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Water quality and drinking water medication

Introduction

This is the second of a series of articles on how to optimize water medication. In order to be successful with water medication you need good water quality, a proper drinking water system and products that have the right formulation. The focus in this article is on water quality.

Water quality

In order to keep the animals healthy and achieve good performance results, drinking water should be safe and without abnormal taste. In other words, water should be of good bacteriological and chemical quality.

Table 1 shows a summary of the criteria for drinking water for pigs and poultry. Water is “not fit for animal consumption” if one or more parameters are “abnormal” or if three or more parameters are between “good” and “abnormal”.

Note: the values in the 'good' column can be considered safe for the animal species concerned. The values in the column 'abnormal' are considered (seriously) risky for the animal species concerned.

parameter	pig		poultry	
	good	abnormal	good	abnormal
pH	5 tot 8	<4 & >9	5 tot 8	<4 & >9
ammonium (mg/L)	< 1	> 2	< 1	> 2
nitrite (mg/L)	< 0,1	> 1,0	< 0,1	> 1,0
nitrate (mg/L)	< 100	> 200	< 100	> 200
chloride (mg/L)	< 250	> 2000	< 200	> 300
sodium(Na) (mg/L)	< 400	> 800	< 100	> 200 (y) > 400 (o)
iron (mg/L)	< 0,5	> 10	< 0,5	> 2,5
manganes (mg/L)	< 1	> 2	< 0,5	> 1,0
sulfate (mg/L)	< 100	> 250	< 100	> 250
hardness(° D)	> 4 & < 15	> 25	> 4 & < 15	> 20
yeasts and fungi		> 10.000		> 10.000
E. coli (kve/mL)	< 10	> 100	< 1	> 100
total plate count (kve/mL)	< 10.000	> 100.000	max 10.000	> 10.000

Explanation parameter sodium for poultry: y: laying poultry younger than 20 weeks and meat poultry and o: laying poultry older than 20 weeks.

[https://www.gddiergezondheid.nl/nl/Diergezondheid/Management/Drinkwater/Referentiewaarden-veedrinkwaterkwaliteitSource:%20GD%20Animal%20Health%20\(Netherlands\)](https://www.gddiergezondheid.nl/nl/Diergezondheid/Management/Drinkwater/Referentiewaarden-veedrinkwaterkwaliteitSource:%20GD%20Animal%20Health%20(Netherlands))

Table 1 Criteria for drinking water for pigs and poultry

Water quality should be monitored regularly. Table 2 shows some general recommendations on the frequency, parameters and locations of the samplings for different water sources. To get a complete

picture of the water quality on a farm it makes sense to include in the samples high risk areas like header tanks, the sick bay (low flow rates!) and the last nipple in any compartment.

	Frequency	Where	
Chemical test	new well: at least 4x/yr stable well: at least 1x/yr	right after purification	not needed
Bacteriological test	at least 2x/yr	right after purification	not needed
		header tanks	header tanks
		where the animals drink	where the animals drink

Table 2 Monitoring protocol for drinking water in farms

Main parameters

The most important parameters in Table 1 are:

- Total number of bacteria and coliform bacteria per ml.

High bacterial counts (especially coliform bacteria) can cause disease in animals. They can also indicate the presence of biofilm, a slimy layer like tooth plaque created by micro-organisms on the inside of the pipes.

- Hardness

This is the sum of calcium and magnesium usually expressed in German hardness degrees (°D). Hard water has a number of risks.

It causes scaling, a deposit of limestone in the pipes, which will reduce flow rates and eventually water intake. The rough limestone surface also promotes the formation of biofilm. Thirdly, very hard water (>25 °D) has a bad taste. And finally calcium and magnesium can form complexes with some medications (e.g. tetracyclines).

- pH

Drinking water should have a pH between 5 and 8,5. Abnormal pH values will reduce water intake because animals do not like the taste. Also some antimicrobials require a narrow pH range to be soluble and stable.

- Iron

Iron occurs naturally in water but the concentration varies with geographical location and depth of the source. High concentrations are quite common and potential issues are diverse:

-concentrations over 2.5 mg/l can lead to deposits that clog drinking nipples.

-iron concentrations above 5 mg/l make the water unsuitable for administering medication because the iron binds to some actives (e.g. tetracyclines).

-over 10 mg/l the animals will drink less because of the bad taste

-and iron concentrations over 30 mg/l can cause diarrhea.

- Manganese

Water with manganese levels above 2.0 mg/l can corrode pipes (even if stainless steel!) and form black granular deposits due to a reaction with oxygen in the water. Finally, manganese also gives a bad taste and smell to the water.

If the quality of the water on a farm is suboptimal you have to identify the root cause. Problems with water quality can originate from:

1. The source
2. The water purification installation
3. The design and maintenance of the drinking water system.

Source of the water

Water from the water company is of good and constant quality as it complies with standards for human consumption. Still problems can occur, for example when ingredients (Ca, Mg, Fe) form complexes with water medication products.

The quality of well water depends on the location and depth of the source. It is advised to check the quality at least 4 times a year because the well can get contaminated or the composition of the water can change over time.

Water purification

If a farm uses well water, most of the time a purification system is needed. The type of system is determined by the parameters that need to be improved:

- Ion exchangers based on saline can be used to eliminate calcium and magnesium. A disadvantage is that the salt content of the water will increase. If the water becomes too soft it will be corrosive and will damage the pipes!
- Aeration installations use oxidation (exposure to air) and filtration to reduce iron and manganese levels.
- Reverse osmosis presses water through a semi-permeable membrane leaving all ions and microorganisms behind. It is very expensive and it is questionable whether water without any minerals is suitable as drinking water.

NOTE: Have the purification installation inspected by a specialist at least once every year.

Drinking water system

Sometimes problems in water quality originate from the water system, for example iron from rusty pipes or bacterial growth in dead ends. To ensure sufficient supply of drinking water and correct

administration of medication a drinking water system should be properly designed, installed and maintained. This will be the topic of the next article.

Summary

Water medication is relatively easy and has major advantages as long as it is carried out in a proper manner. In order to be successful with water medication you need good water quality, a suitable drinking water system and products that have the right formulation. Investing time and money in these requirements is part of Good Farming Practice and will pay off in terms of animal performance and health.