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BUREAU OF INDIAN STANDARDS

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भारतीय मानक ***मसौदा***

सोडियम एल्गिनेट, खाद्य ग्रेड — विशिष्टि

(*आइ एस 5191 का दूसरा पुनरीक्षण*)

Draft *Indian Standard*

SODIUM ALGINATE, FOOD GRADE — SPECIFICATION

(*Second Revision of IS 5191*)

ICS 67.220.20

Food Additives Sectional Committee, FAD 08 **Last date of comments:** 24 February 2025

FOREWORD

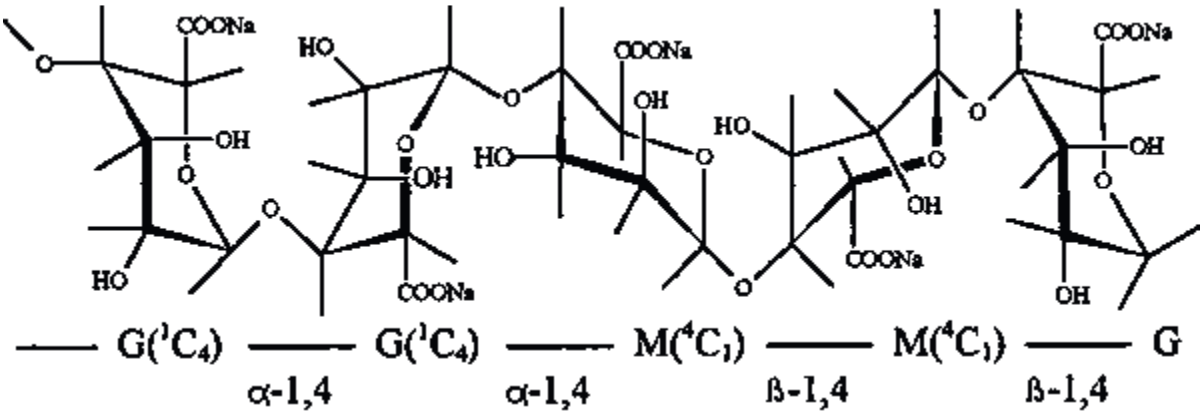
(*Adoption clauses would be added later*)

Food additives are added to improve the appearance, flavour, texture or storage properties, etc of the processed foods. As certain impurities in these substances have been found to be harmful, it is necessary to have a strict quality control of these food additives. A series of standards have, therefore, been prepared to cover purity and identification of these substances. These standards would help in checking purity, which is required to be checked at the stage of manufacture, for it is extremely difficult to detect the impurity once these substances have been added to the processed foods. Besides, these standards are intended to guide the indigenous manufacturers in making their product conform to specifications that are accepted by scientists, health authorities and national/ international bodies.

Sodium alginate is widely used as stabilizing and thickening agents. It is permitted under the *Food Safety and Standards (Food Products Standards and Food Additives) Regulations*, 2011.

The recognized chemical name is sodium alginate. Chemical Formula is $(C_6H_7O_6Na)_n$. Its calculated equivalent weight is 198.11 and actual equivalent weight is 222.00.

Structural Formula



This standard was first published in 1969. In the formulation of this standard, the requirements given in Food chemical codex published by the National Academy of Sciences and National Research Council, Washington DC, USA; FAO Food and Nutrition Paper 4 'Specifications for the identity and purity of thickening agents, anticaking agents, antimicrobials, antioxidants and emulsifiers' published by the Joint FAO/WHO Expert Committee on Food Additives, Food and Agriculture Organization of the United Nations, Rome 1978; and EEC Directive 78/633 laying down criteria of purity for emulsifiers, stabilizers, thickeners and gelling agents for use in foodstuffs were taken into consideration.

It was first revised in 1993 to take into account the latest technological developments in the field, and also to bring it in a line with the International Standards.

In this revision, two amendments issued to the previous version of the standard have been incorporated and the following major changes have been made:

a) The requirements for ash and acid insoluble ash have been removed to keep it in line with JECFA Monograph.
b) The requirement for heavy metals has been removed as the limit of lead (contaminant in food colours) is already covered through the standard; and
c) The marking requirements have been updated.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off' numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for sodium alginate for use as a food additive.

