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IODIZED FOOD GRADE SALT – SPECIFICATION

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Iodized food grade salt — Specification



Table of contents

1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Quality requirements	2
4.1	General requirements	2
4.2	Specific requirements	2
5	Fortification requirements	3
5.1	Levels of iodine	3
5.2	Fortificants	3
6	Food additives	4
7	Hygiene	4
8	Contaminants	4
8.1	Heavy metals	4
8.2	Pesticide residues	4
9	Packaging	4
10	Marking and labelling	4
11	Methods of sampling	5
	Annex A (normative) Method for sampling of edible salts	6
	Annex B (normative) Determination of the chloride content, calculated as sodium chloride	9
	Annex C (normative) Determination of copper content	11
	Annex D (normative) Determination of alkalinity	12
	Annex E (normative) Determination of acid insoluble ash	13
	Annex F (informative) Iodine deficiency: The extent of the problem	14
	Bibliography	16

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Introduction

Iodine is a trace element that is critical for the production of thyroid hormones, which are essential in adults and during foetal life and childhood, when it supports the normal development of the brain and other organs and control of metabolic processes in the body [1,2]. Iodine may have other key roles in the body, although these are not yet fully understood [3,4].

Most countries in the world are affected by iodine deficiency to some extent, and therefore it remains a major threat to the health and development of populations worldwide; particularly among pre-school children and pregnant women in low-income countries [2,5–10]. Iodine deficiency results in hypothyroidism that can occur at any stage of life, but its most devastating consequences take place during foetal development and childhood, with stillbirth, miscarriages, poor growth and cognitive impairment. While cretinism is the most extreme manifestation, of considerably greater significance are the more subtle degrees of mental impairment that lead to poor school performance, reduced intellectual ability and impaired work capacity. Iodine deficiency of the foetus is the result of iodine deficiency in the mother. The condition is associated with: abortions; stillbirths; congenital anomalies; increased perinatal mortality; increased infant mortality; neurological cretinism (mental deficiency, deaf mutism, spastic diplegia, squint); myxedematous cretinism (dwarfism, mental deficiency); and psychomotor defects. For neonates, iodine deficiency causes neonatal goitre and neonatal hypothyroidism. For children and adolescents, iodine deficiency causes: goitre; juvenile hypothyroidism; impaired mental function; and retarded physical development. Iodine deficiency in adults result in goitre with its complications; hypothyroidism; impaired mental function and iodine induced hyperthyroidism. The reduced mental function affects communities' capacity for initiative and decision-making is a major block to the human and social development [10].

It is reported that over two billion people worldwide are at risk of suffering from the spectrum of Iodine Deficiency Disorders (IDD) where 1-10% will suffer cretinism; 5-30% will have some sort of brain damage or neurological impairment and 30-70% will be hypothyroid [11].

Universal salt iodization (USI) is the main intervention strategy for iodine deficiency control, and was adopted by the International Conference on Nutrition in 1992, reaffirmed by the World Health Assembly in 1993, and established as a World Summit for Children mid-decade goal in 1995 [2,6–9,11]. However, to be fully effective in correcting iodine deficiency, salt must not only reach the entire affected population — in particular those groups that are the most susceptible; pregnant women and young children — but it also needs to be adequately iodized. Salt iodization is the preferred strategy for control of iodine deficiency disorders and is implemented in more than 120 countries around the world covering over 71 % of the population. Many countries worldwide have successfully eliminated iodine deficiency disorders or made substantial progress in their control, largely as a result of salt iodization. Four inorganic compounds are used as iodide sources, depending on the producer: potassium iodate, potassium iodide, sodium iodate, and sodium iodide. Any of these compounds supplies the body with its iodine required for the biosynthesis of thyroxine (T₄) and triiodothyronine (T₃) hormones by the thyroid gland. Salt is considered an appropriate vehicle for fortification with iodine, for the following reasons: (i) it is widely consumed by virtually all population groups in all countries, with little seasonal variation in consumption patterns, and salt intake is proportional to energy intake/requirements; (ii) in many countries, salt production is limited to a few centres, facilitating quality control; (iii) the technology needed for salt iodization is well established, inexpensive and relatively easy to transfer to countries around the world; (iv) addition of iodate or iodide to salt does not affect the taste or smell of the salt or foods containing iodized salt, and therefore consumer acceptability is high; (v) iodine (mainly from iodate) remains in processed foods that contain salt as a main ingredient, such as bouillon cubes, condiments and powder soups, and hence these products become sources of iodine; and (vi) iodization is inexpensive. Additionally, the concentration of iodine in salt can easily be adjusted to meet policies aimed at reducing the consumption of salt in order to prevent cardiovascular disease.

