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Campifarma

Drinking water : Systems & Quality

March 13th 2015
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Drinking water

1. Importance of drinking water hygiene
2. Risk of pollution
3. Lay-out of the drinking water system
4. How to prevent and solve water hygiene issues?



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Water as main nutrient

- **Pigs drink much more than they eat**
- **Drinking water should be:**
 - **Tasteful**
 - **Available**
 - **Safe for animals**
 - **Safe for animal products: meat.**
- **Heat stress, drink to cool body**
- **During illness lower feed intake, but keep drinking!**



Consequences of compromising on water requirements

- **Lower water intake**
 - **Lower feed intake**
 - **Lower health status**
 - **Lower technical performance**
- **Blockage, damaged equipment and pressure loss**
- **Continuous challenges on immune system**
- **Less energy spent for growth or reproduction**
- **More intestinal health issues**
- **Reduced effect of medication and supplements**
- **Lower use of antibiotics**

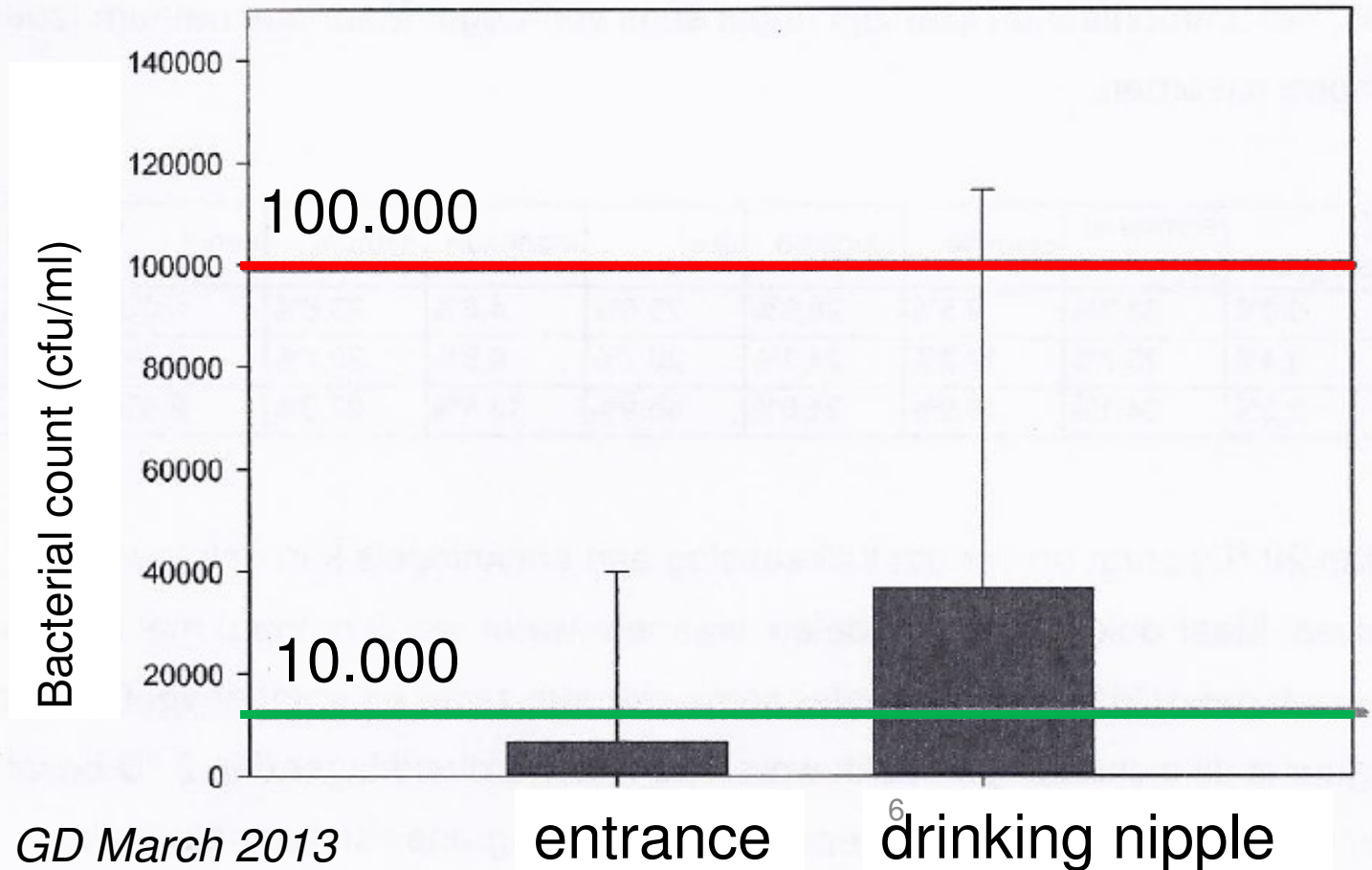
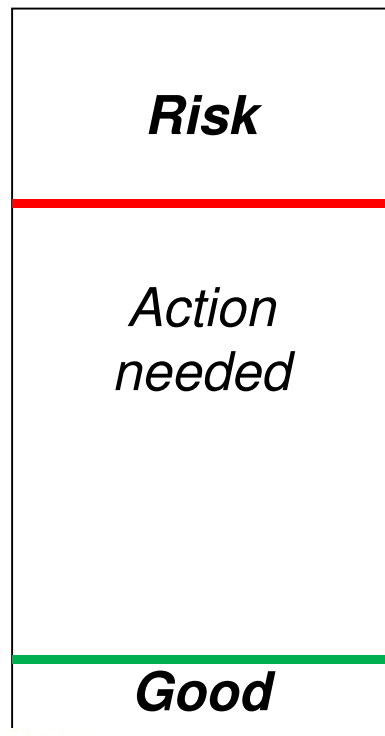
Water requirements

