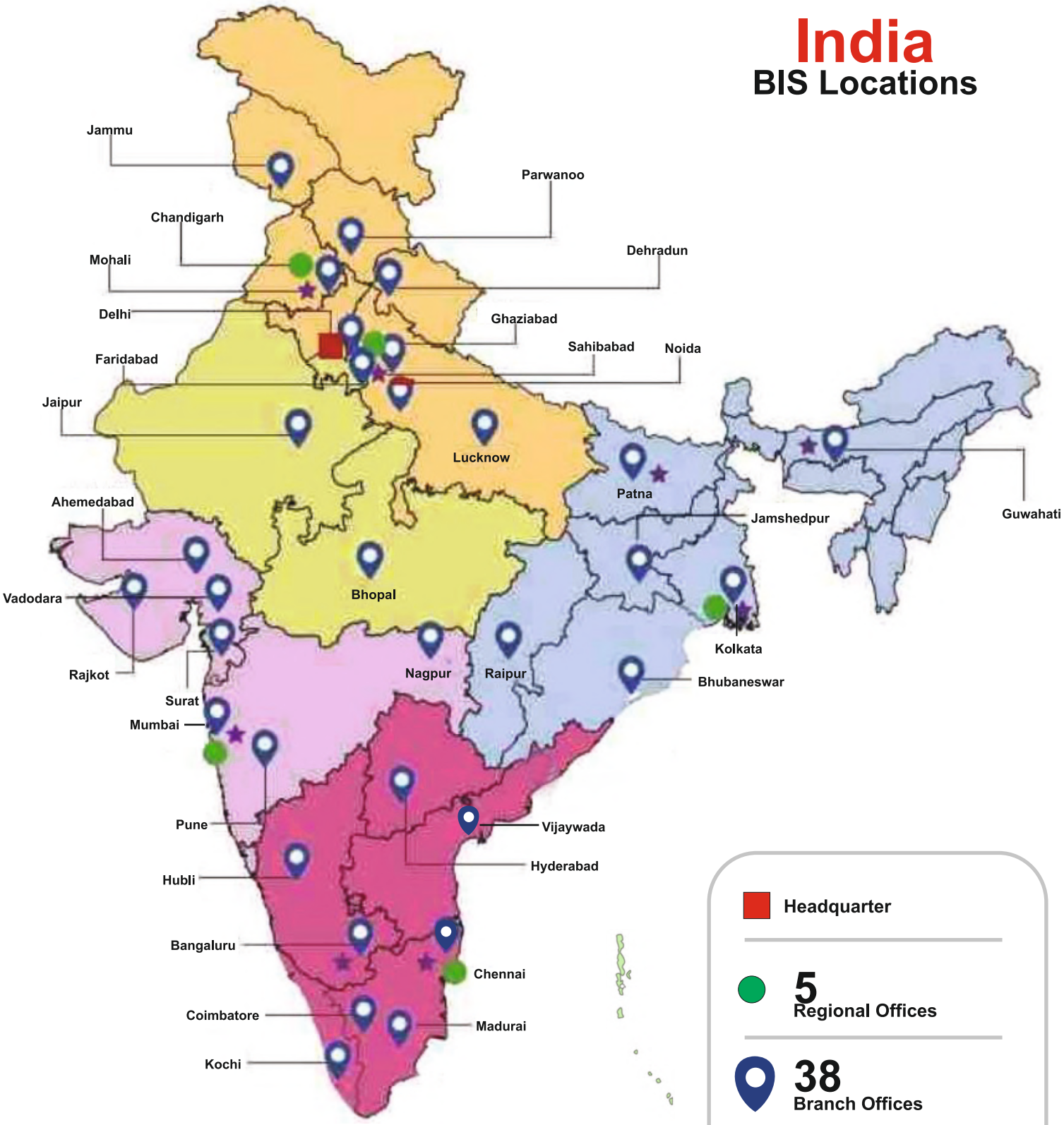
INDIAN STANDARDS ON TESTING OF DAIRY PRODUCTS

BUREAU OF INDIAN STANDARDS
Ministry of Consumer Affairs,
Food and Public Distribution
Government of India

भारतीय मानक ब्यूरो
उपभोक्ता मामले, खाद्य और
सार्वजनिक वितरण मंत्रालय
भारत सरकार

India
BIS Locations



Headquarter

5 Regional Offices

38 Branch Offices

8 Laboratories

— Training Institute (NITS)

सत्यमेव जयते

मानकः पथप्रदर्शकः

Azadi Ka Amrit Mahotsav

ABOUT BIS

Bureau of Indian Standards (BIS), the National Standards Body (NSB) of India was established under the *BIS Act*, 1986 and came into existence on 1 April 1987 assuming the functions of the erstwhile Indian Standards Institution (ISI). The ISI was established on 6 January 1947. The *BIS Act*, 2016 came into force on 12 October 2017 superseding BIS Act 1986. The *BIS Act*, 2016 provides for the establishment of a national standards body for the harmonious development of the activities of standardization, conformity assessment and quality assurance of goods, articles, processes, systems and services and for matters connected therewith or incidental thereto.

BIS through its core activities of standardization and conformity assessment, has been benefiting the national economy by providing safe, reliable and quality goods; minimizing health hazards to consumers; protecting the environment; controlling over proliferation of varieties; promoting exports and imports substitutes, etc. The standardization and conformity assessment schemes of BIS apart from benefitting the consumers and industry also support various public policies especially in areas of product safety, consumer protection, food safety, environment protection, building and infrastructure development, etc.

BIS also represents India in international standards bodies like International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and participates actively in the international standardization work undertaken by these bodies. BIS presents the national viewpoints on new areas taken up for international standardization and on various draft international standards during the process of development of these standards so that the country's interest is protected and reflected in these standards. This also enables the BIS technical committees to consider adoption of the international standards as Indian Standards, with or without modifications, in order to enable our products and services to integrate with global trade and commerce.

What are Standards?

Standard is a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Importance of Standardization

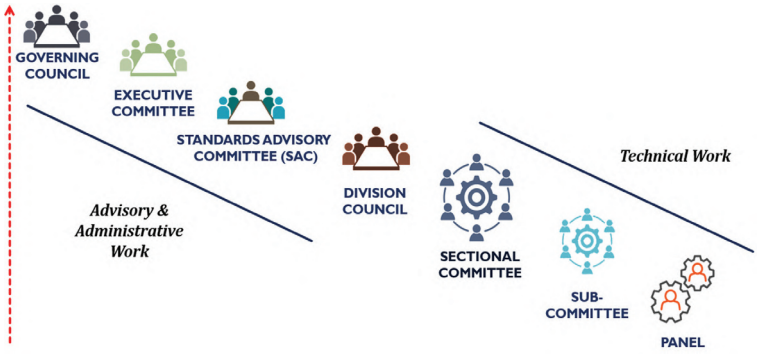
Standardization is the process of developing technical standards through consensus of different parties.This standardization aims to address one or all of compatibility, interchangeability, variety control, safety, environment protection, product protection and fitness for purpose. Standards provide numerable benefits to the technologists, producers, consumers and traders besides defining purpose for each of these entities.

Standards can be formulated at various levels ranging from an individual through National (IS) to International level (ISO). Also, depending on the subject in hand, standards can be made on various aspects such as terminology, specification, sampling, testing, code of good practice, systemes and services.

STANDARDIZATION ACTIVITY OF BIS

Standardization Structure

There are 16 Technical Departments formulating standards in various subject areas. Corresponding to these departments, 16 Division Councils exist. Each division council has several sectional committees working under it. The standards cover important segments of economy and help the industry in upgrading the quality of their goods and services.

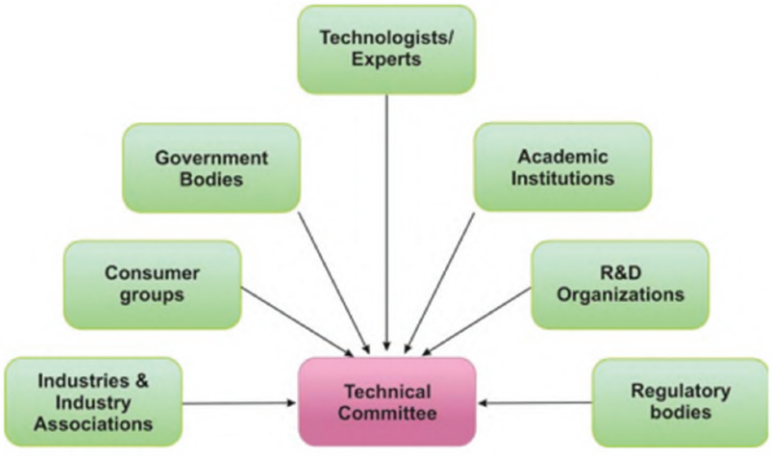


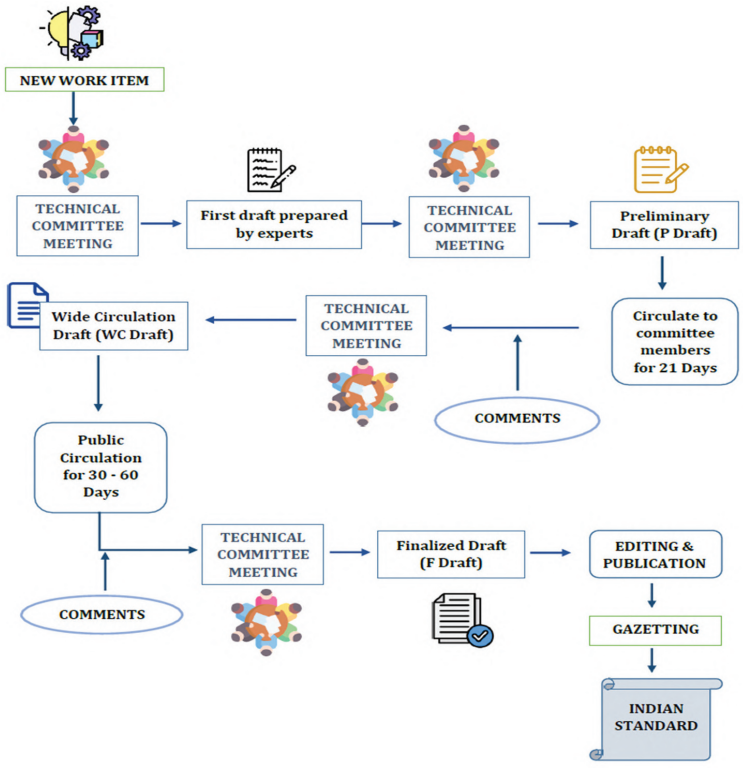
Ayush Division Council (AYDC)	Chemical Division Council (CHDC)	Civil Engineering Division Council (CEDC)	Electro-Technical Division Council (ETDC)
Electronics & Telecommunication Division Council (LITDC)	Food and Agriculture Division Council (FADC)	Mechanical Engineering Division Council (MEDC)	Management and Systems Division Council (MSDC)
Metallurgical Engineering Division Council (MTDC)	Medical Equipment & Hospital Planning Division Council (MHDC)	Petroleum, Coal & Related Products Division Council (PCDC)	Production and General Engineering Division Council (PGDC)
Transport Engineering Division Council (TEDC)	Textile Division Council (TXDC)	Water Resources Division Council (WRDC)	Service Sector Division Council (SSDC)

Standards Formulation Process

The Indian Standards are developed by technical committees that are representative of various stakeholders having interest in the relevant subject of standardization under the scope of such committees through a process of consultation so that views of all are given due consideration and a consensus is evolved in formulating a standard. The stakeholders involved in national standardization can broadly be categorized as industry, consumers/ users, technologists (R&D and scientific institutions, academia, individual subject experts, etc) and government departments/regulators.

