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**INTERNATIONAL STANDARD**



**3705**

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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**Sulphur for industrial use — Determination of arsenic content —  
Silver diethyldithiocarbamate photometric method**

*Soufre à usage industriel — Dosage de l'arsenic — Méthode photométrique au diéthylthiocarbamate d'argent*

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**Descriptors** : sulphur, chemical analysis, determination of content, arsenic, spectrophotometric analysis.

## FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3705 was drawn up by Technical Committee ISO/TC 47, *Chemistry*, and was circulated to the Member Bodies in January 1975.

It has been approved by the Member Bodies of the following countries :

Austria  
Belgium  
Brazil  
Bulgaria  
France  
Germany  
India

Ireland  
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Poland  
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Switzerland

Turkey

United Kingdom

U.S.S.R.

Yugoslavia

No Member Body expressed disapproval of the document.

# Sulphur for industrial use — Determination of arsenic content — Silver diethyldithiocarbamate photometric method

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a silver diethyldithiocarbamate photometric method for the determination of the arsenic content of sulphur for industrial use.

The method is applicable to products having arsenic contents equal to or greater than 0,5 mg/kg.

## 2 REFERENCE

ISO 2590, *General method for the determination of arsenic — Silver diethyldithiocarbamate photometric method.*

## 3 PRINCIPLE

Dissolution of a test portion in carbon tetrachloride. Oxidation by bromine and nitric acid.

Determination of the arsenic content by the method specified in ISO 2590.

## 4 REAGENTS

See clause 4 of ISO 2590.

However, replace reagent 4.1 (hydrochloric acid) by

### 4.1 Sulphuric acid, approximately 15 N solution.

Also, add the following reagents :

**4.9 Bromine**, solution containing 3 volumes of carbon tetrachloride and 2 volumes of bromine.

**4.10 Nitric acid**,  $\rho$  approximately 1,40 g/ml, about 68 % (m/m) solution.

## 5 APPARATUS

See clause 5 of ISO 2590.

## 6 SAMPLING AND PREPARATION OF TEST SAMPLE

Proceed in accordance with the appropriate International Standard.<sup>1)</sup>

Prepare a test sample from the laboratory sample by drying a sufficient quantity for 2 h in an oven maintained at about 80 °C. After cooling in a desiccator, grind until fine enough to pass through a sieve of nominal aperture 630  $\mu$ m.

## 7 PROCEDURE

**WARNING** — Because of the toxicity and unpleasant odour of pyridine, it is recommended that it should be handled with care and in a well-ventilated fume cupboard.

### 7.1 Test portion and preparation of test solution

Weigh to the nearest 0,1 g, about 5 g of the test sample (clause 6) and place in a beaker of suitable capacity (for example 400 ml).

In a well-ventilated fume cupboard, add 20 ml of the bromine solution (4.9). Allow to stand for 45 min and then add, drop by drop, while swirling gently, 25 ml of the nitric acid solution (4.10). During this operation, cool the beaker in an ice/water mixture to prevent a too rapid evolution of nitrous fumes. If the oxidation of sulphur is incomplete, the operation may be repeated using a few millilitres of the bromine solution (4.9) and of the nitric acid solution (4.10).

Heat in a boiling water bath to eliminate the excess bromine, carbon tetrachloride and nitric acid. If the solution is not clear, allow to cool, add a little of the nitric acid solution (4.10), and evaporate until no further nitrous fumes are evolved. Add a little water and evaporate again on a sand bath until white sulphuric acid fumes are evolved. Repeat this operation and fume for 10 min to remove the last traces of nitrous compounds. Allow to cool.

Dilute to about 80 ml with water and allow to cool.

1) Under study.

**7.1.1 Arsenic contents of between 0,5 and 10 mg/kg**

Transfer the test solution (7.1) quantitatively to a 100 ml one-mark volumetric flask, dilute to the mark and mix.

Transfer 40,0 ml of the solution to the conical flask of the glass apparatus for the determination of arsenic. Add 2 ml of the sulphuric acid solution (4.1).

**7.1.2 Arsenic contents of between 10 and 100 mg/kg**

Transfer the test solution (7.1) quantitatively to a 500 ml one-mark volumetric flask, dilute to the mark and mix.

Transfer 20,0 ml of the solution to the conical flask of the glass apparatus for the determination of arsenic. Add 10 ml of the sulphuric acid solution (4.1) and a sufficient quantity of water to give a total volume of about 40 ml.

**7.2 Blank test**

See 6.2 of ISO 2950.

**7.3 Preparation of the calibration graph**

See 6.3 of ISO 2590; in accordance with the note in that sub-clause, use 10 ml of the sulphuric acid solution (4.1) instead of 10 ml of the hydrochloric acid solution.

**7.4 Determination**

See 6.4 of ISO 2590.

**8 EXPRESSION OF RESULTS**

By means of the calibration graph (7.3), determine the mass of arsenic corresponding to the value of the photometric measurement during the determination.

The arsenic content, expressed as milligrams of As per kilogram, is given by the formula

$$\frac{m_1}{m_0} \times D$$

where

$m_0$  is the mass, in grams, of the test portion (7.1);

$m_1$  is the mass, in micrograms, of arsenic found in the determination;

$D$  is the ratio of the volume of the solution prepared according to 7.1.1 or 7.1.2 to the volume of the aliquot portion taken for the determination.

**9 TEST REPORT**

The test report shall include the following particulars :

- a) the reference of the method used;
- b) the results and the method of expression used;
- c) any unusual features noted during the determination;
- d) any operation not included in this International Standard or in the International Standard to which reference is made, or regarded as optional.

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ANNEX

ISO PUBLICATIONS RELATING TO SULPHUR FOR INDUSTRIAL USE

- ISO 2866 – Determination of total carbon content – Titrimetric method.
- ISO 3425 – Determination of ash content at 850-900 °C and of residue at 200 °C.
- ISO 3426 – Determination of loss in mass at 80 °C.
- ISO 3704 – Determination of acidity – Titrimetric method.
- ISO 3705 – Determination of arsenic content – Silver diethyldithiocarbamate photometric method.
- ISO 5793 – Determination of chloride content – Photometric method.