- What do you prefer?

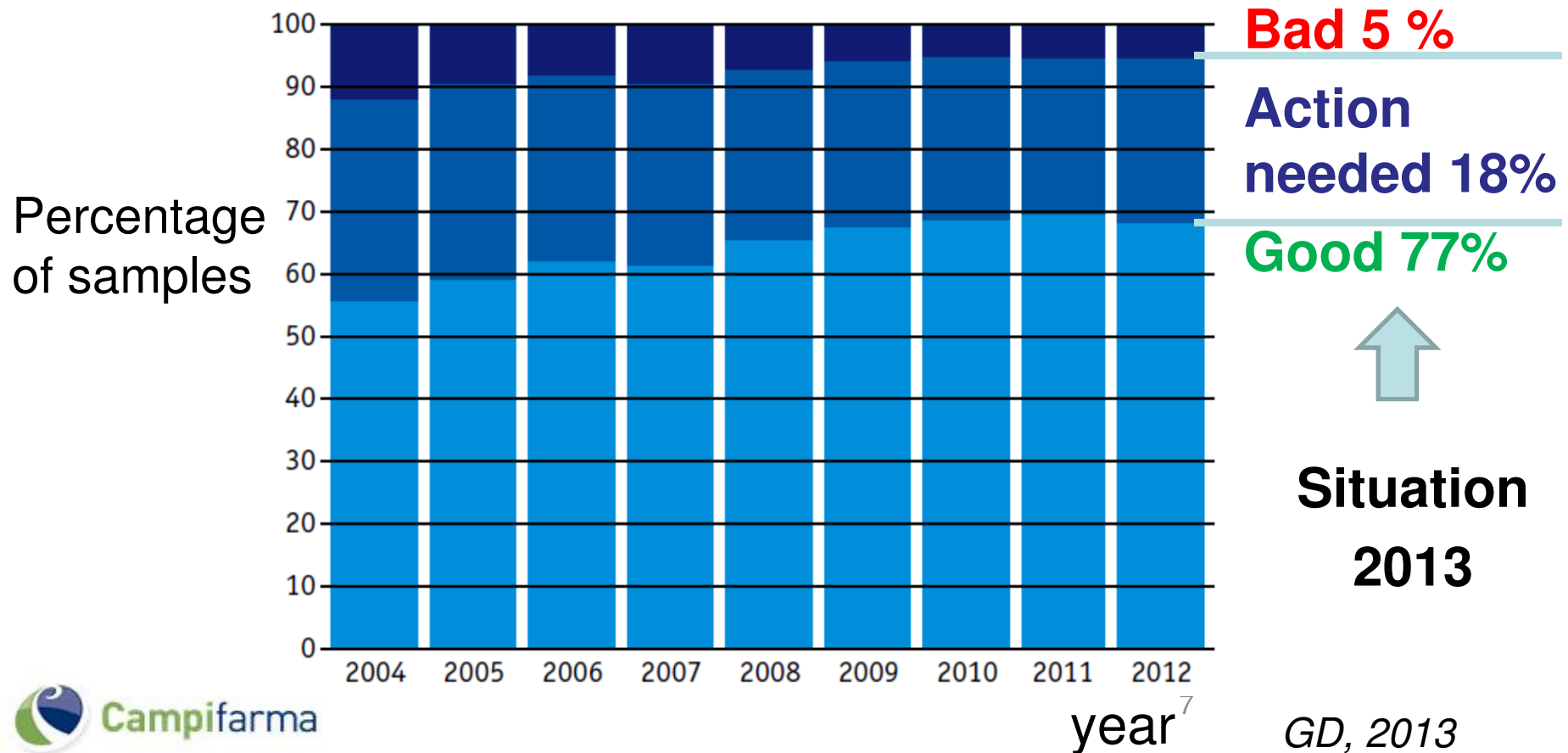


Water quality – entrance vs nipple

Bacterial pollution in water at house entrance versus water at drinking site (nipple)



Big concerns about water quality at drinking point



What is drinking water hygiene?

