



Mastering the **Balling** method with **AquaCalculator** for Android



The *Balling* method is the best way to steer the consumption of Calcium, Magnesium and Alkalinity, which is absolutely essential for growth of stony corals. The major advantage lies in its capability to steer and maintain these three water parameters in your tank separately and very accurately according your tank's needs.

Although several working steps are needed to adjust everything exactly to your tank's demands, experienced Balling users say it is very easy to maintain. That is correct... if only there was an understandable and complete explanation for it!

With this step-by-step instruction, together with the Aqua-Calculator (either for your Android smartphone or tablet or for your Windows computer), you will be able to master the Balling method without any chemical background or calculation effort.

To support this project also in the future i'm asking for a donation!

(Your donation will be used to pay server costs as well as for further development of my FAQs and Aqua-Calculator)

Spenden



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Symbols



Information / Hint



Warning: text passages being extra important or things frequently misunderstood



Ban: Things to be avoided



Text passages explaining complex behavior in detail * Plan some time for reading

**Recommendations given are according actual state of knowledge of the Author.
There is no guarantee for correctness.
Liability in case of correct or incorrect use will be dismissed.**

Introduction

Why should I learn about the Balling method?

Sea water in nature has a very special composition of several mass and trace elements. Animals within our tanks are demanding for an at least likewise water composition to enable a stress-free life. Using high quality artificial salt mixtures, we can adjust optimum conditions in our tanks. Several animals, especially small polyp stony corals (SPS), consume bigger amounts of these elements for growth and healthiness.

Carbonates are consumed most by far and are measurable by two aquarist test methods: Calcium (in mg/l or ppm) and Alkalinity (in either [° dH] or [mEq/L]).

Also consumed, but on a much lower level, is Magnesium.

If we did not balance this consumption, several animals (eg corals and anemones) would stop growing or even degenerate.

Is it really worth doing all the maintenance and measuring needed for the Balling method?

If you do not plan to cultivate sensitive corals like SPS, this method is not definitely needed; you can also balance levels for Ca/Mg/Alkalinity by frequent water changes.

But tanks aiming for a good growth rate of stony corals must have a separate Ca and Alkalinity supply. Balancing this just by water changes might be a lot of work and very expensive.

Besides using the Balling method, you can also do that by using Calcium reactors or by kalkwater. But the Balling method has big advantages that the other methods do not:

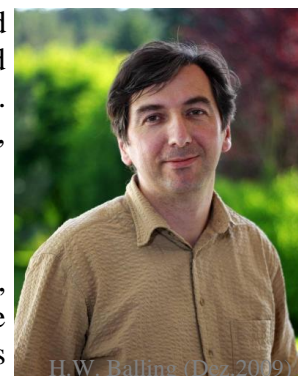
- Ca, Mg and Alkalinity can be balanced independently from each other
- several aquarists report that coral growth improves

There are also several special products and mixtures available for balancing Ca, Mg and Alkalinity, resulting in the same results as using the Balling method. Normally these products are quite expensive and have to be dosed by hand. For smaller tanks, however, they might be a good solution.



At the moment, the Balling method is the best-known way to balance your tank's consumption of Ca, Mg and Alkalinity and thus taking care for well-looking and growing stony corals.

The name of the Balling method is due to *Hans-Werner Balling*, who published it several years ago. His idea was to add a so-called “NaCl-free” salt mixture to make the tank’s water more nature-like. Hans-Werner is a very experienced and advanced aquarist and biologist, working several years for the well-known company Tropic-Marin.



Balling ≠ Balling!

You will find tons of information about the Balling method on the internet, books, or even aquarist stores. Only some of them recommend the initial recipe suggested by Hans-Werner Balling but using the name “Balling”. Recipes as well as dosing suggestions for liquid solutions differ a lot. Also, some of them do not add “NaCl-free salt”. Thus, you might as well ask: “*Which one is correct?*”

The answer: *You can use one or the other, because it is very flexible.*

The following step-by-step instruction explains an **often-used variant** of the Balling method, very detailed and easy to understand with the following boundary conditions:

- Balance elements Ca, Mg and Alkalinity using also NaCl-free salt.
No balance of further trace elements (like Potassium, Iodine...)
- Adjusting to following water parameters (which are my favourite ones):

Ca: 420 mg/l Mg 1250 [mg/l] Alkalinity 8[°dKH]
(of course you can also adjust to alternate values)
- Calcium and Alkalinity (Carbonates) to be adjusted separately and usage orientated.
(differing from original Balling method, which uses a fixed ratio for Ca/Alkalinity)
- Liquid solutions acc. dosing suggestion from Armin Glaser
(see also [Ratgeber Meerwasserchemie: Theorie und Praxis für Aquarianer](#) from Dr Armin Glaser)
- Dosing station with at least three channels available
- All calculations by the software tool *AquaCalculator*
- Examples shown are for the following AquaCalculator settings
 - Units will be calculated in SI Units (not fractional units)
 - Alkalinity measured in [°dH] (not [mEq/l])
 - salinity is measured with a refractometer in [psu] (not density, spec. density or conductivity)



You can and should change all of these settings in the AquaCalculator’s settings menu according your own measuring equipment and needs.



This instruction is based on using my Android application **AquaCalculator** which is available as on the Android Marketplace and Android Pit.



You should know about your tank's exact salinity first to accurately measure and adjust Ca, Alk and Mg. Salinity in your tank should be ~ 34,8 psu.



Correctly measured water parameters is extremely important. Be absolutely sure that you know how to measure and use only correct results. If starting with incorrect measured values, you risk harming your animals or not being able to balance Ca, Alk and Mg correctly. In any case, I recommend checking each test kit with a reference solution about its correctness, before taking the measured values for granted.

