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NANOCONTROL - System for Analytical Quality Control

The *NANOCONTROL* system consists of two components:

a) *NANOCONTROL* standard

The standard solution is used for checking instruments, reagents and accessories as well as for control of proper handling.

Recommended frequency of application:
after every 10th sample for each parameter (referring to operator), at least 1x per month

b) *NANOCONTROL* 100+ solution

This is used for the examination of possible interferences from the sample, i.e. matrix effects (standard addition).

Recommended frequency of application:
at least 1x per quarter as well as a) when results are not plausible or b) when the composition of the sample has changed

Exceptions: see table

Stability: 1 year, after opening 6 weeks

Test No.	Result given as	Standard		Addition per 0.5 mL **100+ solution** (β_m)	REF
		Concentration	Confidence interval CI		
0-07	mg/L AOX	1.0	0.8–1.2	1.0	**92507**
1-16	mg/L Cl_2	1.00	0.90–1.10	–	**92517**
0-17	mg/L Cl_2	0.80	0.70–0.90	–	**92517**
0-24	mg/L CrO_4^{2-}	2.0	1.8–2.2	0.50	**92524**
0-59	mg/L Cr	0.90	0.80–1.00	0.22	**92524**
1-25	mg/L CrO_4^{2-}	0.40	0.36–0.44	0.50	**92524**
0-22 / 27	mg/L O_2	30	26–34	–	**92522**
0-26 / 33 / 36	mg/L O_2	100	90–110	–	**92526**
0-23 / 28	g/L O_2	4.00	3.60–4.40	–	**92528**
0-29 / 38 / 30	mg/L O_2	400	360–440	–	**92529**
0-62	mg/L SO_4^{2-}	120	110–130	–	**92562**
1-67	mg/L NO_2-N	0.060	0.054–0.066	0.02	**92568**
0-68	mg/L NO_2-N	0.30	0.25–0.35	0.02	**92568**
0-69	mg/L NO_2-N	2.1	1.9–2.3	–	**92568**
0-75	mg/L C	10,0	8.5–11.5	–	**92575**
0-76	mg/L PO_4-P	1.00	0.90–1.10	0.10	**92576**
0-78	mg/L C	100	85-115	–	**92578**
1-77	mg/L PO_4-P	0.20	0.18–0.22	0.10	**92576**
0-95	mg/L PO_4-P	0.25	0.22–0.28	0.10	**92576**
0-90	mg/L SO_3^{2-}	50	45–55	–	**92590**

Hazard warning:
Information regarding safety can be found on the box' label and in the safety data sheet. You can download the SDS from *www.mn-net.com/SDS*.

1. *NANOCONTROL* standard

Procedure:
Perform analysis with standard as described in the instructions. The concentration of the standard is indicated on the evaluation table.

Tube tests:

Use standard solution instead of sample
(exception: test 0-07, 0-17, 0-69; see ** Deviating procedure!).

Standard tests:

Pipette 4.0 mL standard solution into a 25 mL volumetric flask and fill to about 20 mL with distilled water. Add the required reagents (follow the instructions of the test carried out). Fill up to 25 mL mark
(exception: Test 1-16; see ** Deviating procedure!).

** Deviating procedure:

Test 0-07 AOX 3:
Mix 100 mL dist. water, 0.5 mL standard solution (200 mg/L) and 1 mL nitric acid 65 %. Use this solution instead of the sample.

Test 1-16 Chlorine:
Pipette 2 mL standard solution into a 25 mL volumetric flask, add 5 drops R1, wait 1 min, the solution turns yellowish. Add 5 drops R2, the solution turns colorless. Fill to approx. 20 mL with dist. water, then continue immediately as described in the manual for test 1-16.

Test 0-17 Chlorine / Ozone 2:
Pipette 2 mL standard solution into a 25 mL volumetric flask, add 5 drops R1, wait 1 min, the solution turns yellowish. Add 5 drops of R2 dropwise. The color of the solution will weaken or may disappear entirely. Fill to 25 mL with distilled water, mix. Use this solution immediately instead of the sample as described in test 0-17 (4 mL).

Test 0-69 Nitrite 4:
Dilute 100+ addition solution with distilled water (1+1) and use it instead of the sample.

Note:
For test 1-16 Chlorine, test 0-17 Chlorine / Ozone 2 and test 0-90 Sulfite 100 the standards contain simulation substances, which react in the same manner as the original parameters. Distilled water and glassware used in chlorine tests must be chlorine demand-free.