Managing quality of the water:

- **Chemical**

- iron, manganese, ammonium
- pH, hardness

- **Microbial**

- Bacteria, yeast, mould



**Drinking water that doesn't meet requirements =
risk for animals!**

Standards for chemical quality

Element	mg / litre
Hardness (Ca&Mg), dH	< 20
pH	< 8,5
Iron, Fe	< 0,5
Manganese, Mn	< 1
Nitrite, NO ₂	< 0,1
Nitrate, NO ₃	< 100
Chloride, Cl	< 250
Sodium, Na	< 400
Sulfate, SO ₄	< 150
Hydrogen Sulfide, H ₂ S	0

Reference:
GD in IKB 2015;
“Drinking water
standards for
pigs”

Chemical quality – dH & pH

- **General hardness:**
 - 6-12° D = target
 - > 20° D = action needed
- **Temporary hardness**
 - > 350 ppm CaCO_3 = action needed
- **High pH limits effect of products in water**
 - pH > 8.0, decreased efficacy of vaccines and antibiotics
 - pH > 7.0, dramatically decrease in activity of chlorine



Chemical quality – Fe & Mn

Iron > 2.5 mg/litre

- Sediment Fe and Mn: blockage
- Bad flavour: decreased water intake
- Visual inspection could be misleading
 - After contact O₂ : 1-2 hours

Manganese > 0.05 mg/litre

- Dark slimy sedimentation
- Visual inspection could be misleading
 - After contact O₂ : 10-20 hours



Chemical quality - Ammonia

Chemical and Microbiological pollution

Ammonia in water indicator for bacterial pollution

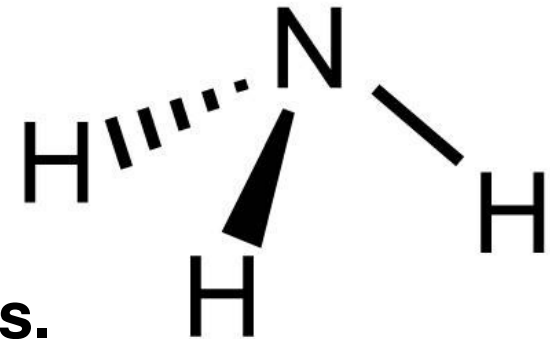
= link between chemical and microbial parameters

(WHO 2003 - Ammonia in drinking-water)

**In ditch-water bacteria can transform
Ammonia into nitrite (NO₂)**

Nitrite is toxic and lead to mortality in pigs.

- dead ends in system
- part of system not in use
- Header tanks



(GD 2013)



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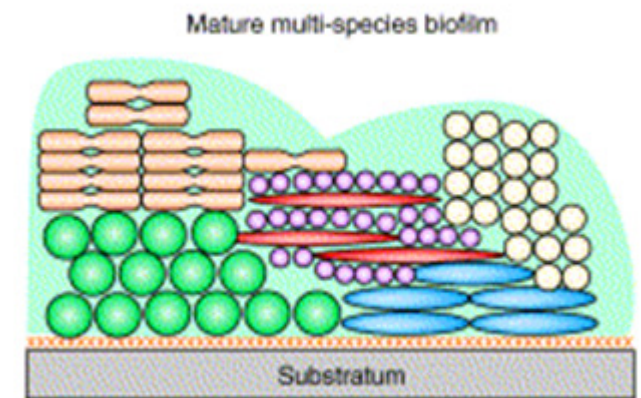
Microbiological quality



TBC	CFU/ml	< 10.000	10.000-100.000	>100.00
	Action	Accepted	Find out about cause of pollution Take control measures	Rejected
E.coli	CFU/ml	< 10	10-100	>100
	Action	Accepted	Find out about cause of pollution Take control measures	Rejected

What is biofilm?

