### Handling interferences – Experience report





www.mn-net.com



# Agenda











**P-Tests** 



**N-Tests** 





## Company

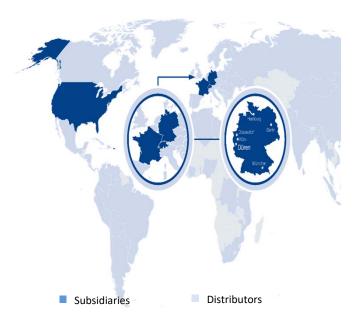


## Company

### **MN** today

- 4<sup>th</sup> Generation family owned
- More than 650 employees
- More than 25.000 products
- Turnover 115 Mio. €





## Company



#### **Business units**



Rapid Tests







## Company – MN Water Analysis



### Why are we here?

- Market share NANOCOLOR®
  - Germany: ca. 40%
  - US: 0%
- Get experience with US regulations







## Company – MN Water Analysis



### **Outstanding photometers**

- NANOCOLOR® VIS II
  - Revolutionary user experience with 10 inch HD touch screen display
  - Intuitive, icon-based menu guidance
  - Integrated turbidity control



## Company – MN Water Analysis

# -

### **Competitive heating blocks**

- NANOCOLOR® VARIO 4
  - Touch screen with intuitive menu navigation
  - Lockable protective lids and safety covers
  - Calibrated sensors to control digestion temperature optional









### Nutrient removal



### Nutrient removal



### **EPA Fact Sheet**

- Nitrogen and phosphorus are the primary causes of cultural eutrophication
- Approximately 25% of all water body impairments are due to nutrient-related causes
  - Oxygen depletion
  - Algal growth
  - Ammonia
- More stringent effluent limits lead to
  - P-removal
  - N-removal













### Phosphate acc. to EPA 365.3

$$PO_4^{3-} + 12 MoO_4^{2-} + 24 H^+ + 3 NH_4^+ V^{Reduction}$$
  
 $(NH_4)_3[P(Mo_3O_{10})_4] + 12 H_2O$ 



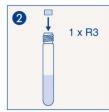
Phosphor molybdenum blue

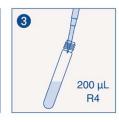


### **Dissolved ortho-Phosphate**





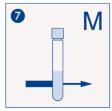








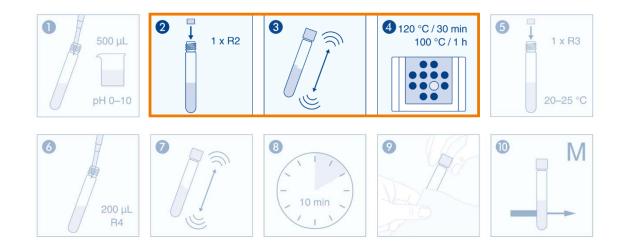








### **Total ortho-phosphate**





### Phosphate acc. to EPA 365.3

- For total phosphate, suspended solids contribute to total amount
- Make sure to draw a representative sample
- Carefully homogenize sample



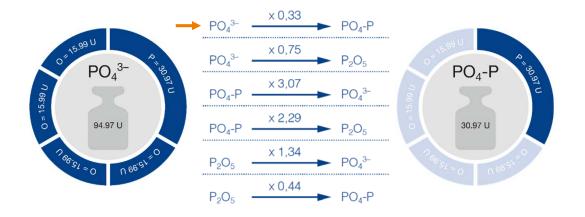






## "Report results in mg/L P or mg/L PO<sub>4</sub>-P"

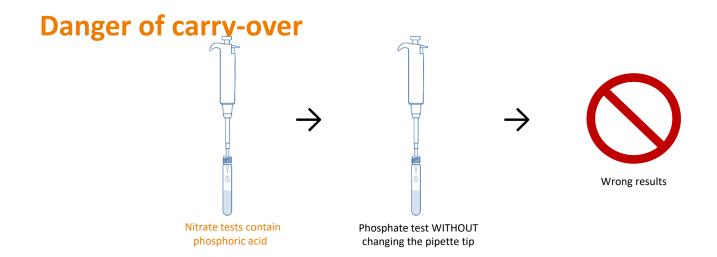
### Know the difference...







### Testing NO<sub>3</sub> and PO<sub>4</sub> in paralle

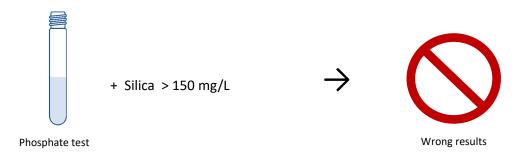






### When dealing with e.g. paper industry discharges

### Be aware of possible silica interference









#### **Total N vs. Parameters 40 CFR Part 136**

- Total N seems to be the target value for eutrophication
- Available EPA methods (examples)
  - NH<sub>3</sub> acc. To EPA 350.1
  - Total Kjeldahl acc. to HACH 10242
  - NO<sub>3</sub> acc. to HACH 10206
  - NO<sub>2</sub> acc. to EPA 353.2
- Not available EPA method
  - Total N









#### **How to detect Total N**

What is total N?	org.N + $NH_3^+$ + $NO_3^-$

Approved N-methods: TKN + NO<sub>3</sub>-

HACH TKN method:  $TKN = TN - NO_3^-$ 

What you then do  $TN - NO_3^- + NO_3^-$ 

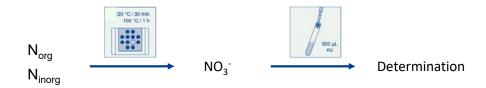








### **Total N testing**



$$CH_3$$
 OH  $CH_3$  OH  $CH_3$  OH  $CH_3$   $CH_3$  OH  $CH_3$   $CH$ 

22





### **Digestion**

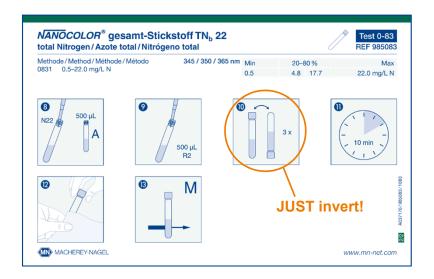








#### **Determination**









### Do not shake

Sample may develop turbi







#### Filtration possible

No!