The process of standards development of BIS is aligned with accepted international best practices that are based on the core principles of openness, transparency, impartiality and consensus. The process begins with the identification of the standardization needs of the given sector or subject following which the development of the standard is taken up and planned bythe relevant technical committee. Apart from consultation within the technical committees, draft standards are also open for public views/comments.





Standards Development Process Flow

STANDARDIZATION IN FOOD AND AGRICULTURE SECTOR

The Food and Agriculture Department (FAD) of BIS is entrusted with the task of formulation of national standards in the field of food and agriculture under the aegis of the Food and Agriculture Division Council, FADC which oversees and supervises its work. The scope of FADC is as under:

'*Standardization in the field of food, feed and agriculture produce covering food and feed chain from primary production to consumption. This also includes soil management, agriculturalinputs agricultural machinery, farm management, animal keeping and husbandry, fisheries andaquaculture, food processing, food and feed safety management, biotechnology for food and agriculture and drinking water*.'

Aspects of Standardization – A total of 2188 standards have been published under FAD. The aspect wise distribution of the standards is as under:

Aspect	No. of Standards
Product Standards	**1276**
Methods of Test	**609**
Codes of Practice	**198**
Terminology	**51**
Dimensions	**06**
System Standards	**13**
Safety Standards	**04**
Others	**31**
Total	2188

3.1 List of Sectional Committees under FAD

Under FAD, there are 29 sector specific Sectional Committees. List of committees with their scope is as follows:

Sectional Committee Number	Sectional Committee Title	Scope
FAD 01	Pesticides	Standardization in the field of a) Pesticides, pesticidal formulations, and other items relating to pest control including safety; b) Biopesticides; and c) Plant growth regulators.
FAD 02	Sugar Industry	Standardization in the field of sugars and by products of sugar industry; Sugar laboratories and sugar godowns; Sugar machinery, equipment and its components, Molasses tanks and other such items; Layout plans for sugar factories including general layout for sugar factories, quality control area and sugar handling and packing area; Test methods of sugar products; Sweeteners produced by the sugar industries' and Speciality sugars such as golden brown sugar, sulphur less sugar etc.

Sectional Committee Number	Sectional Committee Title	Scope
FAD 03	Apiary Industry	Standardization in the field of apiary products and equipment and good apicultural practices.
FAD 04	Tobacco and Tobacco Products	Standardization in the field of: a) Tobacco (excluding specifications), tobacco products; codes for seaworthy packing of tobacco and construction of tobacco barns and farming practices b) Physical and chemical methods of test for tobacco and tobacco products.
FAD 05	Animal Feeds and Nutrition	Standardization in the field of: a) Animal feedstuffs, mineral mixtures, compounded feeds and feed supplements; and b) Physical, chemical and microbiological methods of analysis.
FAD 06	Stimulant Foods	Standardization in the field of: a) Tea, coffee, cocoa and their products; b) Physical, chemical and microbiological methods of test pertaining to this committee; and c) General methodology for sensory evaluation including nutritional aspects.
FAD 07	Soil Quality and Fertilizers	Standardization in the field of: a) Soil sampling, testing and analysis; b) Reclamation of acid and salt affected Soil; c) Improvement of soil qualities and nutrient status, representative samples for fertilizer recommendations and mapping purposes; d) Soil amendments including compost; e) Fertilizers (including primary, secondary and micronutrients), plant hormones and related products); f) Agriculturally useful microorganisms and bio-inoculant technologies; g) Handling storage and packaging of fertilizers; h) Nano fertilizers, bio-stimulant, amino acid, humic acid.
FAD 08	Food Additives	Standardization in the field of: a) Food additives (colours- Synthetic and natural, preservatives/mould inhibitors, acidity regulators, Improvers, flour treatment agent, artificial sweeteners, nutrients, yeast, jellifying agents, antioxidants, synergists, emulsifying and stabilizing agents, flavours, flavouring agents, leavening agents, surface/coating agents, encapsulation agents and dough conditioners, etc.) permitted under the Food Safety and Standards Regulations; b) Their methods of test in food products; and food additives produced through the application of biotechnology; c) Physical and chemical methods of test pertaining to this committee including microbiological aspects; and

Sectional Committee Number	Sectional Committee Title	Scope
		d) General methodology for sensory evaluation including nutritional aspects.
FAD 09	Spices, Culinary Herbs and Condiments	Standardization in the field of: a) Spices, Culinary Herbs and Condiments; and b) General methodology for quality evaluation including nutritional aspects.
FAD 10	Fruits, Vegetables and Allied Products	Standardization in the field of processed fruits and vegetables; dried fruits and nuts, coconut, bamboo, mushroom, edible fungus, processed aloevera and their products; Coconut milk powder, coconut vinegar, packed tender coconut water and packed matured coconut water. Physical and chemical methods of test pertaining to this committee including microbiological aspects. General methodology for sensory evaluation pertaining to this committee including nutritional aspects. Requirements for packaging, storage and transportation of products pertaining to this committee. Food hygiene including codes of hygienic practices applicable for fruits, vegetables and allied products.
FAD 11	Agricultural Machinery and Equipment	Standardization in the field of machinery and equipment used in agriculture, gardening and forestry operationsincluding agricultural tractors, power tillers, other self-propelled machinery, and agricultural electronics.
FAD 12	Fish, Fisheries and Aquaculture	Standardization in the field of: a) Fresh, processed and packaged fish; fisheries and aquaculture products and by-products (both edible and non-edible); fish feed and feed ingredients not covered by FAD 5. b) Fisheries and Aquaculture, including, but not limited to, terminology, technical specifications for equipment and for their operation, characterization of aquaculture sites and maintenance of appropriate physical, chemical, and biological conditions, environmental monitoring, data reporting, traceability, waste disposal and code of transport; and c) Physical, chemical, microbiological and organoleptic methods of test pertaining to this committee.
FAD 13	Oils and Oilseeds	Standardization in the field of: a) Terminology, specifications, methods of sampling and test and codes of practice for handling, storage and packaging for oleaginous seeds and fruits, oils and fats, blended oils and fortified oils (including animal fats and marine oils but excluding oils covered by other Sectional Committees), fatty acids, vegetable tallow and processing aids; and b) Specification for equipment used for handling, processing, packaging, storage and transportation of oleaginous seeds and fruits, oils and fats.

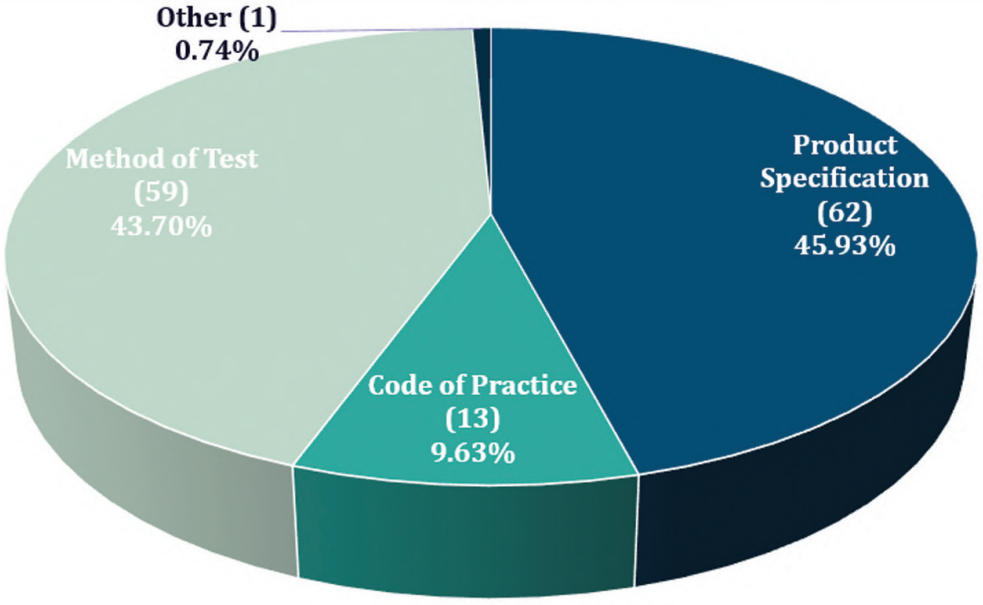
Sectional Committee Number	Sectional Committee Title	Scope
FAD 14	Drinking Water and Carbonated Beverages	Standardization in the field of: a) Drinking water, packaged or supplied in unpackaged form through organized water supply; b) Water used in any food processing industry for the manufacture, processing, preservation, or marketing of products or substances intended for human consumption; c) Carbonated beverages; and d) Physical, chemical and microbiological methods of test pertaining to this Committee including sensory evaluation.
FAD 15	Food Hygiene, Safety Management and Other Systems	Standardization in the field of: a) Food hygiene including codes of hygienic practices applicable for food products in general (except subject/ product specific codes covered under other Sectional Committees of FAD); b) Food safety management systems; and c) Food labelling.
FAD 16	Foodgrains, Allied Products and Other Agricultural Produce	Standardization in the field of: a) Foodgrains, allied products (including edible oilseed flour and excluding ready-to-eat foods) and agricultural produce except those covered under the scope of FAD 4, FAD 6, FAD 9, FAD 10 and FAD 13; b) Starches (including derivatives and by-products); c) Storage of foodgrains; and d) Physical, chemical and microbiological methods of test and general methodology for sensory evaluation including nutritional aspects pertaining to this committee
FAD 17	Farm Irrigation and Drainage Systems	Standardization in the field of: a) Methods of evaluation and adoption of quality of irrigation water, efficiency of irrigation water requirement of crops and guidelines for various practices associated with soil water management as well as various irrigation equipment and systems (excluding centrifugal and hand pumps), soil conservation practices; b) All types of farm drainage practices, design, material, drainage and sub surface drainage systems and equipment, all types of on farm water management practices including construction and improvement of water distribution systems, land levelling & all equipment & machinery dealing with command area development; and c) All types of remote monitoring and controlling of Irrigation and Drainage Systems.
FAD 18	Slaughter House and Meat Industry	Standardization in the field of: a) Equipment, materials used in slaughter house and slaughter house layouts, flow sheet categorization;