- Quality at the source \neq drinking point
- Biofilm definition
- Structure
 - Exopolymers
 - Glycoproteins
 - Polysaccharides (glycans)
- Multi layer & multi species



TRENDS in Microbiology

Risk of Biofilm

- **Why risk for animal health?**
 - **Bacterial infection & immunological challenge**
 - **Mycotoxin production by mo's in Biofilm**
 - **antibiotics kill bacteria in biofilm, but yeast and mould survive and produce toxins**
 - **Lower effect of vaccine, medication, additives**
 - **Not complete dosage**
 - **Antibiotic resistance**

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Role of system lay-out

Water safety

- Dead ends/ not in use
- Drinking points
- Diameter pipeline
- Water pressure
- Materials used (lines)
- Tanks
- Dosage pump

Water availability

- Capacity of drinking points / nipples
- Peak consumption





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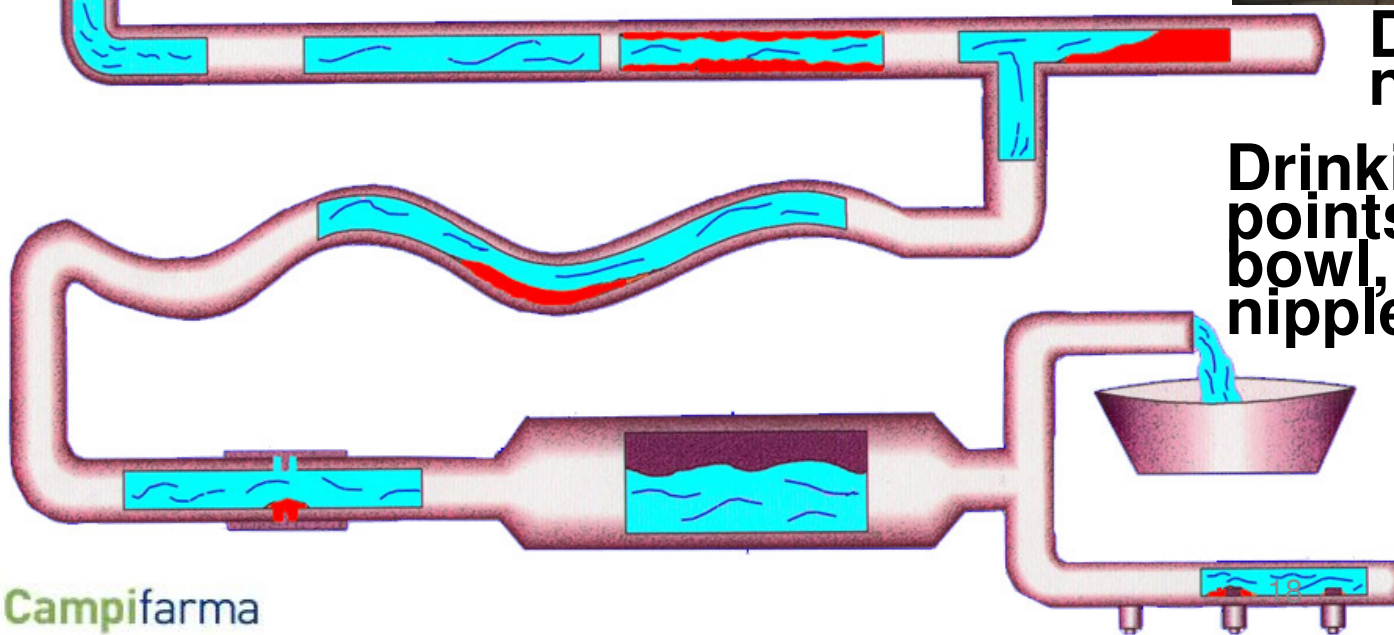
Diameter pipeline

- Small: 20 mm in the unit.
- Fast transport of supplements
- Prevent rise in temperature



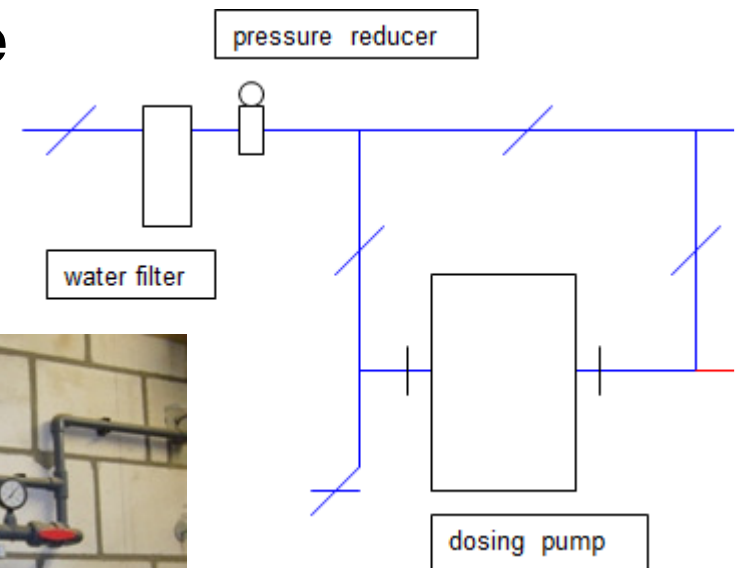
**Dead ends/
not in use**

**Drinking
points:
bowl, cup,
nipple**



Water pressure

- Use pressure reducers instead of 'float tanks'
- Min 3 bar: Make sure no oxygen (and dirt) can enter the system at the drinking points
- Water + oxygen + high temperature
= growth of bacteria