This African Standard is a technical revision of the earlier ARS 471:1987(E), *Food grade salt — Specification* which is hereby superseded and cancelled. This African Standard has benchmarked with relevant provisions of Codex Stan 150:1985(R2012), *Standard for Food Grade Salt*.

ENQUÊTE PUBLIQUE N° 19

Iodized food grade salt — Specification

1 Scope

This African Standard specifies the requirements, methods of sampling and test for iodized food grade salt: coarse salt, crushed salt and table salt intended for human consumption. Salt from other origins, and notably the salt which is a by-product of chemical industries, are excluded.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

AOAC¹ Official Method 935.14, *Iodine in Mineral Mixed Feeds — Elmslie–Caldwell Method*

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

CODEX Stan 192, *General standard for food additives*

CAC/GL 1, *General guidelines on claims*

CAC/GL 2, *Guidelines on nutrition labelling*

CAC/GL 23, *Guidelines for use of nutrition and health claims*

ISO 2479, *Sodium chloride — Determination of matter insoluble in water or in acid and preparation of principal solutions for other determinations*

ISO 2480, *Sodium chloride for industrial use — Determination of sulphate content — Barium sulphate gravimetric method*

ISO 2482, *Sodium chloride — Determination of calcium and magnesium contents — EDTA complexometric methods*

ISO 2483, *Sodium chloride — Determination of moisture content (loss of mass at 110 °C)*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

3 Terms and definitions

For the purpose of this standard the following terms and definitions apply.

3.1

food grade salt

crystalline product consisting predominantly of sodium chloride, which is obtained either from the sea, underground rock salt deposits or from natural brine.

3.2

coarse salt

predominantly sodium chloride product which is crystalline solid mainly of white, pale pink, or light grey colour

¹ AOAC — Association of Official Analytical Chemists (AOAC International)

ARS 471:2016(E)

3.3

dried crushed salt

salt obtained by drying and crushing coarse salt

3.4

table salt

predominantly white crystalline sodium chloride product suitably coated with free flowing agents such as light magnesium carbonate, calcium carbonate, tricalcium phosphate or calcium silicate, so as to retard moisture absorption, caking and to impart the free flowing property to the salt.

3.5

iodated food grade salt

salt to which micronutrients have been added in accordance with this standard

3.6

food additive

any substance not normally consumed as food by itself and not normally used as a typical ingredient of the food, irrespective of its nutritive value, the intentional addition of which is for a technological (including organoleptic) purpose in the manufacture, processing, preparation and treatment of the food

3.7

anti-caking agent

substances that are mixed, in small quantities with salt to coat it and reduce its tendency to cake, and thereby impart to it a free-flowing property, such as magnesium carbonate, calcium carbonate, tricalcium phosphate, calcium silicate or sodium ferrocyanide

3.8

fortificant

a compound which contains the specified micronutrient intended to be added to a food vehicle

3.9

food fortification

the practice of deliberately adding essential micronutrients in a food to improve the nutritional quality of the food and to provide a public health benefit with minimal risk to health

3.10

food grade non-absorbent material

material which safeguard the hygienic, nutritional, technological and organoleptic qualities of the products

4 Quality requirements

4.1 General requirements

4.1.1 Visible impurities

Iodized food grade salt shall be practically free from grit and other extraneous adulterants when visually examined.

4.1.2 Particle size for table and fine salt

Iodized food grade table salt shall be free flowing. 85 % of the material shall pass through a 1.00 mm (1000 micron sieve and not more than 20 % by mass of the material shall pass through a 0.212 mm or a 212-micron sieve.

4.2 Specific requirements

Iodized food grade salt shall also conform to the requirements in Table 1.

