

INTERNATIONAL
STANDARD

ISO
3621

Second edition
1994-12-15

**Photography — Processing chemicals —
Specifications for sodium tetraborate
decahydrate**

*Photographie — Produits chimiques de traitement — Spécifications relatives au
tétraborate de sodium décahydraté*



Reference number
ISO 3621:1994(E)

ISO 3621:1994(E)**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 3621 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 3621:1976), which has been technically revised.

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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, 5 and 9 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 sodium tetraborate decahydrate

1 Scope

This International Standard establishes criteria for the purity of photographic-grade sodium tetraborate decahydrate and specifies the tests to be used to determine the purity.

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

ISO 10349-9:1992, *Photography — Photographic-grade chemicals — Test methods — Part 9: Reaction to ammoniacal silver nitrate*.

3 General

3.1 Physical properties

Sodium tetraborate decahydrate, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$, exists as either a white crystalline powder or granules. It has a relative molecular mass of 381,37.

3.2 Hazardous properties

Sodium tetraborate decahydrate is not hazardous when handled with normal precautions.

3.3 Storage

Sodium tetraborate decahydrate shall be stored in a closed container at room temperature.

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	99,0 % (m/m) min.	7.1	ISO 3621
Heavy metals (as Pb)	0,002 % (m/m) max.	7.2	ISO 10349-5
Iron (Fe)	0,003 % (m/m) max.	7.3	ISO 10349-5
Reaction to ammoniacal silver nitrate	To pass test	7.4	ISO 10349-9
pH	9,14 to 9,34	7.5	ISO 3621
Appearance of solution	Clear and free from insoluble matter except for a slight flocculence	7.6	ISO 3621
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

Content of $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ shall be 99,0 % (*m/m*) min.

7.1.2 Reagents

7.1.2.1 Mannitol, $\text{C}_6\text{H}_{14}\text{O}_6$.

7.1.2.2 Ethanol, $\text{C}_2\text{H}_5\text{OH}$, 95 % (*V/V*), denatured.

7.1.2.3 Methyl red indicator

Dissolve 0,1 g of methyl red in 100 ml of ethanol (7.1.2.2).

7.1.2.4 Phenolphthalein indicator, 5 g/l.

Dissolve 0,5 g of phenolphthalein in 50 ml of ethanol (7.1.2.2) then dilute to 100 ml with water. Filter if necessary.

7.1.2.5 Sodium hydroxide, NaOH , standard volumetric solution of 0,5 mol/l (20,00 g/l)¹⁾.

7.1.2.6 Sulfuric acid, H_2SO_4 (1 + 40)²⁾.

7.1.3 Apparatus

7.1.3.1 One-mark volumetric flask, of 1 litre capacity.

7.1.3.2 Pipette, of 50 ml capacity.

7.1.3.3 Burette, of 50 ml capacity.

7.1.4 Procedure

Weigh, to the nearest 0,01 g, a test portion of about 20 g of the test sample. Dissolve it in water in a 1 litre volumetric flask (7.1.3.1) then dilute to the mark and mix well. [This 20 g/l solution may be used for the pH (7.5) and appearance of solution (7.6) tests.] Using a pipette (7.1.3.2), transfer 50,0 ml of this solution to a 250 ml beaker and, with continuous stirring, add 50 ml of the sulfuric acid (7.1.2.6). Cover with a watch glass and boil gently for 10 min. Without cooling, rinse the watch glass into the beaker, add 6 drops of the methyl red indicator (7.1.2.3) and resume stirring. Using a pipette (7.1.3.2), add 50,0 ml of the sodium hydroxide (7.1.2.5). Using the burette (7.1.3.3), titrate the hot solution with the sodium hydroxide (7.1.2.5) until the colour changes from red to pale yellow but do not record the titre. Add about 15 g of mannitol (7.1.2.1), allow to dissolve, then add 12 drops of the phenolphthalein indicator (7.1.2.4). Then with the burette (7.1.3.3) refilled, titrate with the sodium hydroxide (7.1.2.5) to the endpoint when the red colour changes to yellow and then to a faint pink. Record and use this titre in the calculations.

7.1.5 Expression of results

The assay, expressed as a percentage by mass of $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ is given by

$$190,7 \cdot V \cdot c / m$$

where

c is the actual concentration, expressed in moles per litre, of the sodium hydroxide (7.1.2.5);

V is the volume, in millilitres, of the sodium hydroxide used to reach the endpoint for the titration (7.1.4);

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

190,7 is the conversion factor obtained from the mass of sodium tetraborate decahydrate equivalent to 1 mole of sodium hydroxide (i.e. 95,35/2; the reaction with mannitol generates 2 equivalents of acid to be titrated with sodium hydroxide per mole of sodium tetraborate) × the conversion factor for millilitres to litres (i.e. 0,001) × the sampling factor (i.e. 20) × 100 (for percentage).

1) Commercially available analysed reagent is recommended. The solution can be prepared from sodium hydroxide pellets, (DANGER: <<C>>). (Hazard warning codes are defined in ISO 10349-1.)

2) The solution is prepared from concentrated sulfuric acid, $\rho = 1,84$ g/ml (DANGER: <<C>>).

7.2 Heavy metals content (as Pb)

7.2.1 Specification

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

7.2.2 Procedure

NOTE 1 The standard for the iron test (7.3) is prepared in the same way as the heavy metals standard.

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 the sample prepared in accordance with ISO 10349-5:1992, 7.2. Use 4 ml of the heavy metals standard prepared in accordance with ISO 10349-5:1992, 8.1.1.

7.3 Iron content

7.3.1 Specification

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

7.3.2 Procedure

Determine the percentage of iron in accordance with ISO 10349-5. Use a test portion of 1,90 g to 2,10 g of the sample prepared in accordance with ISO 10349-5:1992, 7.2. Use 6 ml of the iron standard prepared in accordance with ISO 10349-5:1992, 8.1.1.

7.4 Reaction to ammoniacal silver nitrate

7.4.1 Specification

The material shall pass the test.

7.4.2 Procedure

Determine the reaction to ammoniacal silver nitrate in accordance with ISO 10349-9.

7.5 pH value

7.5.1 Specification

The pH shall be between 9,14 and 9,34.

7.5.2 Apparatus

Usual laboratory apparatus and, in particular, the following.

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

7.5.3 Procedure

Use a sample of about 100 ml of the 20 g/l solution prepared in the assay procedure (7.1.4). Measure the pH of the solution at 20 °C, using the pH-meter (7.5.2.1) in accordance with the manufacturer's instructions.

7.6 Appearance of solution

7.6.1 Specification

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

7.6.2 Procedure

Inspect the 20 g/l solution of the sample prepared in the assay procedure (7.1.4). Observe the solution for colour and clarity.

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