Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10636 was prepared by Technical Committee ISO/TC 42, *Photography*.

This first edition cancels and replaces ISO 419:1972 and ISO 3300:1976.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Introduction

0.1 This International Standard is one of a series that establishes criteria of purity for chemicals used in processing photographic materials. General test methods and procedures cited in this International Standard are compiled in parts 1, 3, 5, 7 and 10 of ISO 10349.

This International Standard is intended for use by individuals with a working knowledge of analytical techniques, which may not always be the case. Some of the procedures utilize caustic, toxic or otherwise hazardous chemicals. Safe laboratory practice for the handling of chemicals requires the use of safety glasses or goggles, rubber gloves and other protective apparel such as face masks or aprons where appropriate. Normal precautions required in the performance of any chemical procedure are to be exercised at all times but care has been taken to provide warnings for hazardous materials. Hazard warnings designated by a letter enclosed in angle brackets, < >, are used as a reminder in those steps detailing handling operations and are defined in ISO 10349-1. More detailed information regarding hazards, handling and use of these chemicals may be available from the manufacturer.

0.2 This International Standard provides chemical and physical requirements for the suitability of a photographic-grade chemical. The tests correlate with undesirable photographic effects. Purity requirements are set as low as possible consistent with these photographic effects. These criteria are considered the minimum requirements necessary to assure sufficient purity for use in photographic processing solutions, except that if the purity of a commonly available grade of chemical exceeds photographic processing requirements and if there is no economic penalty in its use, the purity requirements have been set to take advantage of the availability of the higher-quality material. Every effort has been made to keep the number of requirements to a minimum. Inert impurities are limited to amounts which will not unduly reduce the assay. All tests are performed on samples "as received" to reflect the condition of materials furnished for use. Although the ultimate criterion for suitability of such a chemical is its successful performance in an appropriate use test, the shorter, more economical test methods described in this International Standard are generally adequate.

Assay procedures have been included in all cases where a satisfactory method is available. An effective assay requirement serves not only as a safeguard of chemical purity but also as a valuable complement to the identity test. Identity tests have been included whenever a possibility exists that another chemical or mixture of chemicals could pass the other tests.

All requirements listed in clause 4 are mandatory. The physical appearance of the material and any footnotes are for general information only and are not part of the requirements.

0.3 Efforts have been made to employ tests which are capable of being run in any normally equipped laboratory and, wherever possible, to avoid tests which require highly specialized equipment or techniques. Instrumental methods have been specified only as alternative methods or alone in those cases where no other satisfactory method is available.

Over the past few years, great improvements have been made in instrumentation for various analyses. Where such techniques have equivalent or greater precision, they may be used in place of the tests described in this International Standard. Correlation of such alternative procedures with the given method is the responsibility of the user. In case of disagreement in results, the method called for in the specification shall prevail. Where a requirement states "to pass test", however, alternative methods shall not be used.

Photography — Processing chemicals — Specifications for anhydrous sodium thiosulfate and sodium thiosulfate pentahydrate

1 Scope

This International Standard specifies the purity requirements and describes the tests for photographic-grade anhydrous sodium thiosulfate and sodium thiosulfate pentahydrate.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 10349-1:1992, *Photography — Photographic-grade chemicals — Test methods — Part 1: General.*

ISO 10349-3:1992, *Photography — Photographic-grade chemicals — Test methods — Part 3: Determination of matter insoluble in ammonium hydroxide solution.*

ISO 10349-5:1992, *Photography — Photographic-grade chemicals — Test methods — Part 5: Determination of heavy metals and iron content.*

ISO 10349-7:1992, *Photography — Photographic-grade chemicals — Test methods — Part 7: Determination of alkalinity or acidity.*

ISO 10349-10:1992, *Photography — Photographic-grade chemicals — Test methods — Part 10: Determination of sulfide content.*

3 General

3.1 Physical properties

Anhydrous sodium thiosulfate ($Na_2S_2O_3$) exists in the form of a white powder and has a relative molecular mass of 158,09. Sodium thiosulfate pentahydrate ($Na_2S_2O_3 \cdot 5H_2O$) exists in the form of colourless crystals and has a relative molecular mass of 248,14.

3.2 Hazardous properties

Sodium thiosulfate is not hazardous when handled with normal precautions. Refer to the manufacturer for additional information.

3.3 Storage

Store in closed containers away from heat and moisture.

4 Requirements

A summary of the requirements is shown in table 1.

