Tech note

Conductometric determination of the Filtrate dry residue TDS

Note:

Attention! Application reports only describe procedural instructions for special applications. The necessary basic knowledge and all basic prerequisites for these applications are itemized in our conductivity primer and in the operating manuals of the measuring instruments and cells.

Measuring method:

Conductivity measurement

Measuring range:

TDS: 0 – 200 g/l
Conductivity: 0 – 2 mS/cm

Measuring equipment:

Conductivity cell
Measuring instrument

Equipment for determining the filtrate dry residue (Total Dissolved Solids)

As per DIN 38409 Part 1 "Determination of total dry residue, filtrate dry residue and residue on ignition" or listed in 2540 C. "Total Dissolved Solids" and 2540 B.

Definition und Interpretation

In DIN 38409 Part 1 the filtrate dry residue (TDS or Total Dissolved Solids) is defined as the mass of solids (based on the volume used) that is left over from a water sample after the drying process specified in it. (see also 2540 C.)
Because the water sample is filtered before drying, it is therefore possible to make a statement on the concentration of all solids dissolved in the water sample.
However, some components can evaporate during drying due to their physical properties so that not all components dissolved in the water sample can be specified by this value.
In summary, it can be said that the TDS is regarded as the summed parameter for the concentration of all substances dissolved in the sample water, provided that they don't evaporate during the drying.
This concentration is typically specified in g/l.

Theorie:

Substances dissolved in water mainly refer to salts that are present as ions and for this reason mainly determine the conductivity of a solution.
The ability of a water sample to conduct electric current therefore rises with the increasing concentration of dissolved substances and, vice versa, falls when there are less of them present.
For this reason it is possible to calculate the electrical conductivity of dissolved substances where a simple linear relationship between these two parameters is assumed.

$$\beta_{FT} = f \cdot \kappa_{25}$$

β_{FT} = filtrate dry residue (TDS value)
κ_{25} = conductivity at 25 °C
f = proportionality factor

The proportionality factor referred to here as f is a specific constant that has a different value each time in water samples with different compositions.

If the composition of your sample changes, the factor must be redetermined and entered into the measuring instrument each time.

WTW
a xylem brand

Note:

Various effects such as that of temperature progressions at variance from the compensation curve or inter-ionic interaction mean the true dependency between TDS and conductivity can deviate from the ideal behaviour. In typical application scenarios, the resulting errors can however be regarded as negligibly small, hence only slightly falsifying the measurement.
Nevertheless, when interpreting the measured results, it is important to note that the method presented here can only provide an approximation of the measured value of the DIN method.
However, in contrast, the conductometric TDS determination is a quick and uncomplicated method that leads to usable measured results with little effort.

Temperature compensation:

As every electrolyte composition in water has its individual temperature dependency, it is not possible to specify a relationship between temperature and conductivity that is generally applicable. The average values from the measurements of different natural waters are used as the basis of the compensation in WTW measuring instruments where a wide range of applications can be covered. In normal cases, the errors generated by variations in the temperature behavior are also negligibly small.
This compensation method makes it possible to calculate the TDS value of the measurement solution from the conductivity measurement at any temperature without needing to adjust the temperature of the measurement medium.
Please note that when activating the TDS measurement, all previously set temperature compensation methods are disabled for this reason and are only restored when the device switches back to conductivity measurement mode.

Determination of the proportionality factor

The proportionality factor can easily be calculated by measuring the conductivity of the sample solution and then determining the TDS of the same sample as per DIN 39409 Part 1 (respectively 2540 C.). These two values can be used to calculate the factor from the formula given above.

- To measure the conductivity, switch the temperature compensation of your measuring instrument to nlF "non linear compensation for natural waters" and enter 25°C as the reference temperature. The measuring instrument then automatically recalculates the conductivity measured at any temperature to the conductivity of the solution at 25°C.

The setting of this special type of temperature compensation is required because the same temperature compensation must be used in the measurement to determine the factor as for subsequent measurement of the TDS value (fixed nlF stored).

- Measure the conductivity of your water sample and record it.
- Carry out the determination as described in DIN 38409 Part 1 (respectively 2540 C.) of the TDS on the same water sample and record the value obtained.
- Use the following formula to calculate the proportionality factor for your water sample:

$$f = \frac{\beta_{FT}}{\kappa_{25}}$$

β_{FT} = TDS determined as per DIN 38409 Part 1 (respectively 2540 C.)
κ_{25} = conductivity of the water sample measured at 25 °C
f = proportionality factor to be calculated

Please note that the proportionality factor is dependent on the composition of the measurement solution.
This value must be specifically determined for each water type and entered into the instrument for the measurement.

Measurement

- Set your instrument to the TDS measurement method.
- Enter the previously determined proportionality factor into your measuring instrument in accordance with the operating manual.
- Immerse the conductivity cell in your water sample and wait a few seconds until the display has stabilized.
- Read the measured value on the instrument.

For water samples of different composition, the proportionality factor must be determined separately for each water sample and entered in the instrument for the measurement.

T201011

Notes:
The information contained in our application reports is only intended as a basic description of how to proceed when using our measurement systems. In isolated instances or if there are special general conditions on the user side, exceptional properties of the respective sample can, however, lead to a change in the execution of the procedure or require supplementary measures and may, in rare cases, lead to a described procedure being unsuitable for the intended application.
In addition, exceptional properties of the respective sample such as special general conditions can also lead to different measurement results.
The application reports have been prepared with the greatest possible care. Nevertheless, no responsibility can be accepted for the correctness of this information.
The current version of our general terms of business applies.

T201011

Do you have further questions?
Please contact our
Customer Care Center:

Xylem Analytics Germany Sales
GmbH & Co. KG, WTW
Am Achalaich 11
82362 Weilheim, Germany
Phone +49 881 1830
Fax +49 881 183-420
Info.WTW@xylem.com

xylemanalytics.com