Material and Biofilm formation

- **Advice:**

High density polyethylene

HD80/100

- **Not advise:**

Low density polyethylene

**porous for gasses e.g. CO₂ and Ammonia
stimulates growth of bacteria**



Fig.1. Tested pipe tube products

Tsventanova and Hoekstra, 2008

System lay-out

Water safety at risk by using tanks

- **Continuous source of pollution**
 - **Re-contamination system**
- **Float tank**
 - **use pressure reducers instead**
- **Medication tank**
 - **Clean also during cycle**
 - **Accurate dosage of supplements**



System lay-out

Water safety is also water treatment

- **Frequent cleaning**
- **Correct use of disinfectants**
- **Accurate use of drinking water additives**

**All can be achieved by using
dosing pump**



System lay-out

Mechanic and electric dosage systems

Electric

- Precise at low water flow
- Equal dosage
- Acid resistant
- Long life span
- Air release for hydrogen peroxide



Mechanic

- Cheaper
- Shorter life span
- Less precise at low water flow
- Not always acid resistant
- Not suitable for low dosage



Role of system lay-out

Water availability

- Capacity of drinking points/nipples
 - Piglets: 500 ml / minute
 - Finishers: 1,0 litre / minute
 - Lactating sows: 2,5 litre / minute
- Peak in consumption
 - Not only daily consumption, peak !!!



System lay-out

Mistakes often seen:

- **Insufficient capacity**
- **No adjustments in water treatment installation after increasing number of animals**
- **Insufficient water quality during peaks in water consumption**
- **Incorrect flushing set up-of the water treatment installation**
- **Lack of maintenance & monitoring (by analysis, testing equipment and use of water filters)**
- **High hardness level**

Drinking water

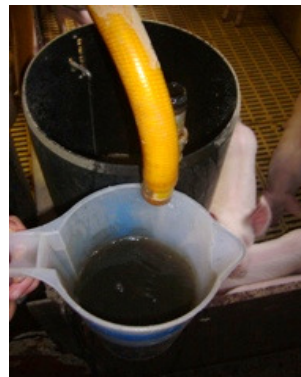
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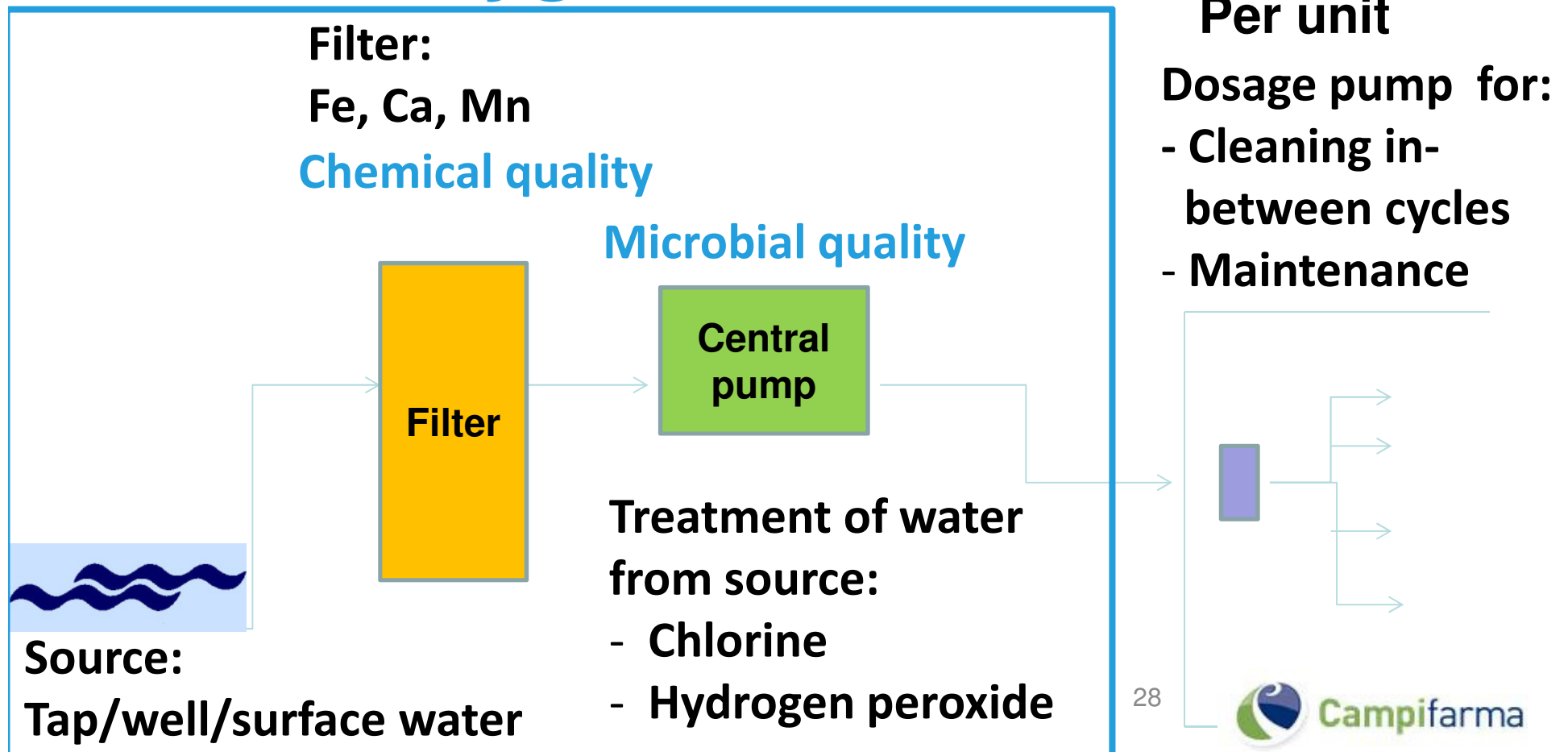
4. How to prevent & solve water hygiene issues?