The number of tests with the *NANOCONTROL* standards depends on the sample volume. This results in the following numbers:

150 tests per kit: test 0-28, 0-69

60 tests per kit: test 0-78

30 tests per kit: test 1-16, 0-17, 0-23, 0-95

20 tests per kit: test 0-07

15 tests per kit: test 0-22, 0-24, 1-25, 0-26, 0-27, 0-29, 0-30, 0-33, 0-36, 0-38, 0-62, 1-67, 0-68, 0-76, 1-77, 0-90

12 tests per kit: test 0-59

6 tests per kit: test 0-75

Evaluation:
A result within the confidence interval indicates proper functioning of all single components of the testing unit and proper handling. If the result is not within the confidence interval, possible errors have to be traced by checking the following points.

Sampling
- proper sample volume

Reagent / Standard
- expiry date not exceeded
- stored property

Analysis
- correct procedure
- proper sequence or reagents
- thorough mixing after each addition of reagents
- proper reactor time
- proper reaction temperature
- zero adjustment with proper solution

Cuvettes
- proper size
- clean

Piston pipette
- technically o.k.
- properly handled
- not contaminated
- new pipette tip

Measurement
- proper filter / Wavelength
- proper factor
- proper dimension (e.g. NO_2-N or NO_2^-)

After replacement of the malfunctioning components or after correcting the procedure another analysis with the standard should yield a result within the confidence interval. If this is not the case, components such as the photometer or the reagent set may have to be replaced.

2. *NANOCONTROL* 100+ solution

The increase in concentration per addition of 0.5 mL 100+ solution (for test 0-07 AOX 3 add 0.5 mL standard solution to 100 mL sample instead of 0.5 mL 100+ solution) is indicated on the evaluation table. The certainty of the evaluation increases with the number of addition steps. We recommend at least two additions.

However, you should make sure that the additions do not exceed the measuring range of the corresponding test **(20–80 % range)**.

Required accessories:
100 mL volumetric flasks (corresponding to the number of additions) piston pipette with tips

Procedure:
Determine the concentration (β_s) of the respective parameter in the water sample: If the value β_s is already close to the upper limit of the measuring range, standard addition **can only be performed with a diluted sample.** In this case you have to measure the concentration β_s of the diluted sample. If the standard addition results in a matrix-induced correction for the result, consequent measurements have to be performed with the same dilution as the standard addition.

Standard addition:
With the piston pipette add to the

1st volumetric flask: 0.5 mL *NANOCONTROL* 100+ solution	value β_1
2nd volumetric flask: 1.0 mL *NANOCONTROL* 100+ solution	value β_2
3rd volumetric flask: 1.5 mL *NANOCONTROL* 100+ solution	value β_3

Note: always use the same pipette!

After addition close volumetric flasks, mix thoroughly; with the contents of the measuring flask perform analysis as per instructions.

Evaluation:
The concentration increase (β_m) per added 0.5 mL is indicated on the evaluation table. If there is no interference, the result after addition must be the initial result plus this value. The differences of the result thus give the measurable increase ($\Delta_{1,2,3}$) in the sample.

$\beta_1 - \beta_s = \Delta_1$ $\beta_2 - \beta_1 = \Delta_2$ $\beta_3 - \beta_2 = \Delta_3$

If the concentration differences $\Delta_{1,2,3...}$ correspond to the added values, there is no proportional interference of the analysis. If, however, the concentration differences are equal, but deviate from the theoretically added concentration, there is a proportional interference of the analysis by third components of the sample. You can then calculate a probable value from the measured result.

Value of the original sample: β_s Added value: β_m

Probable analytical result: $\beta = \beta_s \times \frac{\beta_m}{\Delta_{1(2,3,...)}}$

Example:

The measured value of the sample is β_s = 1.5 mg/L

Standard addition for 0.5 mL is β_m = 0.5 mg/L

Measured value after the 1st addition: β_1 = 1.9 mg/L Δ_1 = 0.4 mg/L

Measured value after the 2nd addition: β_2 = 2.3 mg/L Δ_2 = 0.4 mg/L

Probable analytical result: $\beta = 1.5 \times \frac{0.5}{0.4} = 1.9$ mg/L

If the additions give different concentration increases ($\Delta_1 <> \Delta_2 <> \Delta_3$), unproportional interferences are present. The analytical result has to be rejected. Perhaps the problem can be solved by a sample preparation step.

Please note the following when working with standard additions:
Additive errors can not be recognized by this method!

Examples:
Part of the substance to be determined is not covered by the analysis:
- condensed phosphates besides ortho-phosphate (low results)
- part of a metal to be analyzed is masked or present in another non-ionoganic form (low results)
- turbidities simulate substances (high results)

Removal of such interferences requires other procedures such as decomposition, centrifugation or similar.

Note:
The concentration of the 100+ solution is calculated thus that the dilution caused by addition of the 100+ solution is compensated for.