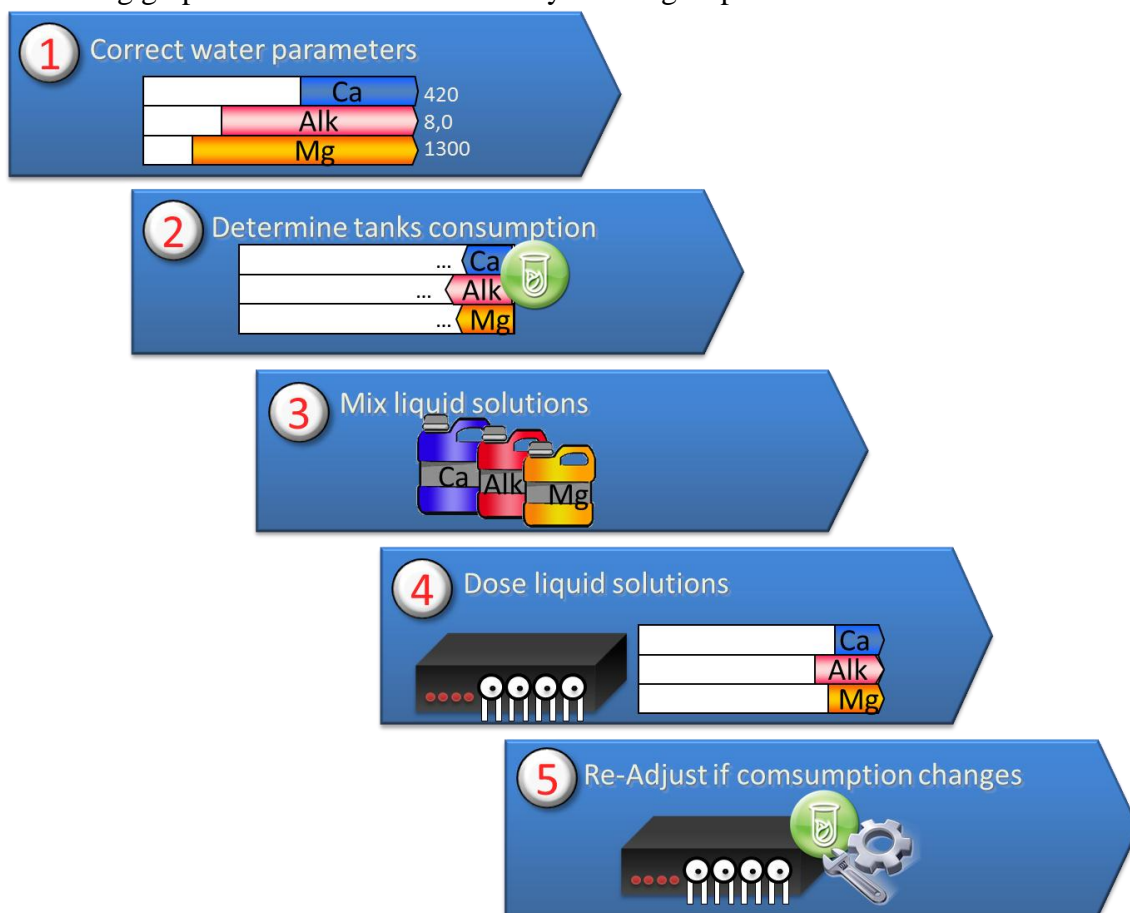


You are missing materials or tools needed for the Balling method?

* Check the shopping list at the end of this FAQ

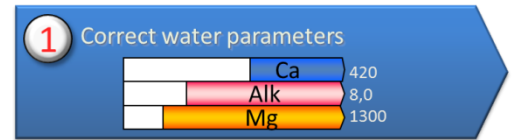
Balling method at a glance

Following graphics show the five necessary working steps:



- ① Situation: Not all of the tank's water parameters might be at a good level when you start **Balling salts will raise Ca, Mg and Alkalinity to an optimum level.**
This might take a few days. Values are checked after each raise.
This phase ends once all values are at an optimum level.
- ② Situation: Concentrations of Ca, Mg and Alkalinity will drop again by the corals' consumption. This cannot be avoided.
For a few days you will not add Balling salts. BUT measure water parameters regularly.
By doing so, you determine the **specific consumption of levels in your tank.**
- ③ Situation: For more comfortable dosing, you will mix so-called liquid solutions (Balling salts + RO water)
Exact content and concentrations of the liquid solutions will be suggested/calculated, and then you have to **mix the liquid solutions.**
- ④ Situation: The exact amount of liquid solutions has to be dosed to your tank daily.
It will be more comfortable if you do this by using dosing pumps.
Required amount of liquid solutions (specific for your tank) will be calculated and then dosed.
- ⑤ Situation: If your tank's consumption stays stable, you can stay with this for a longer time.
But your tank's consumption might change because of increasing or decreasing growth of your corals or addition of new corals.
For this reason, you keep on measuring Ca, Alk and Mg regularly.
Required amount of liquid solutions will be changed in case of changing consumption.

1. Correcting water parameters



The first target is to achieve the following water parameters:

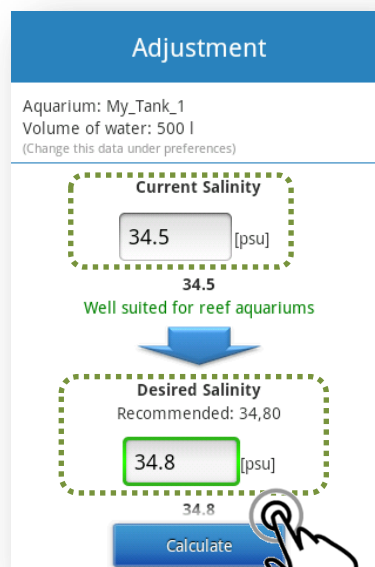
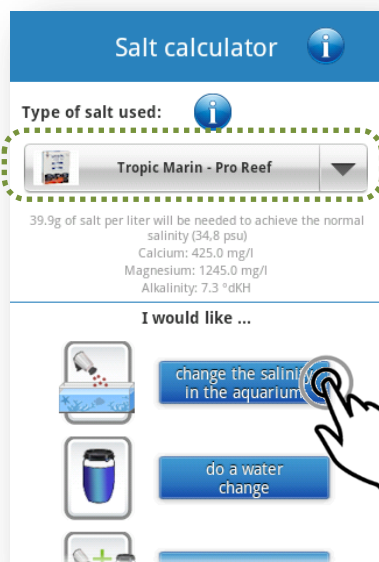
- Calcium: **420** [mg/Liter] or [ppm]
- Magnesium: **1300** [mg/Liter] or [ppm]
- Alkalinity: **8** [° dKH] equaling ~ 2,9 [mEq]

All three parameters are directly dependent on tank's salinity, thus we adjust this to an optimum value of 34,8 psu first.

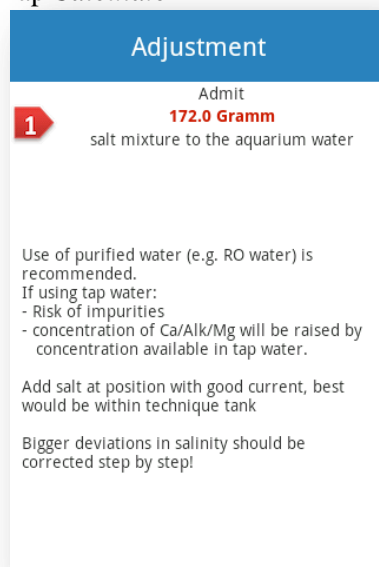
1.1 Adjust for optimum salinity (34,8 psu)

➔ Measure your tank's salinity first.