How to prevent & solve water hygiene issues?

- Safe incoming water
- Good cleaning during clean-out
- Maintenance during cycle
- Accurate dosing equipment
- Correct use of additives

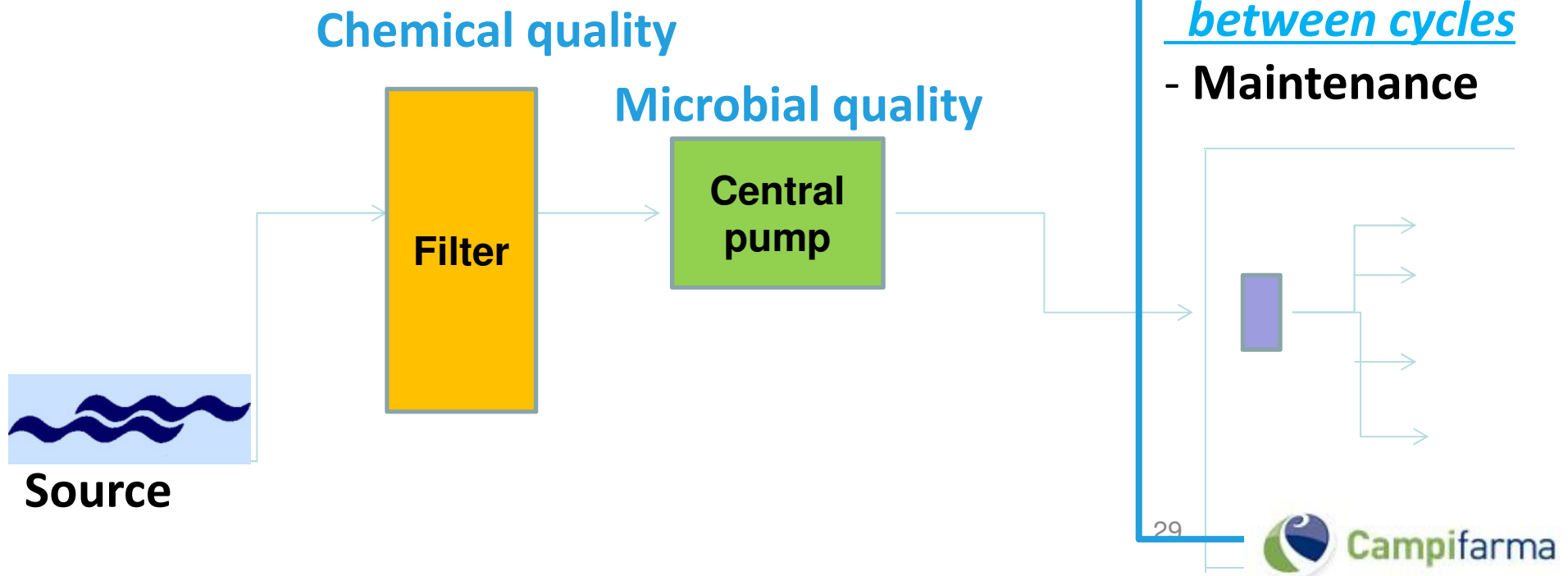


How to prevent & solve water hygiene issues?