Sectional Committee Number	Sectional Committee Title	Scope
		b) Meat, meat products, poultry, poultry products and other by-products from abattoir; codes for ante-mortem and post-mortem examination; meat stalls; and c) Physical, chemical and microbiological methods of test.
FAD19	Dairy Products and Equipment	Standardization in the field of dairy and dairy products covering the dairy chain from primary production to consumption, in particular: a) Product specifications including milk based infant foods; b) Methods of test and analysis including sampling; and c) Codes of hygienic practices.
FAD 20	Agriculture and Food Processing Equipment	Standardization in the field of: a) Equipment for primary processing operations like cleaning, grading, shelling, washing, polishing, drying and testing for food grains, seeds & horticulture produce; b) Equipment and system for secondary processing like milling, expelling, extraction, crushing of food grains, & horticulture produce; c) By product handling and processing equipment; d) Equipment for value addition to agricultural product and by products including packaging; and e) Crop residue utilization.
FAD 22	Agricultural Systems and Management	Standardization in the field of: a) Systems approach to agricultural management including Good Agricultural Practices (GAP); b) Hi-Tech agricultural practices viz. plasticulture, protected agriculture and precision farming; c) Agricultural production systems including crop, horticulture, livestock, medicinal and aromatic plants, aquaculture and organic production systems; d) Post-harvest management system for loss free packaging, storage and transport, and value addition related aspects; e) Agricultural marketing viz. contract, corporate marketing and direct marketing relating aspects; f) Other miscellaneous activities related to Agricultural Resource Management.
FAD 23	Biotechnology for Food and Agriculture	Standardization in the field of: a) Food and agricultural products derived from modern biotechnology, or traits introduced by modern biotechnology into food and other articles of human and animal consumption, on the basis of scientific evidence, risk and analysis and having regard, where appropriate, to other legitimate factors relevant to the health of consumers, biosecurity, and the promotion of fair practices in the food and agricultural products trade; and

Sectional Committee Number	Sectional Committee Title	Scope
		b) Terminology, codes of practice/guidelines, methods of sampling and test, etc.
FAD 24	Ready-to-eat Foods and Specialized Products	Standardization in the field of special purpose foods and specialized products, processed nutritious food, snack foods, protein isolates, bakery, confectionery products and all types of ready-to-eat foods (excluding ready to eat fish products and ready-to-eat meat products), their equipment and related items.
FAD 27	Pesticide Residues Analysis	Standardization in the field of methods of analysis for determination of pesticide residues in soil, water, agricultural and food commodities
FAD 28	Test Methods for Food Products	Standardization in the field of horizontal methods of test for food products including physical, chemical and sensory evaluation excluding the microbiological methods of test covered under the scope of FAD 31 and methods of test for estimation of pesticide residues covered under the scope of FAD 27.
FAD 29	Alcoholic Drinks	Standardization in the field of: a) Alcoholic drinks and its fermenting agents; b) Physical, chemical and microbiological methods of test pertaining to this Committee; and c) General methodology for sensory evaluation of alcoholic drinks.
FAD 30	Water Purification Systems	Standardization in the field of: a) Water Purification Systems for drinking purposes in domestic (point-of-use) as well as industrial sector; and b) Methods of test pertaining to this Committee.
FAD 31	Food Microbiology	Standardization in the field of: a) Horizontal methods in the field of microbiological analysis of the food chain from primary production stage to food products, animal feed products, the environmental samples from food production and handling. Methods in the field of microbiological analysis of water; b) Specifications for ingredients used in media for microbiological work; c) Methods of sampling and handling of food samples for microbiological testing; and d) Safe handling and containment of infectious microorganisms and hazardous biological materials.
FAD 32	Animal Husbandry and Equipment	Standardization in the field of: a) Animal husbandry (management practices, welfare and transport) for livestock, poultry, pet and laboratory animals; b) Equipment for livestock, poultry, pet and laboratory animals; c) Code for breeding, housing and transport of the laboratory and other animals.

4. PORTFOLIO OF INDIAN STANDARDS IN THE DAIRY SECTOR

4.1 BIS has formulated 136 Indian Standards pertaining to dairy sector, aspect wise distribution of standards is as under:



S.N.	IS No.	IS Title
Dairy Products and Test Methods		
1.	IS 1000 : 2021	Edible lactose – Specification (*first revision)*
2.	IS 1165 : 2022	Whole milk powder – Specification (*sixth revision*)
3.	IS 1166 : 2022	Sweetened condensed milk, sweetened condensed partly skimmed milk, sweetened condensed skimmed milk and sweetened condensed high fat milk – Specification (*third revision*)
4.	IS 1167 : 2021	Edible casein products – Specification (*first revision)*
5.	IS 1224 (Part 1) : 1977	Determination of fat by the Gerber method Part 1 Milk (*first revision)*
6.	IS 1224 (Part 2) : 1977	Determination of fat by the Gerber method Part 2 Milk products (*first revision)*
7.	IS 1479 (Part 1) : 2016	Methods of test for dairy industry Part 1 Rapid examination of milk (*first revision*)
8.	IS 1479 (Part 2) : 1961	Methods of test for dairy industry Part 2 Chemical analysis of milk
9.	IS 1479 (Part 3) : 1977	Methods of test for dairy industry Part 3 Bacteriological analysis of milk (*first revision)*
10.	IS 1479 (Part 4) : 2018/ ISO 5764 : 2009	Method of test for dairy industry Part 4 milk – Determination of freezing point Thermistor cryoscope method (Reference method) (*third revision)*
11.	IS 1479 (Part 5) : 1962	Methods of test for dairy industry Part 5 Methods of dairy plant control

12.	IS 1656 : 2022	Infant food – Milk-Cereal based complementary foods – Specification (*fifth revision*)
13.	IS 1806 : 2018	Malted milk foods – Specification (*second revision)*
14.	IS 2785 : 2022	Cheese – Specification (*second revision*)
15.	IS 2802 : 2022	Ice cream and *Kulfi* – Specification (*first revision*)
16.	IS 2981 : 1964	Layout plan for dairy laboratories
17.	IS 3507 : 1966	Methods of sampling and test for butter
18.	IS 3508 : 1966	Methods of sampling and test for ghee/ butterfat
19.	IS 3509 : 1966	Method of sampling and test for cream
20.	IS 3864 : 1966	Specification for mobile kit for milk testing
21.	IS 4079 : 2023	Packed *Rasogolla* – Specification (*first revision)*
22.	IS 4238 : 2020	Sterilized and ultra high temperature sterilized milk – Specification (*first revision*)
23.	IS 4709 : 2021	Flavoured milk – Specification (*first revision*)
24.	IS 4883 : 2023	*Khoa* – Specification (*second revision*)
25.	IS 4884 : 2021	Sterilized/UHT sterilized cream – Specification (*first revision*)
26.	IS 5162 : 2021	*Chhana* – Specification (*second revision*)
27.	IS 5550 : 2023	*Burfi* – Specification (*first revision*)
28.	IS 5839 : 2000	Food hygiene – Code of practice for manufacture storage and sale of ice cream (*first revision)*
29.	IS 7005 : 1973	Code for hygienic conditions for production and processing, transportation and distribution of milk
30.	IS 7607 (Part 1): 1975	Code of practice for keeping dairy accounts Part 1 Primary milk collection units
31.	IS 7607 (Part 2): 1975	Code of practice for keeping dairy accounts Part 2 Market milk plants
32.	IS 7607 (Part 3): 1975	Code of practice for keeping dairy accounts Part 3 Product plants
33.	IS 7768 : 1975	Method for sensory evaluation of milk
34.	IS 7769 : 1975	Method for sensory evaluation of table butter
35.	IS 7770 : 1975	Method for sensory evaluation of ghee/ clarified butterfat
36.	IS 7839 : 2022	Dried ice-cream mix – Specification (*first revision*)
37.	IS 8479 (Part 1): 1977	Method for determination of phosphatase activity in milk and milk products Part 1 Routine method
38.	IS 8479 (Part 2) : 2020/ ISO 3356 : 2009	Milk – Determination of alkaline phosphatase Part 2 Reference method (*first revision*)