- Choose <Salinity> in **AquaCalculator**
Select the salt mixture you are using (**green**) then tap <Change the salinity in the aquarium>
- Enter following values (**green**)
 - a) *Current salinity*: your tanks measured salinity (e.g. 34.5 psu)
 - b) *Desired salinity*: 34.8 psu



- Tap **Calculate**



If tank's salinity is:

- a) **smaller** than 34,8 psu:

AquaCalculator will calculate the **amount of salt that has to be added** (here 172g of Tropic Marin - Pro Reef).

- b) **higher** than 34,8 psu:

AquaCalculator will tell you that you have to **remove a certain amount of saltwater** and **replace it by fresh water (RO)**.



Are you measuring salinity with an aerometer or conductivity sensor?

* Change the AquaCalculator's settings accordingly.

Target values for salinity measured with different measuring equipment, equaling ~34,8 [psu]

Density at 25°C *1)	1,0232 [g/cm ³]	
Spec. density at 25°C *1)	1,0262 [-]	given without unit
Conductivity at 25°C *1)	52,80 [ms/cm]	

*1): value measured valid at a water temperature of exactly 25°C. Because all of these measured values are “dependent from the temperature where they have been measured”, you will have different values for higher/lower temperatures (different to salinity in psu, which is independent from temperature).

Lower water temperature will give you higher measured values.

Higher water temperature will give you lower measured values

1.2 Measuring the actual concentrations of Ca, Alk and Mg



Measure concentrations of Calcium, Alkalinity and Magnesium of your tank's water.

Hint:

For the following example I will use:

Ca	350	[mg/l]
Mg	1150	[mg/l]
Alkalinity	5,5	[dKH]

You have to use your tank's values, of course.

1.3 Calculate the required amount of Balling salts

AquaCalculator is a very flexible application.

For the following example, we use: *<Preferences> → <Ca,Alk,Mg adjustment>*

Ca/Alk/Mg adjustment

Ratg. Meerw.chemie (A.Glaser)

Concentration of stock solutions

☒ Recipe standard (recommend)

Calcium 800.0 [g/l]

Alkalinity 80.0 [g/l]

Magnesium 836.0 [g/l]

Salz NaCl frei 20.0 [g/l]

☐ Low consumption

Use maximum concentration.

Save

Then, switch back to the Home-Menu and choose *<Ca/Alk/Mg Supply>* and there *“I would like ...” <to set my desired values>*

Ca/Alk/Mg supply

Used preference:

Ca & Alkalinity: As needed (Standard)

Mg: MgCl₂ (100.0%)

Alk: NaHCO₃ (100.0%)

NaCl free salt: Yes

(Change this data under preferences)

I would like ...

to set my desired values

to determine my consumption

to compensate my consumption

to know what

- Enter your tank's measured water values (**green**)
- Define *targeted values*. Ca 440, Alkalinity 8.0 and Mg 1250 (**blue**)
- Tap **<at once>**

→ Aqua Calculator will show the recommended dosing of Balling salts

Ca/Alk/Mg set desired values ⓘ

Aquarium: My_Tank_1, Volume of water: 500 l
Speed of adjustment: 'Standard'
Ca: 10 [mg/l] per day
Alk: 1.0 [°dKH] per day
Mg: 20 [mg/l] per day
(Change this data under preferences)

350	440 [mg/l]
✓ Alkalinity	8.0 °dKH
✓ Magnesium	1250 [mg/l]

at once



Ca/Alk/Mg set desired values ⓘ

1 The following amount of aquarium water admit balling salts

Calcium → 9 days
per day 18.3 [g] $\text{CaCl}_2 \times 2\text{H}_2\text{O}$

Alkalinity → 3 days
per day 12.5 [g] NaHCO_3
and 0.0 [g] Na_2CO_3

Magnesium → 5 days
per day 83.6 [g] $\text{MgCl}_2 \times 6\text{H}_2\text{O}$
and 0.0 [g] $\text{MgSO}_4 \times 7\text{H}_2\text{O}$

2 [Compensate by adding the increased salt concentration](#)

>Balling salts directly (dry) or dissolved in water in a well-flow position and carry out directly on animals corals.

Addition of CaCl_2 and NaHCO_3 must be at least 15 minutes delayed

1.4 Adjusting water parameters Ca, Alkalinity and Mg

First of all we need three different so-called *Balling salts*.

With each one, you can raise the concentration of either Ca, Alk or Mg

$\text{CaCl}_2 * 2\text{H}_2\text{O}$	(CalciumChloride-DiHydrat)	* raises Ca-concentration
NaHCO_3	(NatriumHydrogencarbonate)	* raises Alkalinity
$\text{MgCl}_2 * 6 \text{H}_2\text{O}$	(MagnesiumChloride- Hexahydrat)	* raises Mg-concentration



You need exactly the salts specified, not any others.

Balling salts can be purchased quite cheap at your aquarium store.

Buying them in drug stores might be more expensive.

I do not recommend buying to cheap material, because of the risk of impurities.

You will need the identical salts also to mix liquid solutions from it to obtain your Ca, Alk, Mg concentration over weeks and months, thus it might be a good idea to purchase not too small an amount.



You can just raise, but not lower, concentrations by adding Balling salts.

Anyhow, there are two options to decrease concentration:

- Wait until concentration comes down by itself (usage within your tank) or
- Do a water change with a salt mixture which is lower concentrated for a particular macro element.



Add the amount of Balling salts being calculated day by day.



This is what you have to take care of:

- Use an accurate set of scales for weighing the required amount of Balling salts (this is of special importance for smaller tanks).
- You can add Balling salts to your tank's water without soluting them beforehand. If you like you can also put them in RO water and then add them.
- Balling salts should be added at a position with good current flow, best would be in the sump. Under no circumstances should you do so with direct/concentrated contact to any of your corals/animals.
- The two different Balling salts for raising Ca (CaCl_2) and Alkalinity (NaHCO_3) must not be added at one time, but with minimum of 15 minute's difference. Doing this any differently might result in precipitation and not raising values to the appropriate level.

1.5 Check water parameters again



Dose Balling salts as long as AquaCalculator told you.



Measure concentration of Ca, Mg and Alkalinity again.

Targeted concentration of Ca 420 mg/l, Mg 1250 mg/l and Alkalinity 8 °dH reached?

Yes: Very good, continue with chapter two

No: Check if you did everything and used the correct amount of Balling salts.

If one or more of the concentrations are too low, this might be because your tank has already a pretty nice consumption of Ca, Alk, Mg and thus also of the needed Balling salts.

* Continue dosing until optimum concentration is reached.

* If only one concentration is affected → raise only this value.

Eventually you even have to increase the dose per day because the usage of your tank is higher than what you dose for raising concentration.

Ca, Alkalinity or Mg cannot be adjusted in any way?