Water treatment

Good cleaning during clean-out
(empty unit)



Choice of cleaning product

Corrosiveness

	<i>dissolved Zn, mg/l</i>
Hydrogen peroxide + peracetic acid	2100
Chlorine	1200
Hydrogen peroxide not stabilized	1100
Hydrogen peroxide + silver complex	99

pH

Chlorine treatment is very **pH sensitive**:

pH > 7 immediate strong decrease in efficacy

pH 7: still 77% activity => pH 8: only 22% activity

Hydrogen peroxide

Advantages of H_2O_2 for cleaning in between cycles:

- Biofilm structure easily broken down because of specific action against sugar structures/polypeptides
- Auto-Redox reaction: $H_2O_2 \rightarrow O_2 + H_2O$
- Pressure in drinking lines O_2 production
- Water pipes are scrubbed by O_2 bubbles
- Strong antibacterial effect
- No residues: animals & environment



Cleaning procedures H_2O_2

- 1-5%, minimum 24 hours
- Dosage depends on:
 - Maximum dosage pump settings
 - Frequency of cleaning moments
 - Time available for cleaning
- Air release during cleaning
- Flush system after cleaning

1 A) stabilized H_2O_2



1 B) non-stabilized H_2O_2



2 A) Vinegar



2 B) stabilized H_2O_2

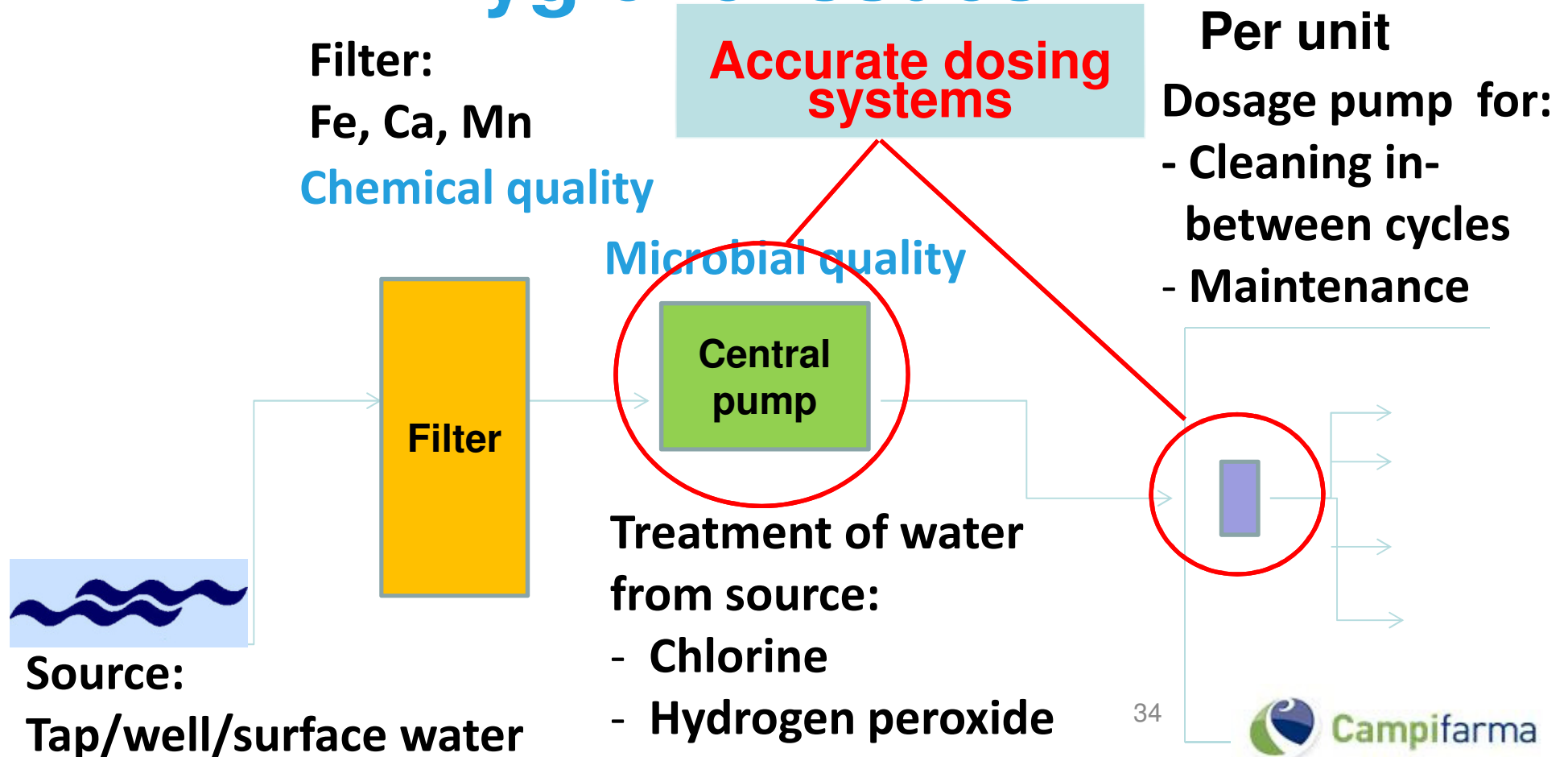


Maintenance during cycle

- Before and after period of additives in water

Day	Product in drinking water	Extra cleaning action
Monday	Maintenance dosage of cleaning product	Flushing lines
Tuesday	Antibiotic or nutritional supplement	
Wednesday	Antibiotic or nutritional supplement	
Thursday	Antibiotic or nutritional supplement	
Friday	Maintenance dosage of cleaning product	Flushing lines

How to prevent & solve water hygiene issues?



Good system and water quality – What's next?

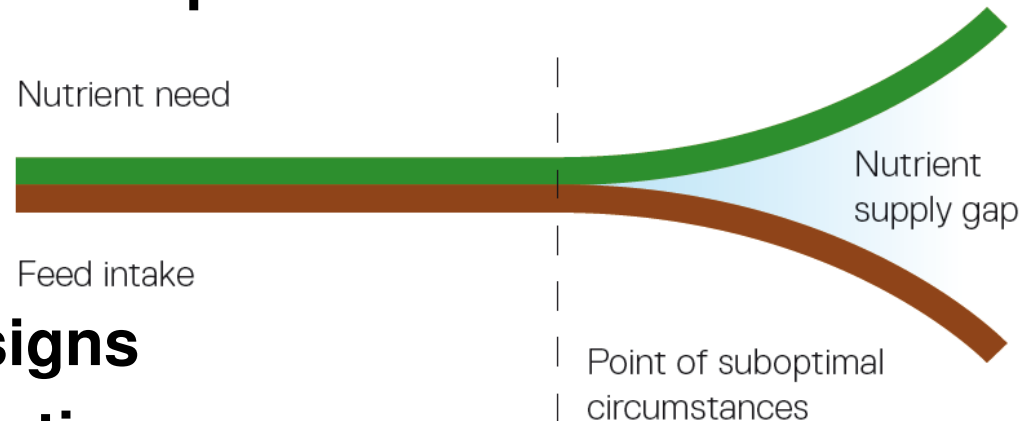
