

# Sulphate, SO4

LAST CHANGED: 05 APRIL 2022

Sulphate is nowadays analysed with ion chromatography. The ions are separated with an anion change column. Thereafter the background is lowered with a suppressor and detection is made conductometric.

Sulphate was earlier analysed with the Mackereth method (see below).

## Known issues with the parameter and/or important method changes

The older method, developed by Mackereth, is susceptible to disturbance by organic acids, and thus will overestimate the amount of sulphate in waters with high contents of humic substances (high water colour/absorbance). Corrections for this overestimation is underway.

## Current methods of measurement

Valid since January 2020

Method: SS-EN ISO 10304-1 1st ed. (modified).

Instrument: Metrohm 930 Compact IC Flex with Sample changer 858 Professional Sample Processor with automatic filter.

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## Previous methods

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2010 – 2019-12 (i.e. partly parallel with the instrument below)

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Method: SS-EN ISO 10304-1 1st ed. (modified).

Instrument: Metrohm 881 Compact IC pro with Sample changer 858 Professional Sample Processor with automatic filter

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2007-05 – 2012 (i.e. partly parallel with the instrument above)

Method: SS-EN ISO 10304-1 1st ed. (modified).

Instrument: Conductivity detector JD21 series II: Column furnace

IC21 series II. Sample changer MIDAS with built-in injector.

Elution pump.

2005-05 – 2007-04

Method: SS-EN ISO 10304-1 1st ed. (modified).

Instruments: Backup: (LDC ConductoMonitor III. Waters 510

(pump). Waters 712 WISP sample changer. Anion exchange

column. Waters maxima 820 version 3.30. New instruments:

Conductivity detector JD21 series II: Column furnace IC21 series II.

Sample changer MIDAS with built-in injector. Elution pump.

1990-01 – 2005-04

Method: Ion chromatography SS-EN ISO 10304-1.

Instruments: LDC ConductoMonitor III. Waters 510 (pump).

Waters 712 WISP sample changer. Anion exchange column. PC

computer with chromatography software WATERS MAXIMA 820

version 3.30.

1984-01 – 1990-12

Method: Ion chromatography.

Instruments: LDC ConductoMonitor/cell. LDC Constametric 111

(pump). SHIMADZU C-R1B (integrator). MAGNUS Autosampler M

7110. VYDAC-column 302 I.C.

N.B. New projects started in April 1983

1965-01 – 1983-12 (Mackereth)

Method: Karlgren, L 1961: Vattenkemiska Analysmetoder

(Hydrochemical Analytical Methods, in Swedish)

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## Mackereth

In most freshwaters, the dominant anions are sulphate, hydrogen carbonate, carbonate and chloride. After passing through a cation exchanger charged with hydrogen ions, the amount of hydrogen ions is determined through titration with hydroxide anions. If the sample simultaneously is aerated with carbon dioxide-free nitrogen gas, the components of the carbonic acid system are expelled to the atmosphere as carbon dioxide. This occurs due to the high concentration of hydrogen ions in the sample after having passed through the cation exchanger. As hydrogen carbonate and carbonate are expelled during the analysis, the titration gives the sum of the number of sulphate and chloride equivalents. The amount of sulphate equivalents is obtained by subtracting the number of chloride equivalents in a separate chloride analysis from the result. In certain humic waters, however, organic acids might constitute a significant proportion of the anions, in which case the analysis results overestimate the sulphate content, unless corrected for.

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## Links

Read more about [sulphate on Wikipedia](#).

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