Table 1 — Compositional requirements for iodized food grade salt

Characteristics	Requirements			Method of test
	Coarse salt	Crushed salt	Table salt	
Chloride content as NaCl, % on dry matter basis, min	96.0	96.0	97.0	Annex B
Moisture content, drying at 105 °C, % m/m, max.	4	4	3	ISO 2483
Matter insoluble in water, % on dry matter basis, max.	1	1	0.2	ISO 2479
Calcium (as Ca) water soluble, % on dry matter basis, max.	0.5	0.5	0.10	ISO 2482
Copper, (as Cu), mg/kg, on dry matter basis, max.	2.0	2.0	2.0	Annex C
Magnesium (Mg) water-soluble, % on dry matter basis, max.	0.5	0.5	0.10	ISO 2482
Sulphate (as SO ₄), % on dry matter basis, max.	0.5	0.5	0.50	ISO 2480
Total alkalinity (as Na ₂ CO ₃), % max, m/m	0.5	0.5	0.20	ANNEX D
Acid insoluble matter % m/m, max.	—	—	0.2	Annex E
pH of solution, 20 g in 100 ml distilled water	7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	Laboratory pH meter.

5 Fortification requirements

5.1 Levels of iodine

Food grade salt shall be iodized with potassium iodate to conform to the iodine levels provided in Table 2 when determined in accordance with any of the methods listed in Codex stan 150 or AOAC 935.14.

Table 2 — Required levels of iodine in iodized food grade salt

Nutrient	Recommended factory level /border point	Requirement, mg/kg	
		Regulatory levels	
		Minimum	Maximum
Iodine	40±5	30	60

5.2 Fortificants

The fortificant for addition of iodine in salt shall be potassium iodate² which shall conform to any of the following:

- British Pharmacopoeia (BP)
- Food Chemical Codex (FCC)
- Merck Index (MI)

² Although iodate is more stable, either potassium iodate (KIO₃) or iodide (KI) can be used. Iodide may be used for dry, low crystal size and washed or refined salts. While iodate can be used alone and in any type of salt quality, iodide is used in very good quality salt and cannot be added alone. Therefore, some salt producers add sodium carbonate or sodium bicarbonate when they iodize salt, to increase alkalinity, and sodium thiosulfate or dextrose to stabilize potassium iodide. Without a stabilizer, potassium iodide may be oxidized to iodine and lost by volatilization from the product [2].

ARS 471:2016(E)

- iv) United States National Formulary (USNF)
- v) European Pharmacopoeia (Ph Eur)
- vi) United States Pharmacopoeia (USP)
- vii) FAO/WHO Codex Alimentarius Commission (CAC)

6 Food additives

Iodized food grade salt may contain food additives in accordance with CODEX STAN 192.

7 Hygiene

Iodized food grade salt shall be produced, prepared and handled in accordance with ARS 53.

8 Contaminants

8.1 Heavy metals

Iodized food grade salt shall conform to those maximum limits for heavy metals established in CODEXSTAN 193.

8.2 Pesticide residues

Iodized food grade salt shall conform to those maximum residue limits established by the Codex Alimentarius Commission for this product.

9 Packaging,

9.1 Iodized food grade salt shall be packaged in food grade, non-absorbent materials.

NOTE Bags that have already been used for packaging other articles such as fertilizers, cement, and chemicals shall not be reused for packaging iodised salt.

9.2 The distribution network shall be streamlined so as to reduce the interval between iodisation and consumption of salt.

9.3 Iodized food grade salt shall not be exposed to rain, excessive humidity or direct sunlight at any stage of storage, transportation or sale.

9.5 Bags of iodized food grade salt shall be stored only in covered rooms or warehouses that have adequate ventilation.

10 Marking and labelling

10.1 General

In addition to the requirements in ARS 56, each package shall be legibly and indelibly marked with the following:

10.2 Name of product

10.2.1 The name of the product shall be "Iodized food grade salt", "Iodized food grade salt" or "Iodized edible salt". The name shall have in its close proximity a declaration of either coarse salt or, crushed salt or table salt. Where salt is also used as a carrier for other nutrients, the name of the product shall be indicated on the label for example "Salt iodized with vitamins" or "Salt iodized with Iron"

10.2.2 The term "dendritic" shall only be used when ferrocyanide salts have been added to the salt during production.

NOTE Dendritic refers to the branched nature of the crystal of the salt due to addition of ferrocyanide salts.

10.2.3 An indication of either the origin, according to the definition in Clause 3, or the method of production may be declared on the label, provided such indication does not mislead or deceive the consumer.

10.2.4 The following information shall be shown on the label:

- a) name and physical address of the manufacturer's/importer/ distributor/packer;
- b) net content of the package in metric units;
- c) lot or batch number in code or clear format;
- d) brand or registered trademark; if any;
- e) date marking to show shelf life of salt;
- f) level of iodine in mg/100g;
- g) caution label "**salt must be stored in a cool and dry place**";
- h) country of origin; and
- i) complete list of ingredients including food additives in descending order of proportions.

