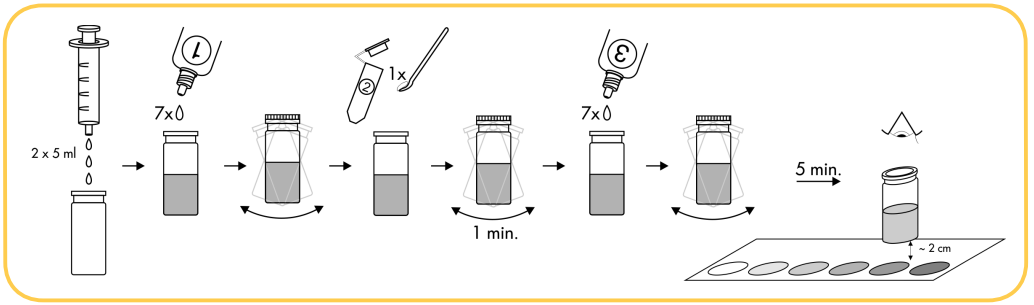
- bottles with Reagent 1 and 3
- container with Reagent 2
- test tube
- yellow spatula
- colour chart with pictorial instruction

## Performing the measurement

1. Rinse the test tube and the syringe three times with the tested water. Take exactly 10 ml of the tested water with the syringe and pour into the test tube.
2. Add 7 drops of Reagent 1, close the cap and mix by shaking. Leave for about 15 seconds.
3. Add 1 portion of powder Reagent 2 with the yellow spatula, close the cap and shake vigorously for 1 minute.
4. Add 7 drops of Reagent 3 and mix.
5. After adding Reagent 3 wait 5 minutes and compare the colour of the solution in the test tube with the colour chart and read the result corresponding to the concentration of nitrates expressed in mg/l. Compare the colour of the sample solution in daylight passing through the vial by holding the test tube over the colour chart.

## Removing nitrate from water

Partial or complete aquarium water replacement can be the way to remove undesirable compounds, but it is not always possible. Unwanted nitrate and nitrite ions can also be removed with Aquafix/ Filtrax $NO_3$ flow bags, which contain a highly-specialized, selective anion exchanger.



# $PO_4$

phosphate test
for measurements
in fresh and seawater
in the range of
0 - 5 mg/l

## General information

In natural, not polluted fresh and marine waters phosphate concentration is 0.01-0.08 mg/l. In aquaria, with much higher density of animals and plants than it is in nature, the level of phosphates is much higher. Elevated phosphates content is especially dangerous for invertebrates, and its concentration in marine aquarium should not exceed 0.3 mg/l. Higher phosphates concentrations do not present direct threat for fish, but may cause rapid growth of algae. It is recommended that phosphates content in freshwater aquariums and ponds does not exceed 1 mg/l.

## Measuring set

- bottle with Reagent 1
- container with Reagent 2
- syringe
- test tube (2 pcs.)
- comparator
- blue spatula
- colour chart with pictorial instruction

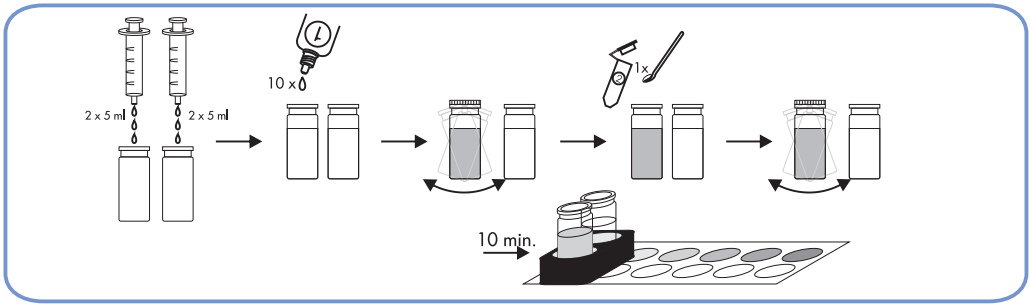
## Performing the measurement

1. Rinse the test tubes and the syringe three times with the tested water.
2. Pour 10 ml of the tested water into both test tubes using a syringe (two times 5 ml).
3. Add 10 drops of Reagent 1 to one of the test tubes, close the cap and shake to mix.
4. Add 1 portion of powder Reagent 2 with the blue spatula to the test tube with Reagent 1 added, close the cap and shake until the powder has dissolved.
5. After 10 minutes place both open test tubes in the comparator. Move the comparator with the test tubes over the colour chart circles. The test tube with reagent added should be over white circles and the test tube with water only over the colour circles.
6. When the colour of the solution in the test tube with reagents is most similar to the colour of the tested water in the second test tube, read the result corresponding to the concentration of phosphate expressed in mg/l.
7. After measurement, thoroughly wash the test tubes and caps with tap water and dry.

Do not use cleaning agents to wash test tubes as they may contain phosphates.

## Remarks

Keep the test locked up and out of the reach of children. Reagent 1 contains the solution of sulphuric acid. Avoid eye and skin contact. If in eyes: rinse cautiously with plenty of water and seek medical advice. If on skin: wash with plenty of water.



# Fe

iron test
for measurements
in fresh and seawater
in the range of
0 to 1.5 mg/l

## General information

Aquarium with plants requires stable supply of supplements containing iron. This element has considerable influence on proper growth and beautiful appearance of plants in aquarium. Desired concentration of iron ions is in the range of 0.2 to 0.5 mg/l. Iron deficiency results in reduced plant growth and yellowed leaves whereas elevated levels - above 1.0 mg/l may be harmful for fish as well as for aquarium plants.

Not all iron compounds are assimilable by plants – fertilizers for aquarium plants contain water-soluble (II) complexes. Content of iron added with soluble supplement decreases with time. The decrease rate depends on the quantity and kind of plants – its iron consumption, as well as on the water composition and the type of base of the aquarium.

That's why it is necessary to measure iron content on a regular basis. It is recommended to perform such a test using Aquatest Fe at least once a week.

## Measuring set

– container with Reagent Fe
– syringe
– test tube (2 pcs.)
– white spoon
– comparator
– colour chart with pictorial instruction

## Performing the measurement

1. Rinse the test tubes and the syringe three times with the tested water.
2. Fill both vials with 15 ml of the tested water using the syringe (5 ml three times).
3. Add 1 flat white spoon of reagent to one of the vials. Close the cap and shake vigorously until the powder has dissolved.
4. After 10 minutes insert both vials into the plastic comparator.
5. Move the comparator with the test tubes over the colour chart circles. The test tube with reagent added should be over white circles and the test tube with water only over the colour circles.
6. Compare the colours appearing in the test tubes. When the colours are most similar, read the corresponding result in mg/l.

## Remarks

Protect the powder reagent from moisture and keep the container tightly closed after use. Keep the reagent spatula always dry. After the measurement, empty the test vials, rinse thoroughly with water and dry.

## Aqualora Fe

To supplement aquarium water with iron, the use of Aquaflora Fe is recommended. Aquaflora Fe is available as one of the fertilizers offered by ZOOLEK under Aquaflora system. To find out what volume of Aquaflora Fe should be added, enter your iron content obtained by use of Aquatest Fe into the calculator available on the Aquaflora Fe site.