39.	IS 9070 : 1979	Method for determination of fat in cheese by van gulik method
40.	IS 9532 : 2023	*Chakka* and *Shrikhand* – Specification (*first revision*)
41.	IS 9584 : 2022	Cheese powder – Specification (*first revision*)
42.	IS 9617 : 2023	*Dahi*– Specification (*first revision*)
43.	IS 9967 (Part 1): 2008/ ISO 14673-1 :2004	Milk and milk products – Determination of nitrate and nitrite contents Part 1 Method using cadmium reduction and spectrometry (*second revision)*
44.	IS 9967 (Part 2): 2008/ ISO 14673-2: 2004	Milk and milk products Determination of nitrate and nitrite contents Part 2 Method using segmented flow analysis (Routine method) (*second revision*)
45.	IS 9967 (Part 3): 2008/ ISO 14673-3: 2004	Milk and milk products – Determination of nitrate and nitrite contents Part 3 Method using cadmium reduction and flow injection analysis with in-line dialysis (Routine method) (*second revision*)
46.	IS 10029 : 1981	Method for sensory evaluation of sweetened condensed milk
47.	IS 10030 : 1981	Method for sensory evaluation of milk powder
48.	IS 10083 : 1982	Method of test for determination of SNF (solids-not-fat) in milk by the use of the lactometer
49.	IS 10281 : 1982	Method for sensory evaluation of processed cheese
50.	IS 10484 : 2021	Paneer – Specification (*first revision*)
51.	IS 10974 (Part 1): 1984	Code for hygienic conditions for production transport storage and distribution of milk products Part 1 *Khoa* and *Khoa* based sweets
52.	IS 10974 (Part 2) : 1984	Code for hygienic conditions for production transport storage and distribution of milk products Part 2 *Dahi*
53.	IS 10974 (Part 3) : 1984	Code for hygienic conditions for production transport storage and distribution of milk products Part 3 Coagulated products *Chhana* and *Chhana* based sweetmeats
54.	IS 10974 (Part 4) : 1984	Code for hygienic conditions for production transport storage and distribution of milk products Part 4 Frozen products
55.	IS 10974 (Part 5) : 1984	Code for hygienic conditions for production transport storage and distribution of indigenous milk products Part 5 Fermented products *Shrikhand*
56.	IS 11202 : 2012/ ISO 8069 : 2005	Dried milk – Determination of content of lactic acid and lactates (*second revision*)
57.	IS 11546 : 2012/ ISO 707 : 2008	Milk and milk products – Guidance on sampling (*second revision*)
58.	IS 11602 : 2023	Packed *Gulab Jamuns* – Specification (*first revision)*
59.	IS 11622 : 1986	Method for determination of total solids content in condensed milk

60.	IS 11623 :2008/ ISO 5537 : 2004	Dried milk – Determination of moisture content (Reference method) (*first revision*)
61.	IS 11721 : 2013/ ISO 1736 : 2008	Dried milk and dried milk products – Determination of fat content – Gravimetric method (Reference method) (*second revision)*
62.	IS 11762 : 2013/ ISO 1737 : 2008	Evaporated milk and sweetened condensed milk – Determination of fat content – Gravimetric method (Reference method) (*second revision*)
63.	IS 11763 : 2011/ ISO 5943 : 2006	Cheese and processed cheese products – Determination of chloride content – Potentiometric titration method (*third revision*)
64.	IS 11764 : 2005/ ISO 2911 : 2004	Sweetened condensed milk – Determination of sucrose content – Polarimetric method (*first revision)*
65.	IS 11765 : 2017/ ISO 6091 : 2010	Dried milk – Determination of titratable acidity (Reference method) (*first revision*)
66.	IS 11766 : 1986/ ISO 6092 : 1980	Method for determination of titratable acidity in milk powder and similar products (Routine method)
67.	IS 11888 : 2005/ ISO 5739 : 2003	Caseins and caseinates – Determination of contents of scorched particles and of extraneous matter (*first revision*)
68.	IS 11917 : 2018/ ISO 8968-1 : 2014	Milk and milk products – Determination of nitrogen content – Kjeldahl principle and crude protein calculation (*first revision*)
69.	IS 11918 : 2017/ ISO 5546 : 2010	Caseins and caseinates – Determination of *p*H – Reference Method (*first revision*)
70.	IS 11919 : 2012/ ISO 5544 : 2008	Caseins – Determination of fixed ash (Reference method)
71.	IS 11920 : 2012/ ISO 5550 : 2006	Caseins and caseinates – Determination of moisture content (Reference method) (*first revision)*
72.	IS 11962 : 2012/ ISO 5545 : 2008	Rennet caseins and caseinates – Determination of ash (Reference method) (*first revision*)
73.	IS 11963 : 2005/ ISO5548 : 2004	Caseins and caseinates – Determination of lactose content – Photometric method (*first revision)*
74.	IS 11964 : 2012/ ISO 5547 : 2008	Caseins – Determination of free acidity (Reference method) (*first revision*)
75.	IS 12299 : 2021	Dairy whitener – Specification (*first revision*)
76.	IS 12333 : 2017/ ISO 6731 : 2010	Milk cream and evaporated milk – Determination of total solids content (Reference method) (*second revision*)
77.	IS 12756 : 2019/ ISO 2962 : 2010	Cheese and processed cheese products – Determination of total phosphorus content – Molecular absorption spectrometric method (*first revision*)
78.	IS 12757 : 2012/ ISO/TS 2963 : 2006	Cheese and processed cheese products – Determination of citric acid content – Enzymatic method (*second revision*)

79.	IS 12758 : 2005/ ISO 1735 : 2004	Cheese and processed cheese products –Determination of fat content – Gravimetric method (Reference method) (*first revision*)
80.	IS 12759 : 2019/ ISO 8156 : 2005	Dried milk and dried milk products – Determination of insolubility index (*first revision)*
81.	IS 12760 : 2012/ ISO 8070 : 2007	Milk and milk products – Determination of calcium sodium potassium and magnesium contents – Atomic absorption spectrometric method (*first revision*)
82.	IS 12898 : 2022	Dairy products – Yoghurt – Specification (*first revision*)
83.	IS 12899 : 1989	Dairy products – Yoghurt – Enumeration of specific lactic acid bacteria – Method of test
84.	IS 13334 (Part 1) : 2014	Skimmed milk powder – Specification Part 1 Standard grade (*second revision)*
85.	IS 13334 (Part 2) : 2014	Skimmed milk powder – Specification Part 2 Extra grade (*first revision*)
86.	IS 13500 : 1992	Spray dried milk powders scorched particles – Determination
87.	IS 13688 : 2020	Packaged pasteurized milk – Specification (*second revision*)
88.	IS 13689 : 2021	Butter oil and anhydrous butter oil – Specification (*first revision*)
89.	IS 13690 : 2021	Butter – Specification (*first revision*)
90.	IS 14433 : 2022	Infant milk substitutes – Specification (*second revision*)
91.	IS 14542 : 1998	Partly skimmed milk powder – Specification
92.	IS 15346 : 2003	Method for sensory evaluation of paneer chhana
93.	IS 15347 : 2003	Malted milk food – Method for sensory evaluation
94.	IS 15348 : 2003	Method for sensory evaluation of *Shrikhand*
95.	IS 15349 : 2003	Ice cream – Method for sensory evaluation
96.	IS 15757 : 2022	Infant food – Follow-up formula – Specification (*first revision*)
97.	IS 16072 : 2012	Determination of moisture content in milk powder and similar products (Routine method)
98.	IS 16195 : 2014/ ISO/TS15495 : 2010	Milk, milk products and infant formulae – Guidelines for the quantitative determination of melamine and cyanuric acid by LC-MS/MS
99.	IS 16326 : 2015	*Ghee* – Specification
100.	IS 17945 : 2022	Food for special medical purpose intended for infants – Specification
101.	IS 18107 : 2023/ ISO/TS 11059 : 2009	Milk and milk products – Method for the enumeration of *Pseudomonas spp.*
102.	IS 18108 : 2023/ ISO 14674 : 2005	Milk and milk powder – Determination of aflatoxin M_1 content – Clean-up by immunoaffinity chromatography and determinationby thin-layer chromatography

103.	IS 18109 : 2023/ ISO 14675 : 2003	Milk and milk products – Determination of aflatoxin M_1 content – Guidelines for a standardized description of competitive enzyme immunoassays
104.	IS 18110 : 2023/ ISO 14501 : 2021	Milk and milk powder – Determination of aflatoxin M_1 content – Clean-up by immunoaffinity chromatography and determination by high-performance liquid chromatography
Dairy Equipment		
105.	IS 1223 : 2001	Apparatus for determination of milk fat by Gerber method – Specification (*third revision*)
106.	IS 1825 : 1983	Specification for aluminium alloy milk cans (*second revision*)
107.	IS 2025 : 1962	Specification for cylindrical pipettes for bacteriological examination ofmilk
108.	IS 2311 : 1973	Specification for fat extraction apparatus for milk and milk products (*first revision*)
109.	IS 2336 : 1963	Specification for stainless steel milk vats
110.	IS 2342 : 1963	Specification for manually operated milk can washer
111.	IS 2343 : 2009	Specification for can washing trough
112.	IS 2492 : 2019	Stainless steel road milk tankers – Specification (*second revision*)
113.	IS 2495 : 1963	Specification for cheese hoops
114.	IS 2498 : 1963	Specification for cheese knife
115.	IS 2504 : 1964	Specification for hand-operated cheese press vertical
116.	IS 2647 : 1964	Specification for cheese mill
117.	IS 2688 : 2009	Insulated stainless steel horizontal milk storage tank – Specification (*first revision*)
118.	IS 2689 : 2019	Stainless steel batch pasteurizer – Specification (*first revision*)
119.	IS 2803 : 1964	Specification for capillary pipette for direct microscopic count of milk
120.	IS 2829 : 2019	Steam jacketed ghee pans boilers Stainless Steel – Specification (*second revision*)
121.	IS 3382 : 1965	Specification for stainless steel milk pipes and fittings
122.	IS 3661 : 2023	Bulk milk cooling tanks – Specification (*second revision*)
123.	IS 3893 : 1966	Specification for slides for direct microscopic count of milk
124.	IS 3922 : 1966	Recommendations for ghee refinery
125.	IS 4743 : 2018	Settling tanks for ghee – Specification (*first revision)*
126.	IS 4938 : 2009	Insulated stainless steel milk storage tank vertical type – Specification (*first revision*)

127.	IS 5253 : 1969	Guidelines for cleaning and sterilizing dairy equipment
128.	IS 5567 : 1970	Specification for bottles for sterilized milk
129.	IS 6591 : 2023	Rail milk tank vans – Specification (*first revision*)
130.	IS 6684 : 1972	Specification for milk can trolleys
131.	IS 9585 : 2021	Lactometers – Specification (*first revision*)
132.	IS 9853 : 2018	Stainless steel accessories for village milk collection center – Specification (*first revision*)
133.	IS 9854 : 2018	Code for construction of milk delivery vans (*first revision*)
134.	IS 11585 : 2009	Insulated stainless steel silos for milk storage capacity 30, 40, 60, and 100 kilo litres – Specification (*first revision*)
135.	IS 16440 : 2016	Stainless steel milk cans – Specification

5. INDIAN STANDARDS ON TEST METHODS FOR DAIRY PRODUCTS

Milk is one of the most important commodities entering trade and required in everyday life as an article of food. The basic public health and economic considerations require that consumers should be provided with pure milk, free from pathogenic bacteria. To maintain quality standards, control operations have to be performed at all stages of the production of milk which include maintenance of sanitary conditions of byres; cleanliness of utensils and of the milking machines, if used; and care during storage and handling. Wilful adulteration at the producing or supplying centre, by carriers or by middlemen, has to be prevented. The only means of ensuring quality, when the purchaser cannot exercise a direct control over the production, transport and handling of milk, is by subjecting representative samples to chemical and bacteriological analysis. The need for having uniform methods for assessing the quality of milk at the time of purchase or sale is, therefore, obvious.