10.3 Nutrition and health claims

Iodized food grade salt may have claims on the importance of the minerals in nutrition and health. Such claims when declared shall be consistent with CAC/GL 1 and CAC/GL 23.

11 Methods of sampling

Sampling shall be done in accordance with Annex A.

Annex A
(normative)

Method for sampling of edible salts

A.1 Scope

This method specifies the sampling procedure to be applied when determining the main component in order to assess the quality of sodium chloride (salt).

The criterion to be used for acceptance or rejection of a lot or consignment on the basis of this sample is also provided.

A.2 Field of application

This method is applicable to the sampling of any type of salt intended for use as food, either pre-packed or in bulk.

A.3 Principle

This method represents a variable sampling procedure for mean quality: blended bulk sample analysis.

A blended bulk sample is produced in such a way that it is representative of the lot or consignment. It is composed of a proportion of items drawn from the lot or consignment to be analyzed.

Acceptance criterion is on the basis that the mean value obtained from analyses of those blended bulk samples must comply with the provision in the Standard.

A.4 Definitions

The terms used in this sampling method refer to those in the "Instructions on Codex Sampling Procedures" (CX/MAS 1-1987).

A.5 Equipment

The sampling equipment used shall be adapted to the nature of the tests to be carried out (for example: sampling by borer and sampling equipment made of chemically inert material). The containers used for collecting the samples shall be made of a chemically inert material and should be air-tight.

A.6 Procedure

A.6.1 Pre-packed Salt

Sampling may be carried out by "random sampling" or by "systematic sampling". The choice of the method to be used depends on the nature of the lot (for example: if the packages are marked with successive numbers, systematic sampling may be suitable).

A.6.1.1 Random sampling

Draw the n items from the lot in such a way that each item in the lot has the same chance of being selected.

A.6.1.2 Systematic sampling

If the N units in the lot have been classified and can be numbered from 1 to N , the 1-in- k systematic sampling of n items can be obtained as follows:

- a) Determine the k value as $k = N/n$. (If k is not an integer, then round to the nearest integer).
- b) From the first k items in the lot take one at random and then make every k^{th} item thereafter.

A.6.2 Salt in bulk

Here, the lot is fictitiously divided into items (strata); a lot with a total mass of m kg is considered to be composed of m/100 items. In this case, it is necessary to draw up a "stratified sampling" plan appropriate to the lot dimension. The samples are selected from all the strata in proportion to the stratum sizes.

NOTE Stratified sampling of a population which can be divided into different subpopulations (called strata) is carried out in such a way that specified proportions of the sample are drawn from the different strata.

A.6.3 Constitution of the sample

A.6.3.1 The size and the number of the items forming the sample depend on the type of salt and the lot magnitude. The minimum size to be taken into account should be in accordance with one of the following specifications according to the circumstances:

- 250 g of salt in bulk or pre-packed in more than 1 kg packages;
- one package for pre-packed salt in 500 g or 1 kg packages.

Concerning the number of samples to be drawn from the lot, an example of minimum sample number that would be picked up, can be found in the document CX/MAS 1-1987, Appendix V, Table 3, taking into account the magnitude of the lot and appropriate inspection level, in this case generally level 4 (see paragraph 8.4 in the same document).

A.6.3.2 Combine and mix well the different items drawn from the lot. This blended bulk sample constitutes the laboratory sample. More than one laboratory sample may be composed in such a manner.

A.7 Acceptance criterion

A.7.1 Determine the NaCl content (%) of at least two test portions of the laboratory sample.

A.7.2 Calculate the average of the results obtained for the n test portions of the laboratory sample using:

$$= \frac{\sum x(n \geq 2)}{n}$$

A.7.3 In accordance with the provision for the relevant NaCl content (%), a lot or a consignment shall be considered acceptable if the following condition is verified: $x \geq$ minimum level specified

A.8 Sampling report

The sampling report should contain the following information:

- a) type and origin of the salt;
- b) alterations of state of the salt (e.g. presence of foreign matter);
- c) date of sampling;
- d) lot or consignment number;
- e) method of packing;

ARS 471:2016(E)

- f) total mass of lot or consignment;
- g) number, unit mass of packages and whether the mass is given net or gross;
- h) number of items sampled;
- i) number, nature and initial position of sampled items;
- j) number, composition and mass of the bulk sample(s) and the method used to obtain and conserve it (them);
- k) names and signature of people who have carried out the sampling.