Table 1 — Summary of requirements

Test	Limit	Subclause	International Standard in which test method is given
Assay			
$Na_2S_2O_3$	97 % (*m/m*) min.	7.1	ISO 10636
$Na_2S_2O_3 \cdot 5H_2O$	99 % (*m/m*) min.	7.1	ISO 10636
	101 % (*m/m*) max.	7.1	ISO 10636
Insoluble matter (as precipitate of calcium, magnesium and ammonium hydroxides)	0,4 % (*m/m*) max. ($Na_2S_2O_3$)	7.2	ISO 10349-3
	0,2 % (*m/m*) max. ($Na_2S_2O_3 \cdot 5H_2O$)	7.2	ISO 10349-3
Heavy metals (as Pb)	0,002 % (*m/m*) max. ($Na_2S_2O_3$)	7.3	ISO 10349-5
	0,001 % (*m/m*) max. ($Na_2S_2O_3 \cdot 5H_2O$)	7.3	ISO 10349-5
Iron (as Fe)	0,005 % (*m/m*) max. ($Na_2S_2O_3$)	7.4	ISO 10349-5
	0,003 % (*m/m*) max. ($Na_2S_2O_3 \cdot 5H_2O$)	7.4	ISO 10349-5
Alkalinity (as NaOH)	0,06 % (*m/m*) max.	7.5	ISO 10349-7
Acidity (as H_2SO_4)	0,01 % (*m/m*) max.	7.6	ISO 10349-7
Sulfide (as S^{2-})	0,000 6 % (*m/m*) max. ($Na_2S_2O_3$)	7.7	ISO 10349-10
	0,000 4 % (*m/m*) max. ($Na_2S_2O_3 \cdot 5H_2O$)	7.7	ISO 10349-10
pH value	6,5 to 9,5	7.8	ISO 10636
Appearance of solution	Clear and free from insoluble matter except for a slight flocculence	7.9	ISO 10636

NOTE — *m*/*m* = mass/mass

5 Reagents and glassware

All reagents, materials and glassware shall conform to the requirements specified in ISO 10349-1 unless otherwise noted. The hazard warning symbols used as a reminder in those steps detailing handling operations are defined in ISO 10349-1. These symbols are used to provide information to the user and are not meant to provide conformance with hazardous labelling requirements as these vary from country to country.

6 Sampling

See ISO 10349-1.

7 Test methods

7.1 Assay

7.1.1 Specification

For anhydrous sodium thiosulfate, the content of $Na_2S_2O_3$ shall be 97 % (*m/m*) min.

For sodium thiosulfate pentahydrate, the content of $Na_2S_2O_3 \cdot 5H_2O$ shall be 99 % (*m/m*) min. and 101 % (*m/m*) max.

7.1.2 Reagents

7.1.2.1 Neutral formaldehyde solution (DANGER: < B >< C >< S >)[1], 37 %.

7.1.2.2 Iodine, standard volumetric solution of 0,05 mol/l (12,7 g/l)[2].

Weigh, to the nearest 0,001 g, 12,7 g of freshly sublimed iodine into a tared weighing flask. Add 36 g of potassium iodide and 100 ml of water. After solution is complete, add three drops of hydrochloric acid, and dilute to 1 litre in a volumetric flask at 20 °C. From the mass of iodine, m, calculate the concentration, c_I:

$$c_I = m/254$$

7.1.2.3 Salicylic acid solution, 1 % (10 g/l).

Prepare a solution of 1 g of salicylic acid in 100 ml of water.

7.1.2.4 Starch indicator solution, 5 g/l.

Stir 5 g of soluble starch with 100 ml of 1 % salicylic acid solution (7.1.2.3). Then add 300 ml to 400 ml of boiling water and boil until the starch dissolves. Finally, dilute to 1 litre with water.

7.1.3 Procedure

Weigh, to the nearest 0,001 g, a test portion of about 0,6 g of $Na_2S_2O_3$ or 1,0 g of $Na_2S_2O_3 \cdot 5H_2O$. Transfer to a conical flask and dissolve in about 50 ml of water. Add 5 ml of formaldehyde solution (7.1.2.1) (< B >< C >< S >) and titrate with the standard iodine solution (7.1.2.2). Add 5 ml of the starch indicator solution (7.1.2.4) near the end of the titration (slow discharges of yellow iodine colour) and continue titrating until the blue colour produced at the endpoint remains for at least 1 min.

7.1.4 Expression of results

The assay for anhydrous sodium thiosulfate, expressed as a percentage by mass of $Na_2S_2O_3$, is given by

$$31{,}6 \cdot c_I \cdot V/m$$

The assay for sodium thiosulfate pentahydrate, expressed as a percentage by mass of $Na_2S_2O_3 \cdot 5H_2O$, is given by

$$49{,}6 \cdot c_I \cdot V/m$$

where

c_I is the actual concentration, in moles per litre, of the iodine solution (7.1.2.2);

V is the volume, in millilitres, of the iodine solution (7.1.2.2) used for titrations;

m is the mass, in grams, of the test portion;

31,6 is the conversion factor of the equivalent mass of anhydrous sodium thiosulfate ($Na_2S_2O_3$) per mole of iodine (i.e. 158,1 × 2) × the conversion factor for millilitres to litres (i.e. 0,001) × 100 (for percentage);

49,6 is the conversion factor of the equivalent mass of sodium thiosulfate pentahydrate ($Na_2S_2O_3 \cdot 5H_2O$) per mole of iodine (i.e. 248,2 × 2) × the conversion factor for millilitres to litres (i.e. 0,001) × 100 (for percentage).