5.1 Rapid Tests for Milk

There are two Indian Standards for rapid testing of milk, namely, IS 1479 (Part 1) : 2016 'Methods of test for dairy industry – Rapid examination of milk (*first revision*)' and IS 1479 (Part 4) : 2018/ISO 5764 : 2009 'Method of test for dairy industry Part 4 Milk – Determination of freezing point - Thermistor cryoscope method (Reference Method) (*third revision*)'

It may not be often necessary nor is it possible to subject all the samples of milk to a regular and elaborate chemical and bacteriological analysis. At milk collecting centers, rapid examination of milk has to be carried out for routine check with the object of ensuring purity of milk, its hygienic quality and fitness for acceptance as raw milk or for further processing. In order to provide uniform methods for this purpose, BIS has published IS 1479 (Part 1): 2016 'Methods of test for dairy industry – Rapid examination of milk (*first revision*)' which specifies rapid methods that are normally required for assessing the quality of raw milk supplies intended for processing and manufacture.

Guidance on sampling of milk from individual containers, bulk milk coolers and trucks is also given in IS 1479 (Part 1) along with various types of appliances used for milk sampling.

The following rapid tests are prescribed in IS 1479 (Part 1) : 2016:

Sl. No.	Rapid test/ Parameter	Significance	Principle/ Procedure
i)	Sediment test	Sediment test on raw milk reveals the extent to which visible insoluble matter has gained entrance to the milk and the extent to which such material has not been removed from milk by single service strainers. Despite the limitations as to the interpretation that may be applied when visible sediment is or is not detected in milk, the sediment test presents a simple, rapid and a quantitative measure of indicating the cleanliness of milk with respect to visible dirt.	The test is carried out by allowing a measured quantity of milk to pass through a fixed area of a filter disc and comparing the sediment left with the prepared standards.
ii)	*p*H value	The *p*H value, or hydrogen ion concentration, gives a measure of the true acidity of milk. The relationship between pH and acidity of milk is only approximate. In normal cow and buffalo milk, the *p*H ranges from 6.6 to 6.8. The value is reduced by the development of acidity. On the other hand, the *p*H value of milk from animals suffering from mastitis is alkaline in reaction, the value being over 7.0. The *p*H test is mainly used for the detection of abnormal mastitis milk. In normal milk the *p*H is well below 6.9. On an average cow milk gives a *p*H of 6.6, and buffalo milk 6.8. Milk of *p*H over 6.9 should be regarded with suspicion as indication of some diseases of the udder, or of late lactation milk.	The *p*H of milk may be determined rapidly by using the indicator strips.
iii)	Clot-on-Boiling (C.O.B.) Test	This is a quick test to determine developed acidity and the suitability of milk for processing, The principal features of the boiling test are speed and definiteness of results. Milk either remains unchanged or coagulates. Milk which gives a positive C.O.B. test has an acidity generally above 0.17 percent (as lactic acid) and is not suitable for distribution as liquid milk or for processing.	Milk sample is placed in a boiling water-bath for about 5 min. Presence of precipitated particles on the surface of milk or side of the test-tube is indicative of a positive test.
iv)	Alcohol test	The alcohol test is used for rapid assessment of stability of milk to processing, particularly for condensing, and sterilization. The alcohol test is useful as an indication of the mineral balance of	Milk sample is placed in a test tube and equal quantity of alcohol is added. Presence of a flake or clot denotes a positive test.

Sl. No.	Rapid test/ Parameter	Significance	Principle/ Procedure
		milk and not so much as an index of developed acidity. The test aids in detecting abnormal milk such as colostrum milk from animals in late lactation, milk from animals suffering from mastitis, and milk in which the mineral balance has been disturbed. A negative test indicates low acidity and good heat stability of the milk sample. Milk showing positive test is not considered suitable for the manufacture of evaporated milk which has to be sterilized to ensure its keeping quality.	
v)	Half-Hour Methylene Blue Reduction (M.B.R.) Test	The length of time taken by milk to decolourize methylene blue is a fairly good measure of its bacterial content, and hence of its sanitary and keeping quality.	The samples which show complete decolourization of blue colour on incubation for 30 min or less shall not be suitable for acceptance.
vi)	Direct Microscopic Count	The direct microscopic method enables the rapid estimation of total bacterial population of a sample of milk and also reveals useful information for tracing the sources of contamination in milk.	The method consists of examining, under a compound microscope, stained films of a measured volume of milk spread on glass slides over specified area.
vii)	Acidity	The titratable acidity test is employed to ascertain if milk is of such a high acidity as to reduce its keeping quality and heat stability. The acidity of milk is not a true measure of lactic acid present but in practice, gives a good indication of the quality of milk.	The titratable acidity test measures the amount of alkali which is required to change the pH of milk from its initial value of about 6.6 to 6.8, to the pH of the colour change of phenolphthalein added to milk to indicate the end point (pH 8.3). The normal range of acidity of milk varies from 0.10 to 0.17 percent lactic acid. Any value in excess of 0.17 percent can safely be reckoned as developed lactic acid.
viii)	Detection of Adulterants	a) Detection of Extraneous Water	Presence of extraneous water in milk is detected by: a) Lower percentage of fat, b) Lower density of milk at 27°C, c) Lower percentage of solids-not-fat, d) Depression of freezing point [IS 1479 (Part 4)]

Sl. No.	Rapid test/ Parameter	Significance	Principle/ Procedure
		b) Detection of Mineral Oil	The presence of mineral oil in milk fat is indicated by the development of turbidity when hot distilled water is added to a freshly made alcoholic solution of the soap formed by the isolated milk fat/oil. For the detection of mineral oils in milk, milk fat needs to be separated and converted into Ghee. In presence of >0.5 percent mineral oil on fat basis, distinct turbidity appears.
		c) Detection of Starch *Starch or cereal flours, may be added to make up the density of milk to prevent detection of added water.*	Place in a test-tube about 3 ml of well-mixed sample. Bring it to boil by holding the tube over a flame. Allow to cool to room temperature. Add a drop of one percent iodine solution. Presence of starch is indicated by the appearance of a blue colour which disappears when the sample is boiled and re-appears on cooling. The test can detect presence of starch at 0.02 percent level in milk.
		d) Detection of Cane Sugar *Cane sugar may be added to milk to raise the density to prevent detection of extraneous water.*	To about 15 ml of milk in a test-tube, add 3 ml of concentrated HCl and 0.1 g of resorcinol and mix. Place the tube in boiling water-bath for 5 min. A white colour or white with slight yellowish tinge is considered as negative for cane sugar and development of slight red colour to brick red colour is considered as positive for added cane sugar.
		e) Determination of Maltodextrins in Milk	The reaction is due to the formation of carbohydrate-iodine complex (brownish) in low pH condition. The presence of maltodextrin is indicated if the color changes to brown. If the colour remains golden yellow, then it will indicate absence of maltodextrin.
		(f) Detection of Glucose *Generally glucose is added as adulterant to increase the specific gravity of milk. General tendency of people with vested interest is to*	Take 1 ml of milk and add 1ml of Modified barfoed's reagent. Place it in boiling water bath for 3 minutes. Cool under tap water (2-3 min). Add 1 ml of phosphomolibdic acid. Development of

Sl. No.	Rapid test/ Parameter	Significance	Principle/ Procedure
		add at the rate of 0.5-1.0 percent to get sufficient increment in Lactometer reading. Therefore, this test can be successfully implemented in milk collection centres also.	deep blue colour is an indication of added glucose.
		g) Detection and Determination of Urea in Milk *Urea content in natural milk varies from 20 mg/100 ml to 70 mg/100 ml. However, urea content above 70 mg/100 ml in milk indicates milk containing 'added urea'. The adulteration of milk by 'added urea' which serves to increase the total solids content of milk, is detected and determined by the following test*	Take 5 ml of milk sample and add 5 ml of 1.6 percent para-dimethyl amino benzaldehyde (DMAB) reagent and mix well. For comparison, prepare a control, that is, milk sample containing no added urea. A distinct yellow colour if observed in milk sample indicates milk containing 'added urea'. The control, however, would show a slight yellow colour due to the presence of natural urea in milk.For determination of urea content, prepare standard curve by taking known concentrations of urea and treating with DMAB and calculate the amount of urea in milk from the standard curve.
		h) Detection of Vegetable Oils/Foreign Fat in Milk	By determination of Butyro-Refractometer (B.R.) Reading or Reichert Meissel (RM) Value of separated milk fat
		i) Detection of Sulphates in Milk *The test method is used to detect added sulphates in milk to increase the solids-not-fat (SNF) content.*	Soluble sulphates present in filtrate forms barium sulphate ($BaSO_4$) with barium chloride ($BaCl_2$) solution and will give precipitate of white colour.
		j) Test for Presence of Anionic Detergent in Milk *Alkyl benzene sulphonic acid (ABS) or anionic detergent may be present in milk due to intentional addition of detergent in milk or due to insufficient rinsing of dairy equipment.*	The method is based on the ionic interaction between the anionic detergent and cationic dye. Anionic detergents have a property to form a complex with cationic dyes. The solubility of dye and dye-detergent complex differs significantly as dye-detergent complex is relatively less polar in comparison to dye alone. Formation of dye detergent complex between cationic dye and anionic detergents and subsequently its extraction into the hydrophobic solvent layer (lower) is the principle behind the method. The method is performed by addition of methylene blue dye solution

