



## Method 9.5 – Boiler water, boiler feed water and effluent: insoluble solids

### 1. Rationale

This method is applicable to boiler water, boiler feed water and effluent and determines the mass of the total insoluble solids in a sample.

### 2. Principle

The water sample is filtered through a sintered glass crucible or glass fibre filter paper. The retained insoluble matter is thoroughly washed, dried and weighed. The insoluble solids are calculated from the increase in the mass of the crucible or filter paper.

### 3. Apparatus

**3.1 Analytical balance** readable to 0.0001 g

**3.2 Drying oven** operating at 105°C

**3.3 Desiccator** with self-indicating silica gel

**3.4 Buchner flask:** 500 cm<sup>3</sup>

**3.5 Filter funnels**

Sintered glass crucible: 70 cm<sup>3</sup>, porosity 4 (for boiler and boiler feed water)  
Buchner funnel: 90 mm  $\phi$  (for effluent)

**3.6 Measuring cylinders:** 100, 500 cm<sup>3</sup>

**3.7 Tweezers**

**3.8 Drying dish**

**3.9 Glass fibre filter paper:** Whatman GH/A, 90 mm  $\phi$  (for effluent only)

### 4. Procedure

**4.1 Boiler water and boiler feed water**

Dry a sintered glass crucible for 1 hour at 105°C, cool in a desiccator for one hour and weigh accurately to 0.0001 g.

Stir the sample of water to ensure that the insoluble solids are uniformly distributed throughout the sample. Measure 100 cm<sup>3</sup> of the sample in a measuring cylinder and filter through the sintered glass crucible mounted on a Buchner flask under vacuum. Rinse the measuring cylinder with three portions of 10 cm<sup>3</sup> distilled water through the crucible to ensure that all insoluble solids are transferred to the crucible. Wash the

inside of the crucible with three portions of 10 cm<sup>3</sup> distilled water allowing the crucible to drain between washings.

Dry the crucible in an oven for 3 hours at 105°C. Cool in a desiccator for 1 hour and weigh accurately to 0.0001 g.

#### 4.2 Effluent

Dry a glass fibre filter paper for 1 hour at 105°C in the oven. Cool in a desiccator and weigh accurately to 0.0001 g.

Stir the sample of effluent to ensure that the insoluble solids are uniformly distributed throughout the sample. Measure 500 cm<sup>3</sup> of the sample in a measuring cylinder and filter through the filter paper inside a Buchner funnel mounted on a Buchner flask. Rinse the measuring cylinder with three portions of 50 cm<sup>3</sup> distilled water through the crucible to ensure that all insoluble solids are transferred to the crucible. Wash the inside of the crucible with three portions of 10 cm<sup>3</sup> distilled water allowing the crucible to drain between washings.

Dry the crucible in an oven for 2 hours at 105°C. Cool in a desiccator for 1 hour and weigh accurately to 0.0001 g.

### 5. Calculations

$$\text{Insoluble solids (mg/litre)} = \frac{(M_2 - M_1) \times 1000}{V \div 1000}$$

where V       ≡       volume of sample (cm<sup>3</sup>)  
 M<sub>1</sub>       ≡       mass of the empty crucible or filter paper (g)  
 M<sub>2</sub>       ≡       mass of the crucible or filter paper and insoluble solids (g)

### 6. Example

Mass of the empty crucible               =       15.5684 g  
 Mass of the crucible and insoluble solids   =       15.6125 g  
 Volume of the sample                       =       100 cm<sup>3</sup>

$$\begin{aligned} \text{Insoluble matter (mg/kg or ppm)} &= \frac{(15.6125 - 15.5684) \text{ g}}{100 \text{ cm}^3} \times 10^6 \\ &= 441 \text{ mg/litre} \end{aligned}$$

### 7. References

SASTA (1985). *Laboratory Manual for South African Sugar Factories*. 3<sup>rd</sup> Edition: 356 - 357, 370 - 371.