

# Solids, residue on evaporation at 180°C, dissolved, gravimetric

## Parameter and Code:

Solids, residue on evaporation at 180°C, dissolved I-1750-85 (mg/L): 70300

### 1. Application

The residue-on-evaporation method is applicable to all water regardless of concentration, provided that the residue layer in the evaporation dish is kept sufficiently thin.

### 2. Summary of method

2.1 A volume of filtered sample that will yield less than 200 mg residue is evaporated just to dryness on a steam bath. The residue is then dried at 180°C for exactly 2 hours, cooled in a desiccator, and immediately weighed.

2.2 The weight of the residue is limited to 200 mg to ensure subjection of all the residue to the full effects of drying at 180°C. Voluminous residues will often seal over during the evaporation process and entrap pockets of water that will not be completely vaporized during the drying process. Massive residues also release their water of crystallization more slowly than do thin films of residue. The chemical composition of the sample has a marked effect on the dissolved-solids value obtained, but the percentage of error incurred for any given chemical type of water is independent of the total concentration if the residue film is kept thin.

2.3 Bicarbonate is converted to carbonate in the evaporation and drying process. The following general observations have been reported by Howard (1933). The residues of carbonate-type water that contain considerable magnesium chloride can be expected to lose some weight (as much as 50 or 100 mg/L) during the drying process; however, such loss of weight is usually more than offset by the water of crystallization tightly held by the salts. Most of the water of crystallization is driven off from sulfates of sodium and magnesium when the

residue is heated at 180°C, but this temperature is insufficient to dehydrate calcium sulfate completely. Residues of water with a high nitrate content may lose as much as 30 mg/L on heating.

2.4 Because many of the salts in the residue are hygroscopic, an efficient desiccant must be used. Silica gel (indicating), anhydrous  $Mg(ClO_4)_2$  or  $CaSO_4$ , and  $Mg(ClO_4)_2 \cdot 3H_2O$  are satisfactory and recommended.  $CaCl_2$  is not suitable. Under no circumstances should the dried residues be allowed to stand for long periods of time before weighing.

### 3. Interferences

There are no known interferences to this method.

### 4. Apparatus

4.1 *Desiccator*, charged with indicating silica gel or other efficient desiccant.

4.2 *Oven*, 180°C, uniform temperature throughout.

4.3 *Platinum evaporating dishes*, 75- to 125-mL capacity, weighing less than 50 g, or zirconium dishes. Platinum or zirconium are recommended for precise work because the change in weight of glass or porcelain dishes may introduce appreciable error into the determination.

4.4 *Steam bath*.

### 5. Reagents

None required.

### 6. Procedure

6.1 Pipet a volume of filtered sample containing 10 to 200 mg dissolved solids (500 mL max) into a tared platinum dish.

6.2 Evaporate the sample just to dryness on a steam bath.

6.3 Dry in an oven at 180°C for 2.0 h.

6.4 Cool in a desiccator and immediately weigh. Record the weight to the nearest 0.1 mg.

### 7. Calculations

Dissolved solids (mg/L) =

$$\frac{1,000}{\text{mL sample}} \times \text{mg residue}$$

### 8. Report

Report solids, residue on evaporation at 180°C, dissolved (70300), concentrations as follows: less than 1,000 mg/L, whole numbers; 1,000 mg/L and above, three significant figures.

### 9. Precision

9.1 Precision for dissolved solids for 22 samples within the range of 60 to 1760 mg/L may be expressed as follows:

$$S_T = 0.024X + 11.3$$

where

$S_T$  = overall precision, milligrams per liter, and

$X$  = concentration of dissolved solids, milligrams per liter.

The correlation coefficient is 0.7633.

9.2 Precision for dissolved solids for six of the 22 samples expressed in terms of the percent relative standard deviation is as follows:

Number of laboratories	Mean (mg/L)	Relative standard deviation (percent)
27	59.2	8
28	267	4
39	524	11
28	558	2
29	1160	4
49	1760	3

### Reference

Howard, C. S., 1933, Determination of total dissolved solids in water analysis: Industrial Engineering Chemistry, Analytical Edition, v.5. p.4.