Sl. No.	Rapid test/ Parameter	Significance	Principle/ Procedure
		k) Detection of Soya Powder in Milk	and chloroform to milk, mixing of the content followed by centrifugation. This results in distribution of dye colour in upper layer and lower layers. Relative intensity of the colour is noticed in these layers. Appearance of relatively more blue colour in lower layer indicates the presence of detergent in milk. Urease enzyme present in soyabean powder converts the urea into carbon dioxide and ammonia. Ammonia dissolves and makes the medium alkaline which turns the colour of phenol red solution to pink.
ix)	Detection of Preservatives	Milk and other dairy products are required by Public Health Laws to be free from preservatives. With a few exceptions, any preservative added to milk is not removed in the process of treatment or manufacture. Thus, if milk containing preservatives is accepted, the treated milk or milk product when subsequently offered for sale may contain preservatives and render the seller liable to prosecution besides constituting a hazard to health. No preservative shall, therefore, be added to milk except in the case of the samples which have to be preserved for chemical examination. Some of the most common preservatives found in milk are boric acid and borax, benzoic acid, formaldehyde and salicylic acid. Hypochlorite residues may also be found in milk when chlorine sterilizers are used for sterilizing milk handling equipment unless such equipment is properly rinsed with water. Antibiotics used in the treatment of udder diseases of milch animals may also find their way in milk if proper precautions are not taken. The presence of chlorine or antibiotics in milk not only enhances the keeping quality of the milk but will reduce the plate counts and also lengthen the M.B.R. When testing for preservatives, it is necessary to carry out a control test with a milk sample known to be free from any preservative.	Following tests are specified: a) Test for Boric Acid Using Glycerol b) Hehner Test for Formaldehyde c) Test for Benzoic Acid using ferric chloride solution d) Ferric Chloride Test for Salicylic Acid e) Test for Presence of Hydrogen Peroxide using vanadium pentoxide f) Detection of Hypochlorite using Stannous chloride solution g) Detection of Thiocyanates in Milk using Trichloro acetic acid and ferric nitrate

Sl. No.	Rapid test/ Parameter	Significance	Principle/ Procedure
x)	Detection of Neutralizers	Neutralizers in the form of lime water, or sodium bicarbonate may be added to neutralize developed acidity before milk is processed. Such a practice is not permissible.	Following tests for detection of neutralizers: a) Rosalic acid test for carbonates b) Detection of added sodium salts with sodium detection meters c) Acidity difference before and after boiling the sample for neutralizer detection
xi)	Detection of Mastitis	Mastitis or inflammation of the udder is caused by certain species of streptococci, principally Streptococcus agalactia, staphylococci and a few other types of organisms. Though in most cases mastitis is caused by the non-pathogenic types of bacteria, their occurrence interferes with the efficient secretion of milk and is invariably a source of great economic loss. It is, therefore, necessary to regularly examine all the milking animals in a herd to ensure that none is suffering from mastitis, and whenever positive cases are detected, to take prompt measures to check and eliminate the disease.	a) Bromothymol Blue Test – This test is based on the fact that milk from infected udders is usually alkaline and shows pH as high as 7.4. In normal milk the pH is well below 6.9. On an average cow milk gives a pH of 6.6, and buffalo milk 6.8. Milk of pH over 6.9 should be regarded with suspicion as indication of some diseases of the udder, or of late lactation milk. b) Direct Microscopic Somatic Cell Count – Bacterial infection causes mastitis or inflammationof the mammary glands. Somatic cell counts haveanimal health, milk quality and productivityimplication. Mastitis causes diminished production of milk due to tissue damage of the glands. The concentration of the somatic cells in the milk is directly related to infection status of udder.

5.2 Chemical Analysis of Milk and Milk Products

5.2.1 IS 11917 : 2018/ISO 8968-1 : 2014 'Milk and milk products – Determination of nitrogen content - Kjeldahl principle and crude protein calculation (*first revision*)'

This standard specifies a method for the determination of the nitrogen content and crude protein calculation of milk and milk products by the Kjeldahl principle, using traditional and block digestion methods. A test portion is digested with a mixture of concentrated sulfuric acid and potassium sulfate. Using copper sulfate (II) as a catalyst to thereby convert any organic nitrogen present to ammonium sulfate. The function of the potassium sulfate is to elevate the boiling point of the sulfuric acid and to provide a stronger oxidizing mixture for digestion. Excess sodium hydroxide is added to the cooled digest to liberate ammonia. The liberated ammonia is steam distilled into the excess boric acid solution and titration with hydrochloric acid standard volumetric solution is carried out. The nitrogen content is calculated from the amount of ammonia produced.

5.2.2 IS 9967 'Test methods for Nitrate and Nitrite Content in Milk and Milk products'

IS 9967 prescribes the methods for determination of nitrate and nitrite contents in milk and milk products and has been published in the following 3 parts based on different methods which are identical adoption of corresponding ISO Standards:

i) IS 9967 (Part 1) : 2008/ISO 14673-1:2004 'Milk and milk products – Determination of nitrate and nitrite contents Part 1 method using cadmium reduction and spectrometry (*second revision*)'

ii) IS 9967 (Part 2) : 2008/ISO 14673-2: 2004 'Milk and milk products – Determination of nitrate and nitrite contents Part 2 method using segmented flow analysis Routine Method (*second revision*)'

iii) IS 9967 (Part 3) : 2008/ISO/14673-3: 2004 'Milk and milk products – Determination of nitrate and nitrite contents Part 3 method using cadmium reduction and flow injection analysis with in-line dialysis (Routine Method) (*second revision*)'

5.2.3 IS 8479 'Determination of Phosphatase Activity in Milk and Milk Products'

Phosphatase activity is determined to judge the efficiency of pasteurization of milk and milk products. To test whether the prescribed heat treatment was properly carried out, the treated milk or milk products is subject-ed to phosphatase test which helps to indicate the presence or absence of phosphatase enzyme. Phosphatase present in milk or milk products is destroyed by just about the same heat treatment necessary for the destruction of Mycobacterium tuberculosis, the most heat-resistant pathogen likely to be present m the products. The method is, therefore, applied for the control of proper pasteurization. IS 8479 prescribes the methods for determination of phosphatase activity in milk and milk products.

It is published in two parts: Part 1 covers the routine method for determination of phosphatase activity which is carried out with special discs and a comparator and is used for day-to-day checks for the control of proper pasteurization of milk and milk products in a dairy; whereas Part 2 which is identical adoption of ISO 3356: 2009 covers the reference method which requires the use of a spectrophotometer and is usually applied in case of dispute.

5.3 Test Methods for Dried and Concentrated Milk Products

The milk production in our country is characterized by seasonal variations and drying of milk, an important method of preservation, facilitates later consumption during the lean season. The dried milk products, thus, have become an essential part of the chain between the producer and the consumer. BIS has published a number of Indian Standards on test methods for dried and concentrated milk products, some of which are mentioned below:

- **IS 11766 : 1986/ISO 6092 : 1980 'Method for determination of titratable acidity in milk powder and similar products – Routine method'**

  Preparation of reconstituted milk by addition of water to a test portion of dried milk corresponding accurately to 5 g of solids-not-fat. Titration with 0.1 mol/l, sodium hydroxide solution using phenolphthalein as indicator and cobalt(II) sulphate as reference colour solution. Multiplication of the number of millilitres used in the titration by the factor 2, in order to obtain the number of millilitres in terms of 10 g of solids-not-fat.

- **IS 11202 : 2012/ISO 8069 : 2005 'Dried milk – Determination of content of lactic acid and lactates (*second revision*)'**

  A test portion of dried milk is dissolved in warm water. The fat and proteins are precipitated then filtered. The filtrate is treated with the following enzymes and biochemical substances, added simultaneously, but acting in sequence:

a) L-lactate dehydrogenase (L-LDH) and D-lactate dehydrogenase (D-LDH), in the presence of nicotinamide adenine dinucleotide (NAD), to oxidize lactate to pyruvate and to convert NAD to its reduced form NADH;

b) glutamate pyruvate transaminase (GPT), in the presence of L-glutamate, to transform pyruvate into L-alanine and to convert L-glutamate to á-ketoglutarate.

The amount of NADH produced is determined by spectrophotometric measurement at a wavelength of 340 nm, and is proportional to the lactic acid and lactates content.

- **IS 16072 : 2012 'Determination of moisture content in milk powder and similar products (Routine method)'**

Quite often, various laboratories employ different temperature and time combinations for determination of moisture content in milk powder and similar products, which might give varying results. This standard has been formulated with a view to providing uniform method to facilitate comparison of results. This method is for use for commercial and quality control purposes. IS 16072 prescribes the routine method for determination of moisture content in milk powder and similar products, which is the loss in mass, expressed as a percentage by mass when the product is heated in an air oven at 102 ± 2°C to constant mass. BIS has also published another Indian Standard IS 11623 : 2008 which is identical adoption of ISO 5537: 2004 and prescribes the reference method for determination of moisture content in all types of dried milk. As per the reference method, a test portion is dried in a drying oven set at 87°C for 5 h while dry air is passed through the test portion. The loss of mass of the test portion (which is related to the content of "non-chemically bound" water) is determined. This method is used for reference purpose.

- **IS 11721 : 2013/ISO 1736 : 2008 'Dried milk and dried milk products – Determination of fat content – Gravimetric method (Reference Method) *(second revision)'* and IS 11762 : 2013/ISO 1737 : 2008 'Evaporated milk and sweetened condensed milk – Determination of fat content – Gravimetric method (Reference method) (*second revision*)'**

Both these methods are based on Röse-Gottlieb principle (an ammoniacal ethanolic solution of a test portion is extracted with diethyl ether and light petroleum. The solvents are removed by distillation or evaporation. The mass of the substances extracted is determined).

- **IS 11764 : 2005/ISO 2911 : 2004 'Sweetened condensed determination of sucrose milk content – Polarimetric method (*first revision*)'**

The method is applicable to sweetened condensed milk of normal composition prepared from whole, partially skimmed or skimmed milk and sucrose only and containing no altered sucrose. A test sample is treated with ammonium hydroxide, so as to bring mutarotation of lactose to final equilibrium. It is neutralized and then clarified by successive additions of zinc acetate and potassium hexacyanoferrate (n), followed by filtration. The optical rotation is determined on a portion of the filtrate. On another portion of the filtrate, inversion is induced (based on the Clerget principle) by mild acid hydrolysis of the sucrose, leaving lactose and other sugars virtually unaffected. The optical rotation is determined after inversion.