2 REFERENCES

The standards, given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

IS No.	*Title*
IS 1070 : 2023	Reagent Grade Water — Specification (*fourth revision*)
IS 1699 : 2024	Food colours - Methods of sampling and test (*third revision*)
IS 5402 (Part 1) : 2021	Microbiology of the food chain - Horizontal method for the enumeration of microorganisms - Part 1: Colony count at 30 C by the pour plate technique (*third revision*)
IS 5887 (Part 3/Sec 1) : 2020/ ISO 6579-1 : 2017	Methods for detection of bacteria responsible for food poisoning: Part 3 Horizontal method for the detection, enumeration and serotyping of *Salmonella*: Section 1 Detection of *Salmonella* spp. (*third revision*)
IS 7928 : 1993	Alginic acid, food grade-Specification (*first revision*)
IS 16067 (Part 3) : 2023/ ISO 16649-3 : 2015	Microbiology of the food chain Horizontal method for the enumeration of beta glucuronidase positive *Escherichia coli*: Part 3 Detection and most probable number technique using 5-bromo-4-chloro-3- indolyl-D-glucuronide
IS 16069 (Part 2) : 2013/ ISO 21527-2	Microbiology of food and animal feeding stuffs - Horizontal method for the enumeration of yeasts and moulds: Part 2 colony count technique in products with water activity less than or equal to 0.95

3 REQUIREMENTS

3.1 Description

The material shall be white, yellowish or pale brown, fibrous or granular powder. It shall be almost odourless and tasteless.

3.2 Identification Tests

3.2.1 *Solubility* **—** Slowly soluble forming a viscous solution in water; insoluble in ethanol, ether and chloroform.

3.2.2 To a 0.5 percent solution of the sample in sodium hydroxide, add one-fifth of its volume of a 2.5 percent aqueous solution of calcium chloride. A voluminous, gelatinous precipitate is formed. This test distinguishes sodium alginate from arabic gum, carboxymethyl cellulose, carboxymethyl starch, carrageenan, gelatin, ghatti gum, karaya gum, locust bean gum, methyl cellulose, pectin and tragacanth.

3.2.3 To a 0.5 percent solution of the sample in sodium hydroxide solution, add one-half of its volume of a saturated solution of ammonium sulphate. No precipitate is formed. This test distinguishes sodium alginate from agar, carboxymethyl cellulose, carrageenan, de-esterified pectin, gelatin, locust bean gum, methyl cellulose and starch.

3.2.4 *Test for Alginic Acid*

Take a quantity of material equivalent to 5 mg of alginic acid in a test tube. Add 5 ml of water, 1 ml of a freshly prepared 1 in 100 solution of naphthoresorcinol in ethanol and 5 ml of concentrated hydrochloric acid. Heat the mixture to boiling. Boil gently for about 3 min and then cool to about 15 °C. Transfer the contents of the test-tube to a 30 ml separator with the aid of 5 ml of water and extract with 15 ml of isopropyl ether. Perform the blank using the same quantities of the same reagents by the same procedure omitting the sample. The isopropyl ether extract from the material shall exhibit a deeper purplish hue than that from the blank.

3.2.5 Moisten 1-5 mg of the sample with water, and add 1 ml of acid ferric sulphate solution. Within 5 min, a cherry-red colour develops that finally becomes deep purple.

3.2.6 Dissolve the sulphated ash of the sample in dilute acetic acid solution and filter. Add to the filtrate uranyl zinc acetate solution. A yellow, crystalline precipitate is formed within a few minutes.

3.3 The material shall also conform to the requirements given in Table 1.

4 PACKING AND STORAGE

4.1 Packing

The material shall be packed in well-filled containers with minimum access to moisture. The containers shall be such as to preclude contamination of the contents with metals or other impurities.

4.2 Storage

The material shall be stored in a cool and dry place so as to avoid excessive exposure to heat.

5 MARKING

5.1 Each container shall be marked legibly and indelibly to give the following information:

a) Name of the material including the words ‘Food Grade’;
b) Source of manufacture;
c) Net content when packed;
d) Batch or code number;
e) Date of manufacture; and
f) Expiry/ Best before date;
g) Any other requirements as specified under the *Legal Metrology* (*Packaged Commodities*) *Rules*, 2011 and *Food Safety and Standards* (*Labelling and Display*) *Regulations*, 2020.

5.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

Table 1 Requirements for Sodium Alginate, Food Grade
(*Clause* 3.3**)**

Sl. No.	Characteristic	Requirement	Method of Test, Refer to
(1)	(2)	(3)	(4)
i)	Purity as $(C_6H_7O_6Na)_n$, percent by mass, on dry basis, *Min*	91 to 106	Annex A
ii)	Moisture, percent by mass, *Max*	15	Annex B
iii)	Matter insoluble in water, percent by mass, *Max*	1.0	IS 7928
iv)	Viscosity of a one percent solution (*m/m*), in centipoise, *Min*	30	Annex C
v)	Lead (as Pb), mg/kg, *Max*	5	IS 1699
vi)	Arsenic (as As), mg/kg, *Max*	3	IS 1699
vii)	*E. coli*	Absent (in 1g)	IS 16067 (Part 3)
viii)	*Salmonella*	Absent (in 10 g)	IS 5887 (Part 3/Sec 1)
ix)	Total plate count per g, *Max*	5000	IS 5402 (Part 1)
x)	Yeasts and moulds per g, *Max*	500	IS 16069 (Part 2)

6 SAMPLING

Representative samples of the materials shall be drawn according to the method prescribed in IS 1699.