A.9 Basic reference

Document CX/MAS 1-1987.

A.10 Remark

"Laboratory sample" is the "blended bulk sample" described in CX/MAS 1-1987, Appendix IV, paragraph 4-B.

Annex B (normative)

Determination of the chloride content, calculated as sodium chloride

B.1 Apparatus

Normally available laboratory glassware.

B.2 Reagents

B.2.1 Potassium chromate solution.

Dissolve 5 g of potassium chromate (K_2CrO_4) in 100 ml of water.

B.2.2 Standard 0.1 N silver nitrate solution

B.2.2.1 Preparation

Dissolve 17.0 g of silver nitrate ($AgNO_3$) in 1 000 ml of water. Store the solution in the dark.

B.2.2.2 Standardization

Carry out the standardization in triplicate.

Weigh out accurately 5.8 g of analytical reagent grade sodium chloride ($NaCl$) (previously dried at $200\text{ }^{\circ}\text{C} \pm 50\text{ }^{\circ}\text{C}$ for 2 h and cooled to room temperature in a desiccator) into a 1 L volumetric flask and dissolve it in approximately 200 ml of water. Adjust the temperature of this solution to $20\text{ }^{\circ}\text{C}$ and dilute it to 1 000 ml with water at the same temperature. Pipette 25 ml of the sodium chloride solution at $20\text{ }^{\circ}\text{C}$ into a 250 ml conical flask, add 1 ml of potassium chromate solution, and titrate with the 0.1 N silver nitrate solution until a faint reddish-brown colour persists after brisk shaking. Carry out a blank titration using the same procedure but replacing the 25 ml sodium chloride solution with 25 ml water.

Calculate the mean normality of the silver nitrate solution from the triplicate determinations.

$$N = \frac{A \times 0.4277}{b - c}$$

where

N is the normality of silver nitrate solution;

A is the mass of sodium chloride, in grams, in 1 000 ml solution;

b is the volume of silver nitrate solution, in millilitres, required to titrate 25 ml of sodium chloride solution;

c is the volume of silver nitrate solution, in millilitres, required to titrate the blank.

NOTE A commercially prepared volumetric solution may be used instead.

B.3 Procedure

Carry out the determination in triplicate on each of the test samples.

Pipette 50 ml of the principal solution prepared in accordance with ISO 2479 at $20\text{ }^{\circ}\text{C}$, into a 250 ml volumetric flask and dilute to 250 ml with water at the same temperature. Mix well and pipette 25 ml of this solution at $20\text{ }^{\circ}\text{C}$ into a 250 ml conical flask. If the solution is acid to litmus, neutralize with sodium bicarbonate solution; if the solution is alkaline, add dilute nitric acid (1:10) drop by drop until the

ARS 471:2016(E)

solution is acid to litmus and then neutralize with sodium bicarbonate solution. Add 1 ml of potassium chromate solution and titrate with the standard 0.1 N silver nitrate solution until a faint reddish-brown colour persists after brisk shaking.

B.4 Calculation

Calculate the chloride content as NaCl, on a moisture-free basis (and free-flowing agent-free basis, where relevant), as a percentage, as follows:

$$C = \frac{a \times N \times 1169}{B}$$

where

- C is the chloride content, as NaCl, expressed as a percentage (by mass);
- a is the volume of silver nitrate solution, in millilitres, used in the titration;
- N is the normality of the silver nitrate solution;
- B is the mass of sample, in grams, in 1 000 ml principal solution, corrected for moisture content and, where relevant, the drier content.

B.5 Report

Report the chloride content of each test sample as the mean of its triplicate determinations.

Annex C (normative)

Determination of copper content

C.1 Apparatus

Nessler cylinders — 50 ml capacity

C.2 Reagents

C.2.2.1 Citric acid solution — 20 percent aqueous.

C.2.2.2 Ammonium hydroxide — Sp.gr. 0.90.

C.2.2.3 Sodium diethyldithiocarbamate solution

Dissolve 1 g of sodium diethyldithiocarbamate in 1000 ml of water. Keep in amber bottle and protect from strong light.