- **IS 12759 : 2019/ISO 8156 : 2005 'Dried milk and dried milk products – Determination of insolubility index (*first revision*)'**

There are several rather elaborate gravimetric methods for determining the solubility of dried milk, but for routine purposes, including grading, the most widely used procedure is solubility index method. The volume, in ml, of the sediment finally obtained (that is, insoluble residue) is the solubility index. Since the solubility

index is thus inversely related to solubility, it seems more direct and more rational to use the term "insolubility index". As per IS 12759 : 2019, Insolubility Index is volume in ml, of sediment (insoluble residue) obtained when a dried milk or dried milk product is reconstituted and the reconstituted milk or milk product is centrifuged, under the conditions specified in this standard. In any sediment-volume solubility method applied to a dried milk or a dried milk product, the temperature at which the test portion is reconstituted is the main factor influencing what the result will be. For the insolubility index method, it was decided to adopt the principle that the reconstituting temperature should be either 24°C or 50°C depending on whether the product, in normal usage from its quality specification, is expected to be reconstitutable in "cold" water or "warm" water, respectively. This means that the reconstituting temperature to be used in the insolubility index method will, in general, be 24°C for spray-dried products and 50°C for roller-dried products. Exceptions to this general rule are spray-dried milk-based baby food and, in some instances, spray-dried whole milk or partly skimmed milk, intended to be reconstituted in warm water.

- **IS 12760 : 2012/ISO 8070 : 2007 'Milk and milk products – Determination of calcium sodium potassium and magnesium contents – Atomic absorption spectrometric method (*first revision*)'**

  This standard specifies a flame atomic absorption spectrometric method for the determination of calcium, sodium, potassium and magnesium contents in milk and milk products. The method is applicable for milk and whey, buttermilk, yogurt, cream, dried milk, butter, cheese, casein and caseinate. The organic matter is decomposed by dry ashing or by wet digestion using nitric acid either in an open microwave-assisted wet digestion system or in a pressurized microwave-assisted wet digestion system or in a pressurized polytetrafluoroethylene (PTFE) decomposition vessel or any appropriate instrumentation in wet digestion. The ash containing calcium, sodium, potassium, and magnesium is dissolved in a nitric acid solution in the case of dry ashing, or the digests diluted in the case of wet digestion. The test and calibration solutions are atomized into an air–acetylene flame of an atomic absorption spectrometer and their absorption is measured at appropriate wavelengths.

5.4 Test Methods for Cheese and Processed Cheese Products

Cheese is the ripened or unripened soft, semi-hard, hard, or extra-hard product, which may be coated with food grade waxes or polyfilm, and in which the whey protein/ casein ratio does not exceed that of milk. Cheese is obtained by coagulating wholly or partly the protein of milk, skimmed milk, partly skimmed milk, cream, whey cream or buttermilk, or any combination of these materials, through the action of suitable enzymes of non-animal origin or other suitable coagulating agents, with or without use of harmless lactic acid bacteria and flavour producing bacteria, and by partially draining the whey resulting from the coagulation, while respecting the principle that cheese-making results in a concentration of milk protein (in particular, the casein portion), and that consequently the protein content of the cheese will be distinctly higher than the protein level of the blend of the above milk components from which cheese was made.

BIS has published the following Indian Standards for test methods for cheese and processed cheese products:

- **IS 9070 : 1979 'Method for determination of fat in cheese by van gulik method'**

  Van Gulik method is used for rapid and routine determination of fat in cheese. The principle of the method is dissolution of the protein with sulphuric acid, followed by separation of the fat of the cheese in a Van Gulik butyrometer by centrifuging, the separation being assisted by the addition of a small quantity of amyl alcohol, and direct reading of the fat content on the butyrometer scale.

- **IS 12758 : 2005/ISO 1735 : 2004 'Cheese and processed cheese products – Determination of fat content – Gravimetric method'**

  This is used as a reference method for the determination of the fat content of all types of cheese and processed cheese products having lactose contents of below 5 percent (mass fraction) of non-fat solids. A test portion is digested with hydrochloric acid then ethanol is added. The acid-ethanolic solution is extracted with diethyl ether and light petroleum and the solvents are removed by distillation or evaporation. The mass of the substances extracted is determined. This is usually known as the Schmid-Bondzynski-Ratzlaff principle.

- **IS 11763 : 2011/ISO 5943 : 2006 'Cheese and processed cheese products – Determination of chloride content – Potentiometric titration method (*third revision*)'**

  A test portion is suspended in water. The suspension is acidified with nitric acid then the chloride ions are titrated potentiometrically with a silver nitrate standard solution.

- **IS 12757 : 2012/ISO/TS 2963 : 2006 'Cheese and processed cheese products – Determination of citric acid content – Enzymatic method (*second revision*)'**

  An extract of the sample is treated with the following enzymes and biochemical substances:

  a) citrate lyase (CL) to convert citric acid to oxalacetate and acetate;

  b) malate dehydrogenase (MDH) and lactate dehydrogenase (LDH), in the presence of reduced nicotinamide adenine dinucleotide (NADH), to catalyse the reduction of oxalacetate and its decarboxylation product pyruvate to L-malate and L-lactate, respectively, with the subsequent conversion of NADH to its oxidized form (NAD+).

  The decrease in concentration of NADH is determined by measurement of the absorbance of the test solution at 340 nm. The citric acid content is proportional to the decrease in NADH concentration.

- **IS 12756 : 2019/ISO 2962 : 2010 Cheese and processed cheese products – Determination of total phosphorus content – Molecular absorption spectrometric method (*first revision*)**

  Cheese is digested by concentrated sulfuric acid and hydrogen peroxide. Molybdenum blue is formed by addition of a sodium molybdate-ascorbic acid solution. Molecular absorption of the blue colour formed is measured spectrometrically at a wavelength of 820 nm.

5.5 Test Methods for Caseins and Caseinates

Casein is the major protein of milk and it exists as a colloidal suspension. Since casein is a good protein nutritionally, it is used in the manufacture of protein foods for oral administration in cases which call for protein supplementation. Edible casein products are the products obtained by separating, washing and drying the coagulum of skimmed milk and/or of other products obtained from milk. Caseinate is the product obtained by reaction of edible casein

or edible casein curd coagulum with neutralizing agents followed by drying. BIS has published the following Indian Standards for test methods for Caseins and caseinates:

- **IS 11888 : 2005/ISO 5739 : 2003 'Caseins and caseinates – Determination of contents of scorched particles and of extraneous matter (*first revision*)'**

  This standard specifies a method for the determination of the contents of scorched particles and of extraneous matter in caseins and caseinates. The level of scorched particles in caseins and caseinates is an indicator of the quality of milk employed for manufacturing of the product, as well as conditions employed for heat processing of milk at prewarming, concentration and spray drying stages. A lower level of scorched particles is desirable in the product.

- **IS 11919 : 2012/ISO 5544 : 2008 'Caseins – Determination of fixed ash (Reference method)'**

  Fixed ash is used to indicate that the phosphorus of organic origin is retained in the ash. This Standard specifies a reference method for the determination of the "fixed ash" of caseins obtained by acid precipitation or lactic fermentation, of ammonium caseinates, of their mixtures with rennet casein and with caseinates, and of caseins of unknown type. A test portion is incinerated at 825 ± 25°C in the presence of magnesium acetate to bind all phosphorus of organic origin. The residue is weighed and the mass of ash originating from the magnesium acetate is subtracted.

- **IS 11962 : 2012/ISO 5545 : 2008 'Rennet caseins and caseinates – Determination of ash Reference Method (*first revision*)'**

  This standard specifies a reference method for the determination of the ash of caseins obtained by rennet precipitation and of caseinates, with the exception of ammonium caseinate. A test portion is incinerated at 825 ± 25 °C. The residue is then weighed.

- **IS 11920 : 2012/ISO 5550 : 2006 'Caseins and caseinates – Determination of moisture content (Reference Method) (*first revision*)'**

  This standard specifies the reference method for the determination of the moisture content of all types of caseins and caseinates. A test portion is dried at 102 ± 2 °C then weighed to determine its loss of mass.

- **IS 11963 : 2005/ISO 5548 : 2004 'Caseins and caseinates – Determination of lactose content - Photometric method (*first revision*)'**

  This standard specifies a photometric method for the determination of the content of lactose and other soluble carbohydrates in caseins and caseinates containing less than 2 % of total soluble carbohydrates. A test portion is dissolved

  a) in hot water in the case of caseinates;

  b) in hot water with the addition of sodium hydrogen carbonate in the case of acid caseins; and

  c) in hot water with the addition of pentasodium triphosphate in the case of rennet casein.

  The casein is precipitated with a solution of acetic acid and sodium acetate at pH 4.6, then filtered to obtain a protein-free solution of the carbohydrates. Phenol solution and concentrated sulfuric acid are added to an aliquot portion of the filtrate, thus producing a colour which is proportional to the amount of carbohydrate present, which is measured photometrically at a wavelength of 490 nm.

- **IS 11964 : 2012/ISO 5547 : 2008 'Caseins – Determination of free acidity (Reference method) (*first revision*)'**

  This standard specifies a reference method for the determination of the free acidity of caseins obtained by acid precipitation or lactic fermentation and of rennet caseins. A test portion at 60 °C is extracted using water and filtered. The filtrate is then titrated against a standard volumetric sodium hydroxide solution, using phenolphthalein as indicator.

5.6 Test Methods for Determination of Contaminants in Milk, Milk Products and Infant Formulae

5.6.1 IS 16195 : 2014/ ISO/TS 15495 : 2010 'Milk, milk products and infant formulae – Guidelines for the quantitative determination of melamine and cyanuric acid by LC-MS/MS'

Some examples of adulteration of milk include addition of water, whey, vegetable oil and protein and milk from different species, which are known as economically motivated adulteration. These milk frauds do not pose any severe health risk. However, some adulterants have serious adverse effect on human health such as adding urea, formalin, detergents, alkaline and acidic compounds, hydrogen peroxide and melamine. Melamine is added into milk to increase the protein count at less cost. Melamine or 2,4,6-triamino-1,3,5-triazine ($C_3H_6N_6$) is a nitrogen-rich compound which has been used for producing plastics, adhesives, laminates, paints, permanent-press fabrics, flame retardants, textile finishes, tarnish inhibitors, paper coatings and fertilizer mixtures. Milk and infant formula adulterated with melamine has been of high concern since September 2008, when in China, six children died due to the presence of melamine in their food. Trace levels of melamine may be detected into the food because of its presence in the environment or indirectly through animal feeds that have been treated with products containing melamine, such as fertilizers or pesticide. Moreover, melamine is added into milk, wheat gluten and other protein sources to increase the protein count falsely at less cost.

IS 16195 : 2014/ISO/TS 15495 : 2010 'Milk, milk products and infant formulae – Guidelines for the quantitative determination of melamine and cyanuric acid by LC-MS/MS' gives guidance for the quantitative determination of melamine and cyanuric acid content in milk, powdered milk products, and infant formulae by electrospray ionization liquid chromatography tandem mass spectrometry.