7.2 Insoluble matter (as a precipitate of calcium, magnesium and ammonium hydroxides)

7.2.1 Specification

Maximum content of insoluble matter for anhydrous sodium thiosulfate shall be 0,4 % (*m/m*).

Maximum content of insoluble matter for sodium thiosulfate pentahydrate shall be 0,2 % (*m/m*).

7.2.2 Procedure

Determine the percentage of insoluble matter in accordance with ISO 10349-3.

7.3 Heavy metals content

7.3.1 Specification

Maximum content of heavy metals for anhydrous sodium thiosulfate shall be 0,002 % (*m/m*).

Maximum content of heavy metals for sodium thiosulfate pentahydrate shall be 0,001 % (*m/m*).

7.3.2 Procedure

NOTE 1 The standard for the iron test (7.4) is prepared in the same way as the heavy metals standard.

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[1] Hazard warning codes are defined in ISO 10349-1:1992, clause 4.

[2] Commercially available analysed reagent is recommended. If solutions are to be prepared, see any quantitative analytical chemistry text. It is recommended that self-prepared iodine solutions be standardized before use.

Determine the percentage of heavy metals in accordance with ISO 10349-5. Use a test portion of 1,90 g to 2,10 g of $Na_2S_2O_3$ or 3,9 g to 4,1 g of $Na_2S_2O_3 \cdot 5H_2O$, prepared in accordance with ISO 10349-5:1992, 7.3. Use 4 ml of heavy metals standard prepared in accordance with ISO 10349-5:1992, 8.1.2.

7.4 Iron

7.4.1 Specification

Maximum content of iron for anhydrous sodium thiosulfate shall be 0,005 % (*m/m*).

Maximum content of iron for sodium thiosulfate pentahydrate shall be 0,003 % (*m/m*).

7.4.2 Procedure

Determine the percentage of iron in accordance with ISO 10349-5. Use a test portion of 0,90 g to 1,10 g of the sample prepared in accordance with ISO 10349-5:1992, 7.3. For $Na_2S_2O_3$, use 5 ml of iron standard; for $Na_2S_2O_3 \cdot 5H_2O$, use 3 ml of iron standard. Prepare the iron standard in accordance with ISO 10349-5:1992, 8.1.2.

7.5 Alkalinity (as NaOH)

7.5.1 Specification

Maximum alkalinity content for anhydrous sodium thiosulfate shall be 0,06 % (*m/m*).

Maximum alkalinity content for sodium thiosulfate pentahydrate shall be 0,06 % (*m/m*).

7.5.2 Procedure

Prepare a sample in accordance with ISO 10349-7 using a test portion of 4,9 g to 5,1 g. If the prepared sample turns pink when the indicator is added, determine the percentage alkalinity as sodium hydroxide using a factor K equal to 4,00 in the calculation.

7.6 Acidity (as H_2SO_4)

7.6.1 Specification

Maximum acidity content for anhydrous sodium thiosulfate shall be 0,01 % (*m/m*).

Maximum acidity content for sodium thiosulfate pentahydrate shall be 0,01 % (*m/m*).

7.6.2 Procedure

If the prepared sample in the alkalinity determination remains clear when indicator is added, determine the percentage acidity as sulfuric acid in accordance with ISO 10349-7. Use a factor K equal to 4,90 in the calculation.

7.7 Sulfide content (as S^{2-})

7.7.1 Specification

Maximum content of sulfur for anhydrous sodium thiosulfate shall be 0,000 6 % (*m/m*).

Maximum content of sulfur for sodium thiosulfate pentahydrate shall be 0,000 4 % (*m/m*).

7.7.2 Procedure

Determine the percentage of sulfide in accordance with ISO 10349-10. Use a test portion of 0,90 g to 1,10 g of $Na_2S_2O_3$ or 1,50 g to 1,70 g of $Na_2S_2O_3 \cdot 5H_2O$, prepared in accordance with clause 7 of ISO 10349-10:1992.

NOTE 2 When analysing S in $Na_2S_2O_3$, the sample weight and the volume of sulfide solution should be half of the values prescribed in ISO 10349-10:1992, table 1 (respectively).

7.8 pH value

7.8.1 Specification

The pH of the solution shall be between 6,5 and 9,5.

7.8.2 Apparatus

7.8.2.1 Electronic pH-meter, equipped with a glass electrode and standard reference electrode.

7.8.3 Procedure

Weigh, to the nearest 0,1 g, 10 g of the anhydrous sodium thiosulfate sample or 20 g of the sodium thiosulfate pentahydrate sample. Dissolve in 80 ml of freshly boiled and cooled water, and dilute to 100 ml. Measure the pH of the solution at 20 °C, using the pH-meter (7.8.2.1) in accordance with the manufacturer's instructions.

7.9 Appearance of solution

7.9.1 Specification

The solution shall be clear and free from insoluble matter except for a slight flocculence.

7.9.2 Procedure

Prepare a solution containing 200 g of the anhydrous sample or 40,0 g of the pentahydrate sample per litre of water and examine for clarity and sediment.