Maybe that is because one of the following reasons:

- Your water test kits show an incorrect result or you made a mistake using them (see instructions for use of test kits).
- Concentration of Magnesium is still too low to add Balling salts for Ca and Alkalinity. It has to be >1200mg/l once you start dosing the other Balling salts.
- One of the concentrations is too high and does not get lower just by waiting. Is there any ceramics or non-reef type material in your tank which might emit Ca/Alk/Mg?

2. Determining your tank's consumption

Our target is to adjust the dosage of Balling salts exactly so that it will match your tank's every-day consumption.

Thus we need to know your tank's consumption.

- ➡ Stop dosing Balling salts as well as dosing other elements that might raise Ca, Mg or Alkalinity.
- ➡ Do not do any water changes now.
- ➡ Measure concentrations of Ca, Mg and Alkalinity daily and always at the same time.

In this working step, we will check *how long your tank will need to reduce a certain amount of Ca/Alk/Mg* by its specific consumption.

I suggest to continue measuring as long as:

- Ca dropped by min. **20 mg/l**
- Alkalinity dropped by min. **1° dH**
- Mg dropped by min. **20 mg/l**

i
Ca/Alk/Mg supply

Used preference:

Ca & Alkalinity: As needed (Standard)

Mg: MgCl₂ (100.0%)

Alk: NaHCO₃ (100.0%)

NaCl free salt: Yes

(Change this data under preferences)

I would like ...

to set my
desired values

to determine my
consumption

to compensate my
consumption

to know what

i
Ca/Alk/Mg determine
consumption

Calcium

440

[mg/l]

Alkalinity/
Carb.hardn.

8

°dKH

Magnesium:

1250

[mg/l]

2 Values measured regularly

3 Note final values if
Ca >= 20mg/l, Mg >= 40mg/l and
alkalinity have fallen >= 2°dKH

	Days	Final value	Cons./Day
Calcium	3	420	6.7 [mg/l]
Alkalinity/ Carb.hardn.	2	7	0.5 °dKH
Magnesium:	20	1230	1.0 [mg/l]

Save consumption

What you need (green) is

- your *measured values* (especially your first and last value) as well as the
- *time needed* in days to reach this specific consumption.

This normally takes a different amount of time for each of the three measured values, because consumption is different. Normally KH drops fastest, Mg slowest.

If you see that one value is going down very slowly, there is no need to measure it every day.

- Then, tap "*Save consumption*"



By determining your tank's consumption, your water values are again in a non-optimal range.
For this reason * adjust your values again.

This means, you have to repeat steps in chapters 1.4 and 1.5.

Ca, Alk, Mg should be at optimum concentrations **again** now.



3. Mixing the liquid solutions

What we *could* do now, is dose the daily consumption in the form of directly adding the (dry) Balling salts to your tank each day. This will work without any doubt.

But it is not very convenient weighing the amount of the three Balling salts for each day. It is also not very convenient to dose the Balling salts per hand each day for a longer period of time. Also, there needs to be a pause between dosing the Balling salts for raising Ca and Alkalinity each day.



My suggestion is to mix so-called liquid solutions from the respective Balling salts and RO water. As the next step we will automate dosing the liquid solutions by a dosing pump and thus using the following advantages:

- Weighing of the Balling salts can be done for several weeks in one working step.
- Liquid solutions are much easier to dose than pulverulent Balling salts.



3.1 Important information for mixing liquid solutions

(to avoid existing confusion)

- ✓ It is not “the Balling liquid solutions” - there are different ones possible.
- ✓ In the end, it is only important to “dose the correct amount of Balling salts” each day. How much water you used to solve the salts is basically irrelevant.
- ✓ But it is extremely important to “know about the concentration of the liquid solutions used”. Not knowing this means also not knowing which amount (eg millilitre) you have to dose to for a “defined raise in Ca, Alk, Mg”.
- ✓ It would be nice to mix each liquid solution in a way that you solute *as much salt as possible*, because it would last for a long time.
But the amount of Balling salts is limited to a certain saturation limit (max. saturation), which restricts the amount of salt than can be used. If you exceed this limit, you will get precipitations in your liquid solution, meaning that you might dose less Balling salts than you want.





Maximum saturation of the different Balling salts is strictly different from each other.

Example:	$\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$	986 Gram mixed to 1 liter.
	NaCl-free salt	only 20 - 25 Gram mixed to 1 liter

Recipes suggested in AquaCalculator are slightly below maximum saturation, to avoid precipitation if weighed not too accurately.

3.2 Designation of containers

To avoid any possible confusion with the liquid solutions, it is strongly recommended to add a simple designation to the containers. Parallel to AquaCalculator we will name them as following:

Content	Adaptation of	Designation
RO-water *1) + $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$	C alcium	
RO-water *1) + NaHCO_3	A lkalinity	
RO-water *1) + $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$	M agnesium	
RO-water *1) + NaCl-free salt	-	

If you don't use standard Balling salts, but products such as Balling Light, the content description can change.



It is recommended to use RO water, distilled water or water from a purification unit. Using tap water you risk bringing in impurities (nutrients, copper, silicates) or precipitation.



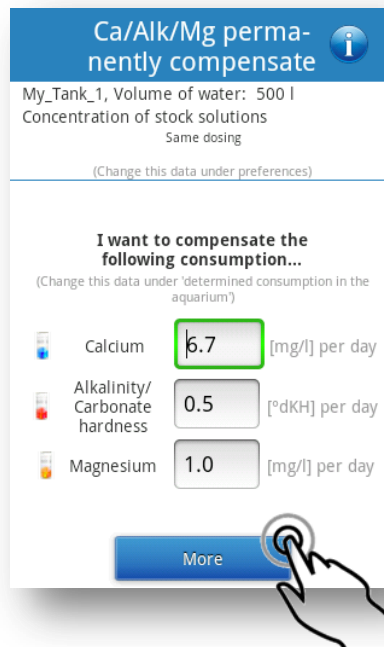
It is not possible to mix two or more of the Balling salts to only one liquid solution (with the plan of saving dosing pumps).

Besides the missing possibility to adapt Ca, Alk, Mg separately, you might also step over the maximum possible saturation. Even more, this will lead to precipitation effects (eg NaHCO_3 vs. $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$)

3.4 Mixing your liquid solutions

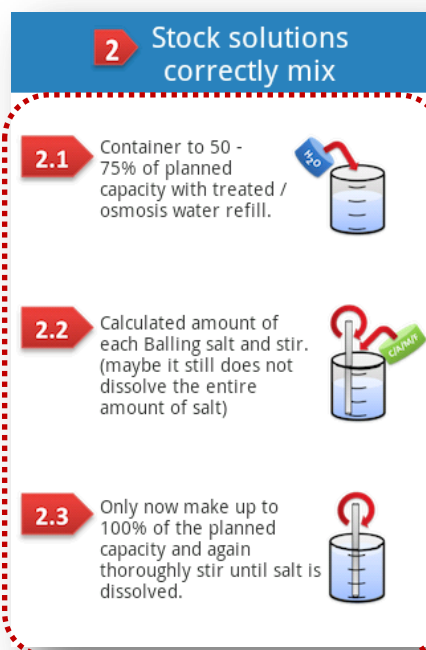
After learning a lot of theory, we will now mix our liquid solutions.