The sample is made homogenous and optionally reconstituted in the case of powdered samples. A suitable solvent is added to the test sample to precipitate proteins from the matrix and to extract melamine and cyanuric acid. After centrifugation, an aliquot of the supernatant is analysed by LC-MS/MS. For the purposes of this Technical Specification, LC-MS/MS designates any method combining either high-performance liquid chromatography (HPLC) or ultra-performance liquid chromatography (UPLC), with either triple quadrupole or ion-trap mass spectrometric detection. Chromatographic separation is based on hydrophilic interaction liquid chromatography (HILIC) to ensure good separation of melamine and cyanuric acid. Ionization of the substance is accomplished by electrospray ionization (ESI) and detection operates in the selected reaction monitoring (SRM) mode. Quantification of both melamine and cyanuric acid is based on isotope dilution using stable isotope internal standards for both analytes.

5.6.2 Test Methods for Determination of Aflatoxin M_1 in Milk and Milk Products

The occurrence of aflatoxins in milk and milk products is one of the most serious problems of food hygiene, as milk is a key source of nutrients for humans. Aflatoxin M_1 in milk and dairy products could be a risk to human as well as animal health. High contamination in feed may result in a significant aflatoxin M_1 level in milk when animals are fed with highly contaminated foodstuffs.

BIS has laid down the following Indian Standards for determination of aflatoxin M_1 in milk and milk products.

These standards are identical adoption of corresponding ISO Standards:

i) IS 18108 : 2023/ISO 14674 : 2005 'Milk and milk powder – Determination of aflatoxin M_1 content – Clean-up by immunoaffinity chromatography and determination by thin-layer chromatography'

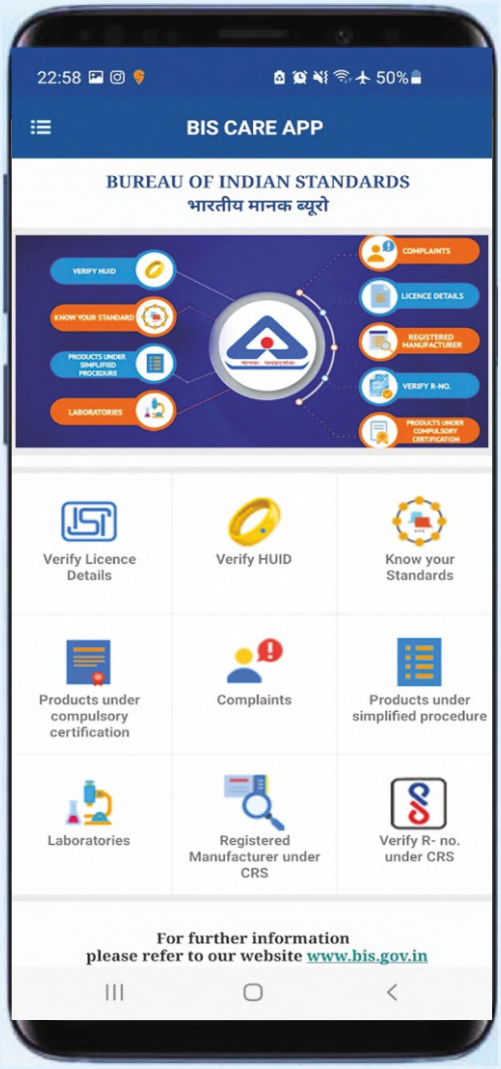
ii) IS 18109 : 2023/ISO 14675 : 2003 'Milk and milk products – Determination of aflatoxin M_1 content – Guidelines for a standardized description of competitive enzyme immunoassays'

iii) IS 18110 : 2023/ISO 14501 : 2021 'Milk and milk powder – Determination of aflatoxin M_1 content – Clean-up by immunoaffinity chromatography and determination by high-performance liquid chromatography'

IS 18108 : 2023 specifies a method for the determination of the aflatoxin M_1 (AFM_1) content of milk and milk powder by a method including a clean-up step using immunoaffinity chromatography followed by a thin-layer chromatography (IAC-TLC). The method is applicable to raw milk, low fat or skimmed liquid milk and milk powder. The lowest quantity of AFM_1 that can commonly be determined is 2 ng, which corresponds to a limit of quantification close to 0.10 µg/l for liquid milk or dissolved milk powder. AFM_1 is extracted by passing the test portion through an immunoaffinity column. The column contains specific antibodies bound onto a solid support material. As the sample passes through the column, the antibodies selectively bind with any AFM_1 (antigen) present and form an antibody-antigen complex. All other components of the sample matrix are washed off the column with water. Then the AFM_1 is eluted from the column with methanol and acetonitrile. After concentration of the eluate, the amount of AFM_1 is determined by one-dimensional thin-layer chromatography. In the case of interference, two-dimensional thin layer chromatography is carried out to separate the AFM_1 from its impurities.

IS 18109 : 2023 give guidelines on the use of screening methods used for the determination of AFM_1 content in milk and milk products, based upon competitive enzyme immunoassays. For legal purposes, positive enzyme immunoassay results require confirmation by an accepted reference method. However, depending on whether the test complies with the specifications given hereafter, enzyme immunoassays can be used for routine quality control, especially when the absence of aflatoxin M_1 above the regulatory limit needs to be documented. Immunochemical methods are based on the ability of antibodies to bind to specific substances. The reversible association between antibodies and their corresponding antigens is called the immunological reaction. The binding forces involved are weak molecular interactions, such as Coulomb and van der Waals forces, as well as hydrogen bonds and hydrophobic binding. The antigen-antibody reaction is based on the law of mass action and the amount of antigen or antibody present in the reaction mixture can be inferred from the extent of the reaction. The "quality" of any immunoassay is a function of the immunochemical principle of the method, the properties of the reagents, the assay design and the experimental errors. These basic principles determine the sensitivity, specificity, precision and accuracy of the assay.

IS 18110 : 2023 specifies a method for the determination of aflatoxin M_1 content in milk and milk powder. The lowest level of validation is 0.08 µg/kg for whole milk powder, i.e. 0.008 µg/l for reconstituted liquid milk. The method is also applicable to low-fat milk, skimmed milk, low-fat milk powder and skimmed milk powder. Aflatoxin M_1 is extracted by passing the test portion through an immunoaffinity column that contains specific antibodies bound onto a solid support material. As the sample passes through the column, the antibodies are selectively bound with any aflatoxin M_1 (antigen) present and form an antibody-antigen complex. All other components of the sample matrix are washed off the column with water. Then aflatoxin M_1 is eluted from the column and the eluate is collected. The amount of aflatoxin M_1 present in this eluate is determined by means of high-performance liquid chromatography (HPLC) coupled with fluorimetric detection.



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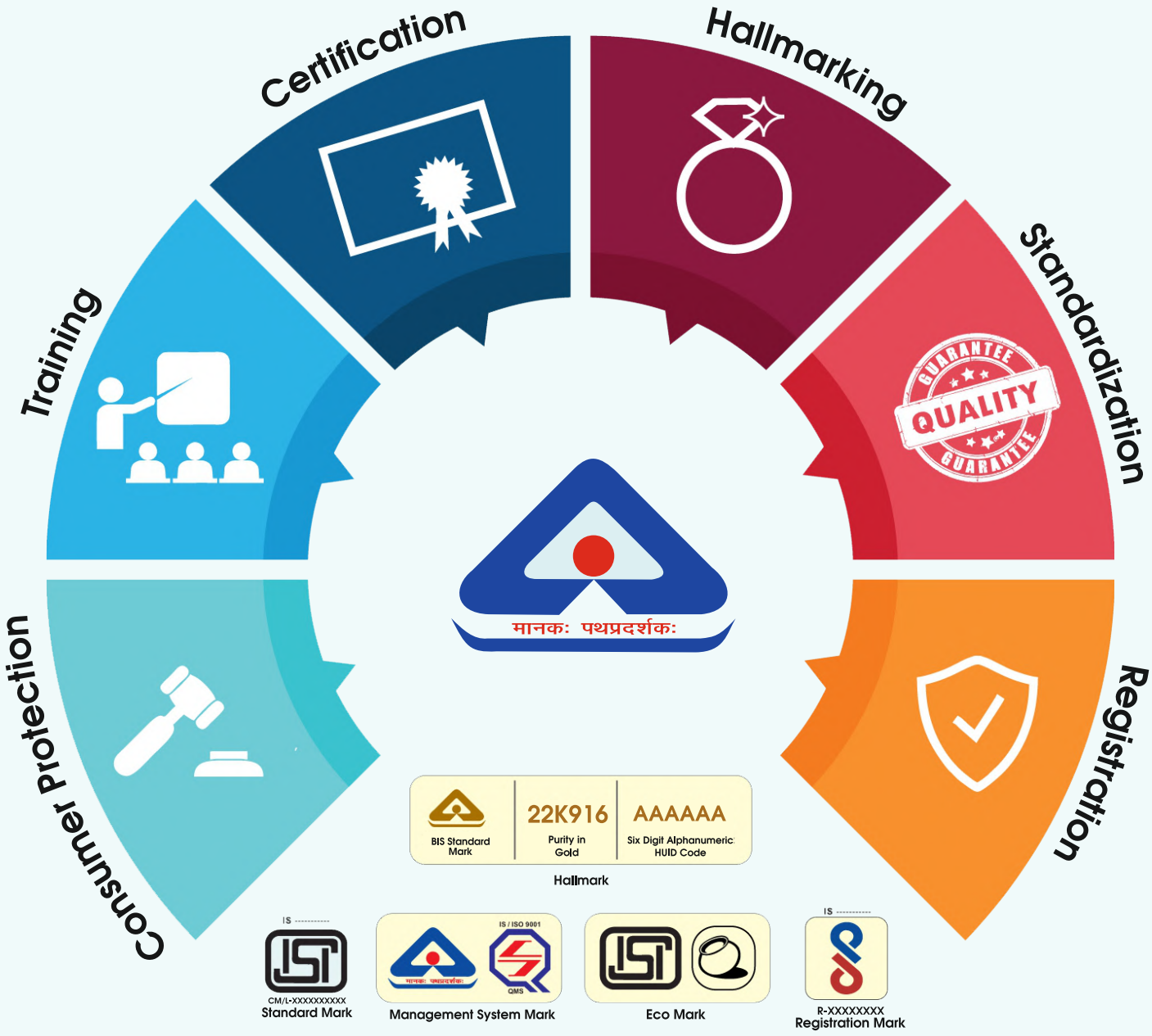

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