### **Test for Chloride**

#### Yes!

- Chloride determination with QUANTOFIX<sup>()</sup>
- Dilute
- Chloride elimination cartridges



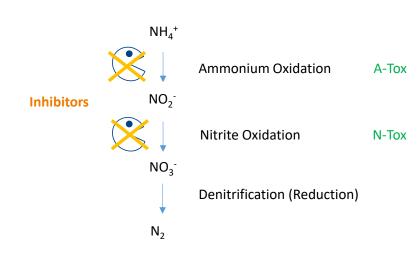


### Tox Tests Inhibitors for denitrifaction





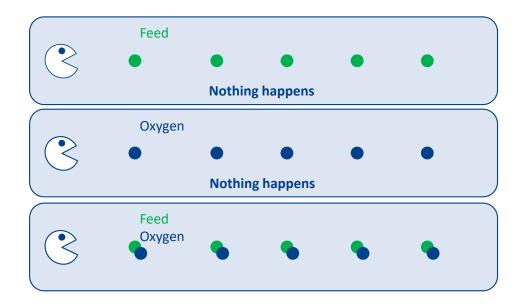
#### **Processes**







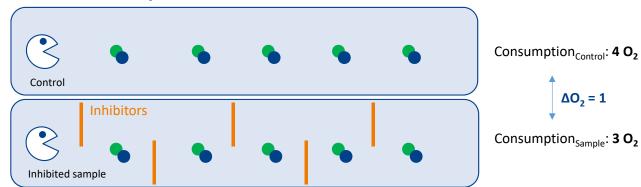
#### **How Tox-tests work**







#### **Control and sample**



Inhibition = 
$$\Delta O_2$$
: Consumption<sub>Control</sub> x 100 = [1 : 4] x 100 = 25 %





#### How the test is done

- Use oxygen probe
- Measure
  - Control
  - Sample
- Calculate inhibition from difference







### ISO 9509 vs. BioFix® Tox Tests

- Only for POTW with nutrient removal
- Easily detects nitrification-inhibitors
- Lab test, result in 12 minutes







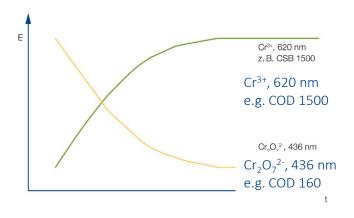


### **Method summary**

- Tube tests for chemical oxygen demand
- Principle

• 
$$Cr_2O_7^{2-}$$
 + "Dirt"  $\rightarrow$  2  $Cr^{3+}$ 

- NANOCOLOR® COD HR 1500
- NANOCOLOR® COD LR 150





#### More detail

- Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> is actice reagent
  - Test is based on oxidation potential
  - So far not replacable for real samples
- Hg<sup>2+</sup> masks Chloride
  - allows use of Silver as catalyst
  - Prevents false to high results caused by Cl-
    - Oxidation

$$Cr_2O_7^{2-}$$
 + "Dirt" +  $Cl^-$  +  $Hg^{2+}$   $Gr^{3}$  +  $HgCl_2$ 



### Mercury is used to overcome Chloride interference

Chloride interference Part I

$$Cr_2O_7^{2-} + 2 Cl^- + Hg^{2+}$$
  $Cr_2O_7^{2-} + HgCl_2$ 

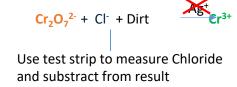
Chloride interference Part II

$$Ag^+ + 2Cl^- + Hg^{2+}$$
  $Ag^+ + HgCl_2$ 



### **Hg-free COD Part I: Chloride Compensation**

- POTW inflow
  - Expected "Chloride error" at 800 ppm
     COD: approx. 3%
  - Most substances easy to crack
- POTW effluent
  - Expected "Chloride Error" at 40 ppm COD: approx. 60%
  - Ag+ catalyst needed to crack refractary substances





### **Hg-free COD Part II: Chloride Removal**

- POTW inflow
  - Filtration not suitable because loss of particles
- POTW effluent
  - Filtration no problem (little particles in effluent)
  - Ag+ catalyst available to crack refractary substances



Use cartridge to remove Chloride (involves some kind of filtration)



#### Result

- Chloride compensation
  - Inflow: reasonably OK
  - · Outflow: useless
  - Cl- teststrip would need improvement
- Chloride removal
  - · Inflow: useless
  - Outflow: reasonably OK (expected)
  - · Handling would need improvement









## Summary



## Summary



- P-Tests
  - Take care when Nitrate is tested at the same time
- N-Test
  - Total Nitrogen test is almost there
- Tox-Tests for denitrification
  - Easy detection of inhibitors the reduce POTW performance
- Green(er) COD
  - Improved Mercury-free test could be available when needed



### Thank you for your attention!

Dr. Christian Prokisch I cprokisch@mn-net.com I +49-2421-969-166



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