7 TESTS

7.1 Tests shall be carried out by the methods specified in co1 4 of Table 1.

7.2 Quality of Reagents

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the result of analysis.

ANNEX A
[*Table* 1, Sl. No. (i)]
DETERMINATION OF PURITY

A-1 APPARATUS

A-1.1 The assembly of the apparatus is shown in Fig. 1. It consists essentially of a soda-lime column (*A*), a mercury valve (*B*) connected through a side tube (*C*) to a reaction flask (*D*) by means of a rubber connection, the reaction flask D is a 100 ml round bottomed, long-necked boiling flask with 24/40 ground joint attached. The oil bath *E* is maintained at 145 °C by means of a thermoregulator and an immersion heater. The reaction flask is provided with a 20 cm relux condenser (*F*) terminating in a trap (*G*) containing 25 g of 850 micron zinc or tin, which is connected with an absorption flask (*H*) (a 250 ml Erlenmeyer flask equipped with 24/40 ground-joint and a side tube attached a little below the ground joint as shown in Fig. 1).

Flask *H* is provided with an absorption tower (*J*) the lower part of which consists of an 18 mm tube, fitted with a medium porosity fritted Pyrex or equivalent disc, sealed to the inner of the lower end of a 24/40 ground-joint and terminating 1 or 2 mm above the bottom of the absorption flask when the joint is in place. A trap, consisting of a bulb of approximately 100 ml capacity, is blown above ground portion of the joint; and the outer portion of a 24/40 ground joint is sealed on above this bulb. The absorption tower, from the bottom of the disc to the top of ground joint, is approximately 30 cm in length. The top of the tower is fitted with a hollow ground stopper with a short side tube attached. The tower assembly may be attached to a soda-lime tower (*K*) connected with a water pump by means of a capillary-tube regulator (*L*) which serves to seep 1700 to 2000 ml of carbon dioxide-free air per hour through the apparatus during the heating period.

A-2 REAGENTS

A-2.1 Hydrochloric Acid — 19 percent.

A-2.2 Phosphoric Acid — syrupy

A-2.3 Sodium Hydroxide Solution — 0.25 N

A-2.4 Butanol

A-2.5 Barium Chloride ($BaCl_2.2H_2O$) Solution — 1 : 10.

A-2.6 Phenolphthalein Solution — 1 percent in alcohol.

A-2.7 Hydrochloric Acid — 0.1 N.

A-3 PROCEDURE

A-3.1 Transfer about 250 mg of the material, previously dried at 105 °C for 4 h and accurately weighed, to the reaction flask (*D*), add 30 ml of 19 percent hydrochloric acid, insert a small boiling tube, and connect it to the reflux condenser (*F*) using syrupy phosphoric acid as lubricant.

NOTE — Stopcock grease may be used for other connections.

A-3.2 Draw a current of carbon dioxide-free air through the entire assembly for about 10 min and then discontinue it. Disconnect the absorption tower (*J*), rapidly transfer from a pipette 25.0 ml of 0.25 N sodium hydroxide into the absorption flask (*H*), add 5 drops of butanol, and again attach it to the absorption tower. Raise the oil-bath (*E*), previously heated to (145 ± 2) °C until the oil level is several millimetres above the liquid level in the reaction flask. After the initial rapid evolution of carbon dioxide has subsided, resume the passage of carbon dioxide-free air through the apparatus, and continue the heating at about 145 °C for 2 h. At the end of the 2 h period, discontinue the current of air, and disconnect the absorption flask (*H*) and the lower part of the absorption tower (*J*) from the rest of the assembly. Remove the absorption tower unit, washing any adhering sodium hydroxide solution into the flask with several small portions of water. To the flask add 10 ml of 1 in 10 barium chloride ($BaCl_2.2H_2O$) solution, stopper the flask, shake gently for about 2 min, add phenolphthalein solution and titrate with 0.1 N hydrochloric acid. Perform a blank determination and make any necessary correction.

