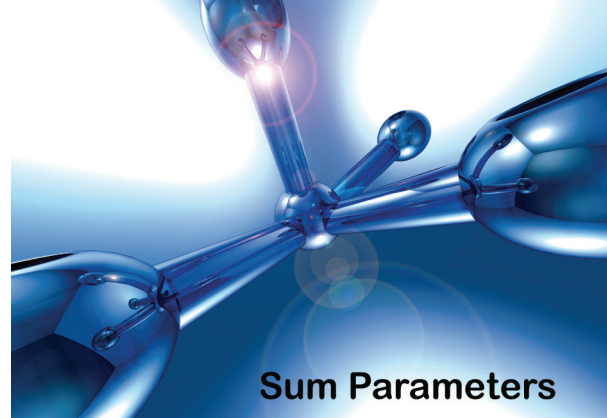


# Application Note



## Determination of the TN<sub>b</sub> in the trace range

The TN<sub>b</sub> parameter originates from wastewater analysis application as an alternative to the Kjeldahl determination. Just like the history of TOC sum parameter development, application areas for TN<sub>b</sub> are rapidly increasing. In addition to the TN<sub>b</sub> determination in the ppm range for environmental applications, there is also interest in determination of total nitrogen content in the ultra trace range. For this purpose, Shimadzu has increased the maximum injection volume to 300µL and subsequently lowered the detection limit.



### TOC-V CSH with TNM-1

#### TNM-1 Unit

The TNM-1 unit enables a combined determination of total organic carbon and total nitrogen. The TN<sub>b</sub> determination is based on catalytic combustion at 720°C and chemiluminescence detection in accordance with the requirements in EN 12260 – Determination of Total Nitrogen.

#### Determination of the detection limit according to the blank value analysis

To determine the detection limit  $x_{NG}$ , the blank sample is measured  $N$  times. The mean value  $\bar{y}_B$  and the standard deviation  $s_y$  is calculated of all measured values.

$$x_{NG} = \frac{s_y}{m} \cdot t \cdot \sqrt{\frac{1}{\hat{N}} + \frac{1}{N}}$$

$s_y$  Standard deviation of N blank value analysis.

$N$  Number of blank value analysis

$\hat{N}$  Number of replicates

$t$  t-value ( $f=N-1, P=95\%$ )

$m$  Slope of the calibration curve

For the determination of the detection limit of the TNM-1 module, blank water samples were measured 7 times with an injection volume of 300µL:

No	Area
1	1,089
2	1,105
3	1,117
4	1,072
5	1,02
6	1,034
7	1,074
Mean value:	1,073
Standard deviation:	0,035

Results of the blank water sample analysis

### Calculation of the detection limit:

$$x_{NG} = \frac{0,035}{0,057} \cdot 1,94 \cdot \sqrt{\frac{1}{1} + \frac{1}{7}} = 1,3 \mu\text{g/L TN}$$

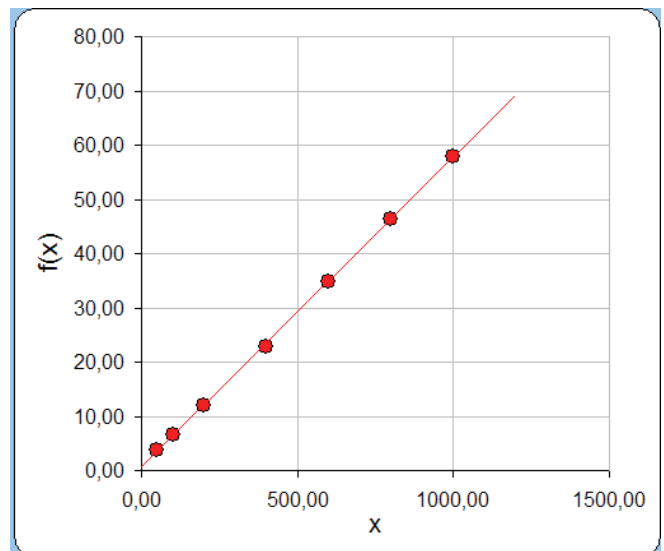
t-value: 1,94

The determination of the detection limit depends of the quality of the blank water sample and of the performance of the calibration curve. Base to this Shimadzu announces official a detection limit of 5 $\mu\text{g/L}$

### Calibration Curve up to 1000 $\mu\text{g/L}$ TN

For this calibration curve 7 Standard solutions from 50 to 1000 $\mu\text{g/L}$  were prepared. The standard solution is a mix standard of ammonium sulphate and potassium nitrate following the recommendation in the EN 12260. Each point was measured three times with an injection volume of 300 $\mu\text{L}$ :

Concentration [ $\mu\text{g/L}$ ]	Mean Area
50	3,877
100	6,596
200	11,89
400	22,76
600	34,91
800	46,45
1000	57,85



The given specifications serve purely as technical information for the user. No guarantee is given on technical specification of the described product and/or procedures.