Nutritional supplements via drinking water

- **Advantages for animal health
and performance**
- **Acidification**
- **Critical points for successful
administration**

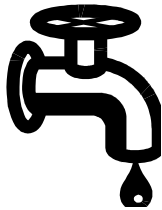


Drinking water supplementation

- Pigs are more easy to reach via water than feed
- Stress or disease: ↑ nutrient requirement
↓ feed intake
- ‘Nutrient Supply Gap’ => disruption intestinal health
- Pigs keep drinking, so faster solved via water!
- Flexible:
 - Start directly at first signs
 - Adjust dosage to situation
 - Period of administration by farmer & veterinarian
 - Targeted administration per pig unit



Acidification



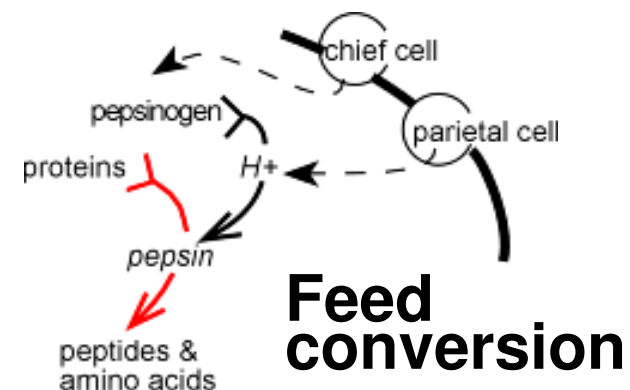
← Source \pm pH 8 Dosage farm specific
(buffering elements)



← Acidifier in stock solution Pathogens don't survive pH < 4



← Drinking water
Target pH 3.8





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Critical points for successful administration of supplements

- 1. Good water quality**
- 2. Correct installation of the drinking system**
- 3. Appropriate dosing equipment**
- 4. Knowledge about water intake**
- 5. Good solubility & accurate use of additives**
- 6. Correct cleaning procedures**



Conclusion

**Drinking water hygiene =
Key to success
for animal health and performance**



Thank you for your attention!

Paulien Rutten & team Kanters & team Campifarma

Your take home message

Veterinarian plays as crucial role
in
emphasizing the importance of drinking water hygiene,
to
guarantee effectiveness of medication and supplements
and finally
improve animal health



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Thank you for your attention!

Team Kanters Special Products

Healthy Animals, Healthy Farm