- ➡ Switch to MainMenu and tap ***I would like ... <to compensate my consumption>***
(You will notice that our consumption is already available)



First we need to know, the required quantity of salts we need AND how long the containers will last (We should have bigger containers for the liquid solutions with higher demand).

- ➡ Enter your “planned” container sizes for the liquid solutions (green)
- ➡ Tap the Info button (blue) You will see IMPORTANT info on how to mix the standard solutions that you should follow strictly (red).



Ca/Alk/Mg permanently compensate

4 Compensate salt concentration

Calcium

container 1000 ml → 15 ml per day
 + $\text{CaCl}_2 \times 2\text{H}_2\text{O}$: 800.0 [g]

Alkalinity/Carbonate hardness

container 1000 ml → 93 ml per day
 + $\text{NaHCO}_3 \times 2\text{H}_2\text{O}$: 80.0 [g]

Magnesium

container 1000 ml → 5 ml per day
 + $\text{MgCl}_2 \times 6\text{H}_2\text{O}$: 836.0 [g]

NaCl free salt

container 1000 ml → 112 ml per day
 + salt NaCl free: 20.0 [g]

➡ The black text (green rectangles) tells you which amount of Balling salts are needed for your containers ...depending on the container size you specified

➡ The blue text (blue rectangles) tells you which amount of your liquid solutions have to be dosed daily ...to adapt your tank's specific demands

Tips: Containers with big openings are best, because it is easier to pour in the Balling salts. Containers should have a closing cap to avoid evaporation.



- Salts are added to the water, never the other way round

Correct: pour in water first, then mix in salt



- Only using the described three-step method gets you the correct volume of your liquid solution and thus also correct concentration

Correct: Fill up calculated amount of Balling salts
 with water to reach the targeted container filling volume.

Wrong: Add the calculated amount of Balling salts to the amount of
 water that matches your container filling volume.

- Some Balling salts warm up the water after mixing in (eg. $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$).
 Higher concentrated liquid solutions = Higher temperature.
- You are not able to solute the calculated amount of Balling salt?
 - a) Eventually you used "not enough RO water" or "too much Balling salt".
 * Check your weight and/or water volume in a measurement device.
 - b) Use another Balling salt than being asked
 (eg: waterfree Calciumchloride or Calciumoxide instead of $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$).
- Sediments in liquid solution containers
 * are normally uncritical. Remove if mixing the next liquid solution.

3.5 Dosing designation for your containers

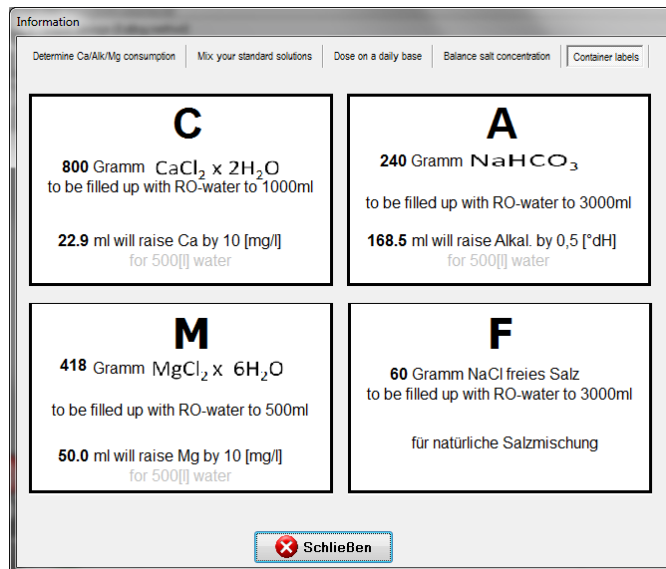
I recommend adding a detailed label to each container for the liquid solutions:

Reduced risk of using wrong container

- Data for refill of liquid solution immediately available
- Hint how much liquid solution is to be dosed for an additional (manual) one-time adaptation.

(screenshot below is just an example.

You have to use your specific liquid solutions data for your container designation)

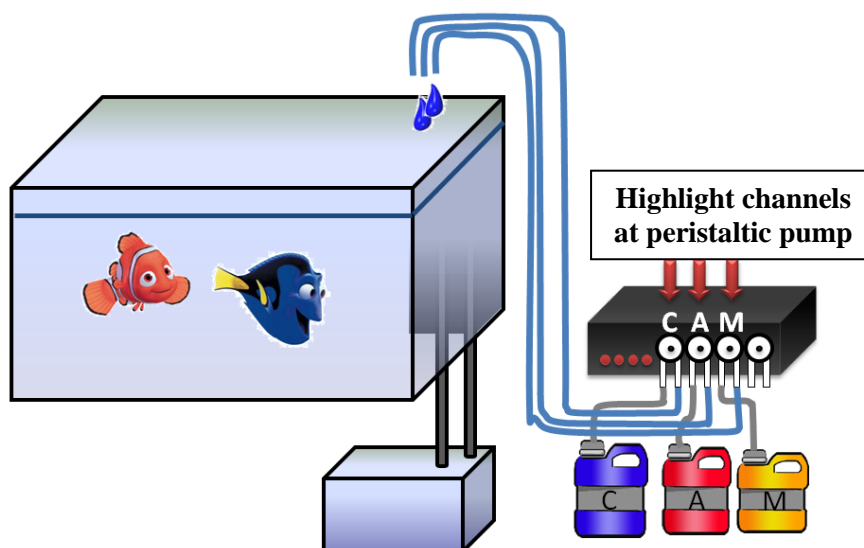


4. Dosing liquid solutions

4.1 Installing peristaltic pumps correctly

Look for the best place to establish your peristaltic pump as well as the containers for the liquid solutions. To avoid problems in case of defects or leakage, you should install as following:

- ✓ Containers with liquid solutions should be below the water level of the tank where they will be dosed. (Avoid unwanted leakage of liquid solution)
- ✓ Hoses coming from peristaltic pump should “drop into” the tank’s water and not “reach into” the tank. (Avoid unwanted leakage of tank’s water)



- ➡ Highlight the channels of your peristaltic pump with letters C, A, M, (F)
- ➡ Install all hoses tightly. (Also check them regularly for possible clogging)
- ➡ Add cap/covers to your containers to avoid evaporation.
Drill holes through cap/cover. This is where your hoses will run through.
Hint: Closed containers should not be as tight that pumping of liquid solutions create a vacuum.
- ➡ Adjust your dosing pump’s channels according to AquaCalculator’s dosing recommendations. See manufacturer’s instructions of use for this working step.