C.2.2.4 Standard copper solution

Dissolve 0.392 g of copper sulphate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) in water. Make up the volume with water to 1 000 ml. When required for use, pipette 10 ml of the solution into a 1 000 ml volumetric flask and dilute up to the mark with water. One millilitre of this solution contains 0.001 mg of copper (as Cu).

C.3 Procedure

Dissolve 2 g of the dried material in 10 ml of water in a cylinder; add 5 ml of citric acid solution, 2 ml of ammonium hydroxide and 10 ml of sodium diethyldithiocarbamate solution. Dilute to the mark and mix well. In the other Nessler cylinder carry out a control test using 4 ml of standard copper solution proceeding exactly as with the sample.

The limit prescribed in Table 1 shall be taken as not having been exceeded if the intensity of the colour developed with the sample is not greater than that obtained in the control test.

Annex D
(normative)

Determination of alkalinity

D.1 Reagents

D.1.1 Standard Hydrochloric Acid — 0.1 N.

D.1.2 Methyl orange indicator

Dissolve 0.1 g of methyl orange in 100 ml of water.

D.2 Procedure

D.2.1 Procedure for common salt

Pipette out 100 ml of the solution preserved in D.1.2 and titrate against standard hydrochloric acid using methyl orange as indicator.

Transfer about 20 g of the prepared sample, accurately weighed, in a 100 ml measuring flask through a funnel. Wash the funnel in the flask with carbon dioxide-free distilled water and fill it to the mark with that water. Shake the flask well till all the salt goes into solution (undissolved magnesium carbonate will remain in suspension).

Shake it well and filter first 10 ml to 15 ml of the solution through Whatman filter paper No. 1 and discard the filtrate. Then filter the remaining solution and titrate 50 ml of the solution so obtained against standard hydrochloric acid using methyl orange as indicator.

D.3 Calculation

Alkalinity (as Na_2CO_3), per cent by mass:

$$\text{For common salt} = \frac{5.3V}{m}$$

$$\text{For table salt and food industry salt} = \frac{1.06V}{m}$$

where

V = volume in ml of standard hydrochloric acid used in the titration, and

m = mass in g of the prepared sample taken for the test

Annex E (normative)

Determination of acid insoluble ash

(Carry out this test for free-flowing table salt only)

E.1 Reagents

E.1.1 Dilute hydrochloric acid

E.1.2 Concentrated hydrochloric acid

E.2 Procedure

Transfer for residue obtained in D.1.2 into a beaker. Alternatively, transfer the sintered crucible itself with the residue to 100 ml beaker, and add 15 ml to 20 ml of water and 25 ml of concentrated hydrochloric acid so that the sinter base is immersed in the acid. Heat to boiling for 10 min to 15 min so that practically all the residue and drier have decomposed with the acid. Remove the sintered crucible from the beaker (if it is transferred to the beaker) and wash the crucible with water. Evaporate the extract and wash solution together to dryness and transfer the solid residue with 25 ml of dilute hydrochloric acid (1:1).

Filter on a filter paper (Whatman No. 41 or equivalent), wash the precipitate first with warm dilute hydrochloric acid (1:20) and then with hot water until washings are free from chloride. Dry the residue and ignite in a silica crucible. Heat strongly at red heat for 1 h. Cool and weigh.

NOTE If silicate drier is not used, acid-insoluble residue will be very low for accurate weighing. In that case, repeat with 50 g of dried material.

E.3 Calculation

$$\text{Acid insoluble matter, per cent by mass} = 100 \times \frac{m_1}{m_2}$$

where

m_1 = mass in g of the residue, and

m_2 = mass in g of the dried sample taken for the test.

Annex F (informative)

Iodine deficiency: The extent of the problem

Most countries in the world are affected by iodine deficiency to some extent, and therefore it remains a major threat to the health and development of populations worldwide; particularly among pre-school children and pregnant women in low-income countries. Iodine deficiency results in hypothyroidism that can occur at any stage of life, but its most devastating consequences take place during foetal development and childhood, with stillbirth, miscarriages, poor growth and cognitive impairment. While cretinism is the most extreme manifestation, of considerably greater significance are the more subtle degrees of mental impairment that lead to poor school performance, reduced intellectual ability and impaired work capacity. For iodine-deficient communities, between 10 and 15 intelligence quotient (IQ) points may be lost when compared to similar, but noniodine-deficient populations. The adverse effects of iodine deficiency on cognitive performance and motor function may be partly reversible, as shown in moderately iodine-deficient school-age children following iodine supplementation.