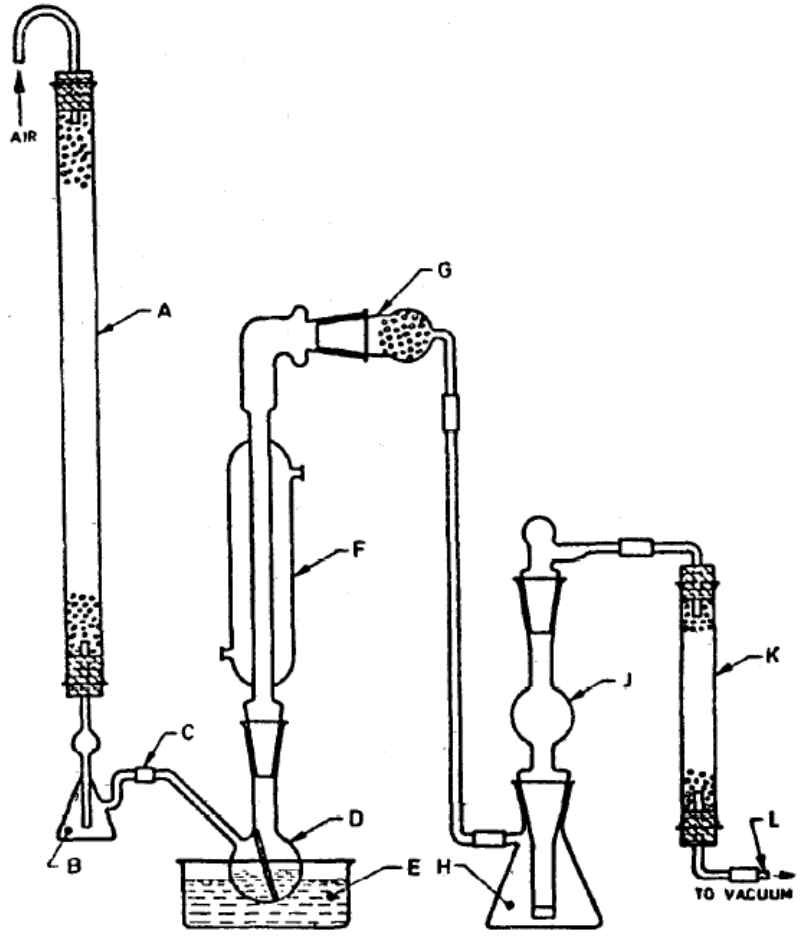


FIG. 1 APPARATUS FOR DETERMINATION OF PURITY

A-4 CALCULATION

A-4.1 Each millilitre of 0.25 N sodium hydroxide consumed in the assay is equivalent to 27.75 mg of sodium alginate (equivalent weight 222.00).

ANNEX B
[*Table* 1, Sl. No. (ii)]
DETERMINATION OF MOISTURE

B-1 APPARATUS

B-1.1 Oven-electric, maintained at (105 ± 1) °C.

B-1.2 Weighing Bottle — glass-stoppered, shallow.

B-2 PROCEDURE

B-2.1 Weigh accurately about 10 g of the well-mixed material in a tared weighing bottle. Distribute the material as evenly as practicable to a depth of about 5 mm. Place the bottle containing the material (uncovered) in the oven maintained at (105 ± 1) °C. Remove the bottle from the oven after 4 h, close the bottle promptly and allow it to come to room temperature in a desiccator. Weigh it.

B-2.2 Calculation

$$\text{Moisture, percent by mass} = \frac{100\times(M_1-M_2)}{(M_1-M)}$$

Where,

M = mass, in g, of the empty bottle;

M_1 = mass, in g, of the bottle with the material before drying;

M_2 = mass, in g, of the bottle with the material after drying and after it has come to room temperature.

ANNEX C
[*Table* 1, *Sl. No.* (iv)]
DETERMINATION OF VISCOSITY

C-1 PRINCIPLE

The resistance to movement of a spindle is measured and expressed in terms of viscosity in seconds. The resistance, being directly linked with viscosity, can be expressed directly in terms of viscosity by previous calibration of the instrument.

C-2 APPARATUS

C-2.1 Brookfield Viscometer — type LVF or equivalent

C-2.2 Mechanical Stirrer

C-2.3 Constant Temperature Bath — maintained at 25 °C.

C-3 PROCEDURE

C-3.1 Determine the moisture content of the sample (*see* Annex B). Calculate, on dry basis, the weight of sample necessary to make 500 g of test solution as follows:

$$\text{Weight of sample, g} = \frac{100 \times A}{100 - B}$$

Where,

A = desired dry mass of sample in grams; and
B = percentage of moisture in the sample as weighed.

C-3.2 Add 100 ml of distilled water to the jar, add the sample of sodium alginate (**C-3.1**). Bring the *p*H of the solution between 6 and 8 by adding hydrochloric acid or sodium hydroxide. Add sufficient distilled water to make a total of 500 g of solution. Place the stirrer in the solution so that the blade is about halfway between the bottom of the jar and the surface of the liquid, stir till the sample dissolves. Remove the agitator and transfer the sample container to the constant temperature bath and keep it there for 3 h. Remove the sample container from the bath, stir it again and measure the viscosity with the Brookfield viscometer at 25 °C using the spindle and speed given below:

Viscosity range	*Spindle No.*	*Speed (rev/min)*	*Scale*
10 to 100	1	60	100

C-3.2.1 Allow the spindle to rotate until constant reading is obtained. Note the reading.