Tips: Best time for dosing is before the tank’s lighting starts. At this time ph value is lowest, thus having the lowest risk of precipitation. Adjust pump to dose different liquid solutions with a difference of 15 to 30 minutes. If your dosing pump also splits the doses over several portions, this is even better for your animals.



Once container content is used up, dispose of the rest first and then fill up from scratch.

4.2 Balancing the raise of salinity

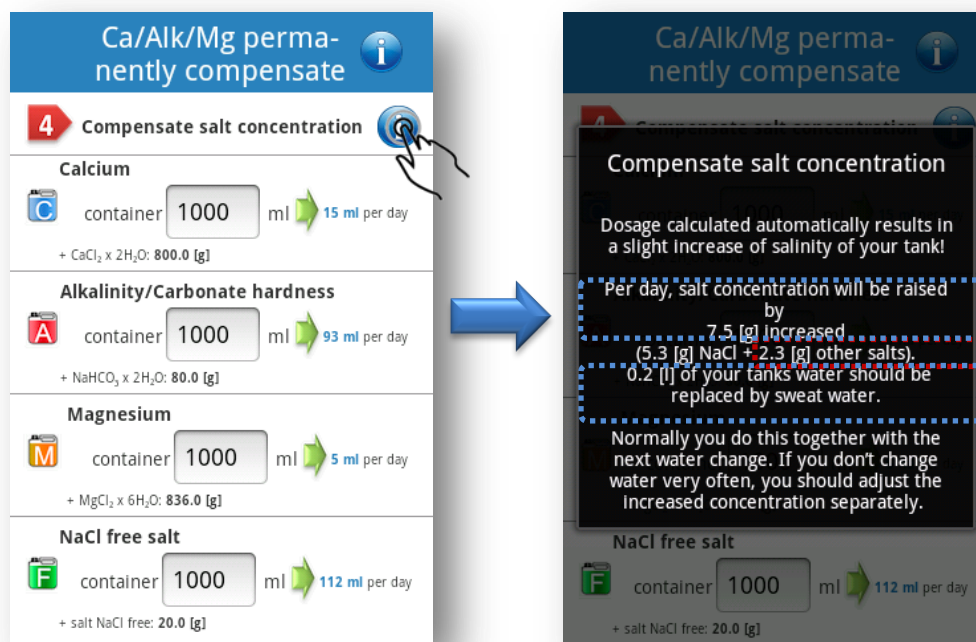
By adding Ballingsalts, we added salts (eg also sodium chloride) which will automatically raise salinity for a certain amount. If we continue without any countermeasures salinity will raise more and more over the time.

Thus we need to know **how much is salinity raised** by our specific dosing of Ballingsalts?

Natural sea water is a mix of 70% pure NaCl (sodium chloride) and 30% other salts (like Strontium, potassium, iron, fluorine, silicon, sulphur, manganese, aluminium, zinc, antimony, barium, bromine, germanium, gallium, ...). One option to add the restly 30% “other salts” is to use “NaCl free salt mixture” available in aquaristic stores. (another option is to do so by adding trace elements). If you are missing the fourth dosing pump channel, this salt can also be added manually.

In this case we also need to know **how much NaCl free salt** needs to be added to get a balance (ionic balance) to 70%/30% as in natural sea water (amount of dry salt).

➡ Click the Info-Button right to „Compensate salt concentration“



The image shows two screenshots of a software interface for dosing aquarium salts. The left screenshot shows the 'Ca/Alk/Mg permanently compensate' screen with four sections: Calcium, Alkalinity/Carbonate hardness, Magnesium, and NaCl free salt. Each section has a container size of 1000 ml and a dosing rate per day. The 'Compensate salt concentration' section is highlighted with a red box and a hand icon pointing to the info button (i). A blue arrow points from the left screen to the right screen, which shows the resulting salinity increase.

Parameter	Container (ml)	Dosing Rate (ml/day)	Chemical Formula	Weight (g)
Calcium	1000	15	$\text{CaCl}_2 \times 2\text{H}_2\text{O}$	800.0
Alkalinity/Carbonate hardness	1000	93	$\text{NaHCO}_3 \times 2\text{H}_2\text{O}$	80.0
Magnesium	1000	5	$\text{MgCl}_2 \times 6\text{H}_2\text{O}$	836.0
NaCl free salt	1000	112	salt NaCl free	20.0

Compensate salt concentration

Dosage calculated automatically results in a slight increase of salinity of your tank!

Per day, salt concentration will be raised by **7.5 [g]** increased (5.3 [g] NaCl + 2.3 [g] other salts). 0.2 [l] of your tanks water should be replaced by sweat water.

Normally you do this together with the next water change. If you don't change water very often, you should adjust the increased concentration separately.

NaCl free salt

Parameter	Container (ml)	Dosing Rate (ml/day)	Chemical Formula	Weight (g)
NaCl free salt	1000	112	salt NaCl free	20.0

In the given example and assuming that the last water change was two weeks before (meaning before **14 days**), you should act as following:

- **Dose less** of your sea salt mixture according to “**substitute salt**“ at your next water change

$$14 \text{ days} \times 7,5 \text{ Gramm} = \sim 105 \text{ Gramm}$$

* instead of dosing less sea salt mixture at the next water change, your other option to balance salinity accordingly is to replace 0,2l of salt water by fresh water each day

- **Add NaCl-free salt** daily (**2,3 Gramm**), or also together with your next water change

$$14 \text{ days} \times 2,3 \text{ Gramm} = \sim 32 \text{ Gramm}$$

5. Readjustment in case of changing consumption



Your tank's Ca, Alk, Mg should now be stable for a longer period of time, but your tank's consumption can change again in case of:

- Adding new corals or other livestock
- Your tank changes consumption by other reasons
Hint: Pretty often, especially in tanks with lots of SPS, you will see better growth of your corals, thus your consumption will raise.

Measure Ca, Alkalinity and Mg on a regular basis. If values are constant and no new corals are added, you can have longer intervals between your measurements.

In case you see a drop (or increase) of one of the values you should react by adding the correct Balling salts.

You know how to do everything right now, but just a quick recap:

- Parameters Ca, Alkalinity and Mg can and should be adjusted separately from each other.
- **Raising** of the values is done by **adding** the appropriate Balling salts.

Reducing of the values can be done either by **waiting**, or **water changes** with a salt mixture having a low concentration of the elements you want to reduce.

- Once values are adjusted from optimum, first **readjust the amount of dosage** at your **dosing pump**. (Separate for each channel/liquid solution).