Iodine deficiency is the world's greatest single cause of preventable brain damage, and also the primary motivation behind the current worldwide drive to eliminate iodine deficiency.

Universal salt iodization (USI) is the main intervention strategy for iodine deficiency control, and was adopted by the International Conference on Nutrition in 1992, reaffirmed by the World Health Assembly in 1993, and established as a World Summit for Children mid-decade goal in 1995. Salt has been chosen as a vehicle, because of its widespread consumption and the extremely low cost of iodization. In high-risk areas, where populations cannot easily be reached by iodized salt, the alternative is to administer iodine supplements – either as iodide or as iodized oil – focusing on women and children.

Until the early 1980s, only a few countries were known to be affected by iodine deficiency, but over the last two decades, knowledge of the global magnitude of iodine deficiency has improved considerably.

Urinary iodine concentration (UIC) is currently the most widely used biochemical marker of iodine nutrition [8]. As most iodine ingested by the body is excreted in the urine (>90%), UIC reflects iodine intake at the time of measurement. By measuring UIC in the population, it can be determined if iodine requirements are being met, and thus, whether a population is at risk of iodine deficiency.

Table F.1 provides the criteria to define the public health significance of iodine deficiency based on median UIC [1,8].

Table F.1 — Classification of iodine deficiency as a public health problem in a population

Median UIC (µg/l)	Corresponding iodine intake (µg/day)	Iodine intake	Iodine status
<20	<30	Insufficient	Severe iodine deficiency
20–49	30–74	Insufficient	Moderate iodine deficiency
50–99	75–149	Insufficient	Mild iodine deficiency
100–199	150–299	Adequate	Adequate iodine nutrition
200–299	300–499	Above requirements	Risk of iodine-induced hyperthyroidism in susceptible groups
≥300	>499	Excessive	Risk of adverse health consequences (iodine-induced hyperthyroidism, autoimmune thyroid disease)

Until the 1990s, total goitre prevalence (TGP) in school-age children was the primary indicator for the assessment of functional consequences of iodine deficiency in the population [8]. Thyroid size was traditionally determined by palpation, but the reliability of this method is limited by high inter-observer and intra-observer variations. The measurement of thyroid size by ultrasound has therefore been an

important step in the detection of mild-to-moderate iodine deficiency. International reference values for normal thyroid size are now available from iodine-sufficient children [12]. Because TGP is not a sensitive indicator of recent changes in iodine status in the population, it is currently recommended for the baseline assessment of iodine status, but not as the main indicator for regular monitoring of the response to an intervention. A TGP of $\geq 5\%$ in school-age children indicates a public health problem [8].

Because the effects of iodine deficiency are most critical during brain development, iodine sufficiency is critical in the infant and young child, especially in the foetus [11]. Sufficient iodine intake during pregnancy is essential, and surveillance of pregnant women is now recommended by WHO, alongside surveillance of school-age children [8]. Pregnant women have higher iodine requirements, since they must ingest enough iodine for themselves and for the developing foetus. The normal range for the median UIC is therefore higher for pregnant women than for the general population. Reference ranges for UIC during pregnancy are listed in Table F.3.

Table F.2 — Recommended iodine intakes for individuals [8]

Population group	Age	Recommended iodine intake ($\mu\text{g/day}$)
Infants	0–59 months	90
School-age children	6–12 years	120
Adolescents and adults	>12 years	150
Pregnant and lactating women	14–50 years	250

Table F.3 — Classification of iodine deficiency as public health problem in pregnant women [8]

Median UIC ($\mu\text{g/l}$)	Iodine intake	Iodine status
<150	Insufficient	Iodine deficiency
150–249	Adequate	Adequate iodine nutrition
250–499	Above requirements	No added health benefits
≥ 500	Excessive	No added health benefits

Strategies for the Control of Iodine Deficiency

The recommended strategy for the control of iodine deficiency is universal salt iodization (USI), which requires the iodization of all salt for both human and animal consumption. The success of USI lies in the fact that it is a cost-effective and sustainable method for delivering iodine to the population. In countries where there are many small local salt producers, implementation of USI is more challenging, but still achievable. Distribution of iodized salt to impoverished and geographically remote areas may require extra efforts, but it is vital for the goal of covering more than 90% of households. Nationally, representative monitoring is important to identify pocket areas within countries not reached by USI. Global efforts to strengthen USI were initiated in 1998. The remarkable impact on iodine deficiency between 1993 and 2003 must be attributed to these efforts.