If **consumption has dropped**

* **Reduce** amount per day

If **consumption has raised**

* **Raise** amount per day

* use AquaCalculator's module <Balance Ca, Alk, Mg steadily> again

Hint: This time we already have liquid solutions available. We can use them to raise values instead of weighing in and using the dry salts. Use a syringe with an attached thin hose to get a certain amount of liquid solution from its container. The container label tells you how much you need.

Raise the values of your tank – but again not too fast. Rule of thumb is not more than:

Calcium	20	[mg/l]
Alkalinity	2	[°dH]
Magnesium	30	[mg/l]

per day

Also: CaCl_2 and NaHCO_3 have to be dosed with a minimum 15-minute's break to avoid precipitations.

6. Frequently asked questions (FAQ)

6.1 What is “ionic balance” and what do I have to regard?

We are using industrial-available chemicals to raise the parameters Ca, Alkalinity and Magnesium, which we call Baling salts. Besides the desired elements (Ca, Mg, Carbonate) they also contain unwanted elements (Na, Cl, SO₄...).

Within our tanks these elements react as chemical compounds. Besides the desired effect of raising Calcium (Ca), Magnesium (Mg) and Alkalinity (Carbonate), the unwanted elements will remain in our tanks.

Most interesting are these Baling salts:

- CaCl₂ * 2H₂O
- NaHCO₃
- MgCl₂ * 6H₂O

- Ca and carbonates are consumed by corals
- Some additional “water” (H₂O) is added to the tank
- Na and Cl will remain (marked red above)
 - * NaCl is “sodium chloride” also known as “table salt” * is added to the salt water

- Only a part of natural salt-water salt (70%) is NaCl.

There are 30% of “other salts” in sea water

- Adding different amounts of the three different Baling salts can formulate stoichiometric “not totally balanced” chemical compounds
(some formulas might be not fully balanced).

These effects are described as “ionic balance”

The AquaCalculator is automatically calculating the added amount of NaCl by Baling salts dosed, in a stoichiometric exact way.

One possible way to ionic balance is to dose an NaCl-free salt mixture. If dosed, the amount of arising NaCl is extended to the 70/30% mix, which is also in natural sea water.

NaCl-free salt is a mixture from the other ingredients (besides NaCl) of natural sea water and is only available in aquatic stores. Price per Kilo is \$20US, which is quite expensive. Anyhow, you need just small amounts of this salt mixture.

6.2 Should I dose trace elements with my Balling salts/liquid solutions?

Dosing trace elements is another way to compensate the consumption of NaCl-free salts by corals.

Most owners of SPS tanks rely on trace elements to get maximum coral growth and colour.

Also, trace element solutions are made out of several elements available in natural sea water (besides Ca, Mg and carbonates). Most manufacturers have two or three different trace element complexes that have to be dosed together.

It is strictly recommended to dose according to manufacturers suggestions, because exact concentrations are normally not given out.

What I like most is trace elements that are added directly to the Balling liquid solutions. Thus you need not dose them separately (but together with the liquid solutions C, A, M) and, even more importantly, they are automatically dosed in the correct amount in relation to Ca, Mg and Alk consumption.

This also reduces the risk of overdosing trace elements.

6.3 Which Balling salts should I buy?

First of all you might think this is only a price question, but “cheap” Balling salts are often less straight – meaning that they include more “unwanted/other” elements.

Using lots of impure salts over a longer time period might act like a time bomb (eg by adding heavy metals or sulfur steadily to your tank). I suggest relying on Balling salts from manufacturers that guarantee you very good purity and quality only.

There are also “special Balling-salt-mixtures” which are a mix of different salts, partially with added additional organic material. Possible advantages might be better pH-buffering or others. The most known of these products is Fauna Marin’s “Balling Light Balling salts”, but also special balling products from Tropic Marin and RedSea.

The AquaCalculator can calculate with these salt mixes as long as the ingredients/recipes are made known to me. To prevent manufacturers know-how, recipe concentration is hidden and, instead of the chemical formula of a standard Balling salt, the special salt mixes “product name” is shown.

(At the moment only Fauna Marin’s “Balling Light” special salt mixes are integrated. Other special Balling salts can be added on manufacturers’ demand, as I can only do that once I have the required information from the manufacturers)

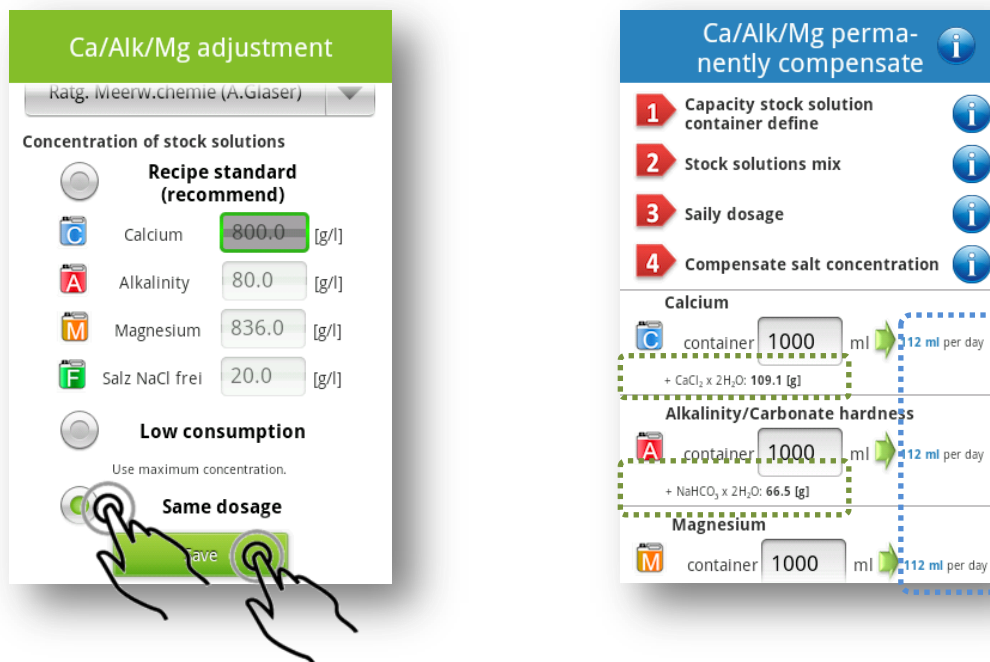
6.4 I can't control my dosing pump's channels separately, only all together. Can I carry out consumption-orientated dosing?

This is a special case. You have to define and mix your liquid solutions in a way that the same amount of each liquid solution can be dosed.

You have to know the specific consumption of Ca, Mg and Alk before mixing the liquid solutions.

Then you tell the AquaCalculator to calculate your special liquid solutions.