More recently, concerns have been raised about the potential for mixed messages created by campaigns to reduce salt intake and those to consume iodized salt [13]. It has been recommended that the amount of iodine added to salt may need to be adjusted depending on the recommended level of salt intake within a country, and that these two public health messages need to be coordinated [14]. This highlights the importance of assessing a population's salt consumption, since too little or too much iodine ingested may have health consequences in the population. This also makes regulation an important component of any USI program.

An alternative to USI is iodine supplementation. This strategy is more costly, but is the only option in areas of severe endemicity or where USI cannot be implemented. A recent WHO report recommends that where USI is not fully implemented, the most vulnerable population groups – pregnant women and young infants – be given additional iodine supplied through targeted supplementation [8]. Options for supplementation include iodized oil, which is given yearly or as daily iodine supplements.

Bibliography

- [1] Pearce, E.N. (2017) Iodine Deficiency Disorders and Their Elimination [Internet]. 1st Ed. Springer International Publishing, Cham, Switzerland.
- [2] WHO. (2014) Guideline: Fortification of Food-Grade Salt With Iodine for the Prevention and Control of Iodine Deficiency Disorders [Internet]. Department of Nutrition for Health and Development, World Health Organization, Genève, Switzerland.
- [3] Brownstein, D. (2014) Iodine: Why You Need It, Why You Can't Live Without It [Internet]. 5th Ed. Medical Alternatives Press, West Bloomfield, Michigan, USA.
- [4] Sircus, M. (2011) Iodine: Bringing Back the Universal Medicine. 2nd Ed. International Medical Veritas Association.
- [5] Hetzel, B.S. (2005) Towards the Global Elimination of Brain Damage Due to Iodine Deficiency: The Role of the International Council for Control of Iodine Deficiency Disorders. *International Journal of Epidemiology*, **34**, 762–4. <https://doi.org/10.1093/ije/dyi073>
- [6] Andersson, M., Karumbunathan, V. and Zimmermann, M.B. (2012) Global Iodine Status in 2011 and Trends over the Past Decade. *The Journal of Nutrition*, **142**, 744–50. <https://doi.org/10.3945/jn.111.149393>
- [7] Lowe, N., Westaway, E., Munir, A., Tahir, S., Dykes, F., Lhussier, M. et al. (2015) Increasing Awareness and Use of Iodised Salt in a Marginalised Community Setting in North-West Pakistan. *Nutrients*, **7**, 9672–82. <https://doi.org/10.3390/nu7115490>
- [8] ICCIDD, UNICEF and WHO. (2007) Assessment of Iodine Deficiency Disorders and Monitoring their Elimination: A Guide for Programme Managers [Internet]. 3rd Ed. World Health Organization (WHO), Geneva, Switzerland.
- [9] UNICEF, editor. (2011) The State of the World's Children 2011: Adolescence: An Age of Opportunity [Internet]. United Nations Children's Fund (UNICEF), New York, NY, USA.
- [10] Delange, F., Dunn, J.T. and Glinioer, D. (1993) Iodine Deficiency in Europe: A Continuing Concern [Internet]. 1st Ed. Springer US, Overijse, Belgium.
- [11] Preedy, V.R., Burrow, G.N. and Watson, R.R., editors. (2009) Comprehensive Handbook of Iodine: Nutritional, Biochemical, Pathological and Therapeutic Aspects [Internet]. 1st Ed. Academic Press/Elsevier, Burlington, MA, USA; London, UK.
- [12] Zimmermann, M.B., Hess, S.Y., Molinari, L., De Benoist, B., Delange, F., Braverman, L.E. et al. (2004) New Reference Values for Thyroid Volume by Ultrasound in Iodine-Sufficient School Children: A World Health Organization/Nutrition for Health and Development Iodine Deficiency Study Group Report. *The American Journal of Clinical Nutrition*, **79**, 231–7. <https://doi.org/10.1093/ajcn/79.2.231>
- [13] WHO. (2007) Reducing Salt Intake in Populations: Report of a WHO Forum and Technical Meeting, 5-7 October 2006, Paris, France [Internet]. World Health Organization (WHO), Geneva, Switzerland.
- [14] WHO. (2008) WHO Expert Consultation on Salt as a Vehicle for Fortification, Luxembourg, 21-22 March 2007 [Internet]. World Health Organization (WHO), Geneva, Switzerland.

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