<Settings> * <Ca/Alk/Mg adjustment > -> "same dosage"



- Take care that your standard solutions now have different concentrations (green)
- Amount for dosing per day is now equal (blue)

i As a side effect of this, if consumption of your tank changes, you have to recalculate and mix new liquid solutions. The amounts to be dosed will also change.

6.5 My consumption of liquid solutions is very high. Can I use higher concentrated ones?

Yes you can, as long as you respect the maximum possible saturation of the different Balling salts in water.

Let AquaCalculator determine the highest feasible concentration without exceeding the borderline of maximum saturation of Balling salts within the liquid solutions.

Ca/Alk/Mg adjustment

Ratg. Meerw.chemie (A.Glaser)

Concentration of stock solutions

☒ **Recipe standard (recommend)**

☐ **Low consumption**
Use maximum concentration.

Calcium 800.0 [g/l]

Alkalinity 80.0 [g/l]

Magnesium 836.0 [g/l]

Salz NaCl frei 20.0 [g/l]

Save

i You should measure/weigh in amount of RO water and Balling salts very accurately if using these settings to avoid possible precipitations in your liquid solution containers.

6.6 The Balling recipe I'm using is not included in the AquaCalculator's recipe selection. Can I use it anyway?

Yes, select <Settings> < *I will define my recipe* >

The image shows two side-by-side screenshots of the AquaCalculator's 'Ca/Alk/Mg adjustment' settings screen. The left screenshot shows the 'Exploiting the saturation limit' section with a note 'depends on consumption in the aquarium (saturation limit is variable/N.A.)'. It has two radio buttons: 'Consumption oriented (Standard)' (selected) and 'Always in good balance'. Below is a checked checkbox for 'NaCl free salt dose' and a slider for 'Increase Alkalinity' set to 100% NaHCO₃. The right screenshot shows the 'NaCl free salt dose' section with a checked checkbox. Below is a slider for 'Increase Alkalinity' set to 100% NaHCO₃. Further down is a slider for 'Increase magnesium' set to 100% MgCl₂. At the bottom is a section 'Adding of Trace Elements to Liquid dosage' with a text input field and a 'Save' button.

Now you can define all possible recipe settings by yourself

1) Options for setting the Balling recipe itself

- Should the ratio between raising Calcium vs. Alkalinity be
 - a) *according your tank's specific consumption* of Ca vs Alkalinity separately (recommended), or
 - b) *in always the same and stoichiometric balanced ratio* (according HW Balling's initial recipe)
- Should "only one" or "both" available salts for raising Alkalinity be used and in which ratio
- Should "only one" or "both" available salts for raising Magnesium be used and in which ratio
- Add NaCl-free salt? Yes or No?

2) Options for liquid solutions

- Which amount of the Balling salts should be used for mixing exactly one litre of liquid solution (might be also the mixture of two salts for Alkalinity and Mg)

3.) Options to add liquid trace elements to the liquid Balling solutions

Up to three different trace element solutions can be added to the liquid solutions
(In case you don't want to add any trace elements, just leave edit fields empty)

- Define designation/name of the trace element solution you plan to use
Which of the three containers (C,A,M,F) should it be added to?
- Amount of trace element solution to be added per litre of liquid solution

It is recommended to use the manufacturer's dosing suggestions for trace elements.

6.7 Where do I find the former recipe with MgCl_2 and MgSO_4 ?

Selecting the recipe is much easier and much more flexible than it was in earlier versions of the AquaCalculator.

- Either you use a recipe that already uses a mix from $\text{MgCl}_2/\text{MgSO}_4$ (eg The recipe of distributor “AquaFair”) or
- you define a recipe on your own (see 6.5)

6.8 One of my values does not drop over a period of weeks. Should I dose the according Balling salt anyway?

No, you should NOT dose the Balling salt for a period of time, because it would raise this value to an unwanted (high) level.



This is pretty often the case for Magnesium concentration.

6. Shopping list



Description	Designation, comment, where can I buy this?	average price
Measurement unit to measure salinity	Recommendation: - Big areometer and temperature measurement or - Refractometer (use psu display only.) Aquarist stores and aquarist online shops	Starting with 30€
Water measurement test kits: - Calcium - Alkalinity - Magnesium	Use only high-quality test kits and only test kits that are designed for measuring salt water Aquarist stores and aquarist online shops	together 40€
“Standard solutions” to calibrate your test kits for Ca, Alk and Mg	Aquarist stores and aquarist online shops	together 20€
Balling salt $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ <i>CalciumChlorid-DiHydrate</i>	Option: use special Balling salt mixes like Fauna Marin’s Balling Light salts Aquarist stores, aquarist online shops and also drugstores and pharmacies (might be more expensive here)	5€/kg
Balling salt $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ <i>MagnesiumChlorid Hexahydrate</i>		5€/kg
Balling salt NaHCO_3 <i>Natrium Hydrogen-Carbonate (Soda)</i>		5€/kg
NaCl-free salt mixture	Available products: - Tropic Marin <i>Pro Special Mineral</i> , - Fauna Marin <i>Mineralsalz</i> - Aqua Terrashop <i>Cheap Mineralsalz</i> - Grotech <i>Mineral Pro</i> - Preis <i>Mineralsalz</i> Aquarist stores and aquarist online shops	15€/kg
Scales for weighing in Balling salts	Especially for smaller tanks you need an accurate set of scales available in lots of shops	30€
3 to 4 containers	- size depending on consumption - big opening, closed by cap - should be food-safe quality	1-10€ each
Funnel to bottle Balling salts into containers	Pipe diameter as big as possible to fit in your containers openings	5€
3 to 4 syringes - for manually dosing liquid solutions - Attach tube to exhaust from containers	Recommended size 50ml Available in pharmacies, drugstores	5€
Dosing pump (peristaltic pumps)	Recommended models - Grotech TEC III NG (3 channels, expandable to 11) - GHL Dosing unit 3 pumps - GHL Dosing unit 4 pumps - Aqua Medic Reef doser triple (3 channels) - Aqua Medic Reef doser Quadro (4 channels) - IKS Vario 4Pro (4 channels, needs also IKS Computer) Aquarist stores and aquarist online shops Prices given have been checked 2010 (partially below manufacturers MSRP)	360€ 250€ 300€ 260€ 330€ 300€

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Credits / List of sources and references

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Author Android Version of AquaCalculator

Gary Chappell

English translation support

Armin Glaser

Ratgeber Meerwasserchemie,
Rüdiger Latka Verlag, ISBN-13: 9783981057027

Hans-Werner Balling

Article: Die Balling Methode – Eine nicht mehr ganz neue
Methode der Calciumhydrogencarbonat Zufuhr für Riffaquarien
from professional journal „Koralle“

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