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उत्पाद मैनुअल
स्टाइरीन (विनाइल बेंजीन)
IS 4105:2023 के अनुसार

PRODUCT MANUAL
FOR Specification for Styrene (Vinyl Benzene)
ACCORDING TO IS 4105:2023

विभिन्न उत्पादों के लिए भारतीय मानक ब्यूरो) अनुरूपता मूल्यांकन (विनियम, 2018 की योजना -I के तहत प्रमाणन के संचालन में एकरूपता और पारदर्शिता के लिए इस उत्पाद मैनुअल का उपयोग सभी क्षेत्रीय / शाखा कार्यालयों और लाइसेंसधारियों द्वारा संदर्भ सामग्री के रूप में किया जाएगा। दस्तावेज़ का उपयोग बीआईएस प्रमाणन प्राप्त करने के इच्छुक संभावित आवेदकों द्वारा भी किया जा सकता है।

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure uniformity of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations,2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification.

1.	**मानक संख्या** **IS No.**	:	IS 4105:2023
	शीर्षक **Title**	:	Specification for Styrene (Vinyl Benzene)
	संशोधनों की संख्या **No. of amendments**	:	00
2.	**नमूना दिशानिर्देश** **Sampling Guidelines**		
a)	**कच्चा माल** **Raw material**	:	No specific requirement
b)	**समूहीकरण दिशानिर्देश** **Grouping Guidelines**	:	Not applicable
c)	**नमूने का परिमाण** **Sample Size**	:	1 litre
3.	**परीक्षण उपकरणों की सूची** **List of Test Equipment**	:	Please refer Annex-A

4.	निरीक्षण और परीक्षण की स्कीम **Scheme of Inspection and Testing**	:	Please refer Annex-B
5.	एक दिन में संभावित परीक्षण **Possible tests in a day. :** All tests except polymer content		
6.	**लाइसेंस का दायरा /Scope of the Licence:**		
	Licence is granted to use Standard Mark as per IS 4105:2023 with the following scope:		
	Name of the product	Styrene (Vinyl Benzene)	

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN,9, BAHADUR SHAH ZAFAR MARG,
NEW DELHI-110002

ANNEX-A

LIST OF TEST EQUIPMENT

(Indicative list, for guidance only)

Sl. No.	Tests Used in With Clause Reference	Test Equipment/Chemical
1	Colour, Cl. 3.2	**Method A (Tristimulus Colorimeter method)** Apparatus: Tristimulus Colorimeter Reagents: Cobalt Chloride, Conc. Hydrochloric Acid, Potassium Chloroplatinate **Method B (IS 1448 Pt-178)** Apparatus: Colour-measuring instrument (as per clause 4.1 of the IS 1448(Part 178):2020 Absorptions cells (50 mm light path length), Glass tubes (11 mm path length)
2	Relative density at 27/27°C, Cl. 3.2	**Method A (Manual method)** Apparatus: Relative Density Bottle 25 ml capacity, Water-Bath, thermometer of suitable range with 0.1 or 0.2 deg sub-divisions, Analytical balance, hot plate **Method B (Digital Density Analyzer)** Apparatus: Digital Density Analyzer, Circulating Constant-Temperature Bath, Syringes (for manual injection), Auto Sampler (automated injection analyses), Temperature Sensing Device (TSD), Ultrasonic bath (optional)
3	Refractive index at 27ºC, Cl. 3.2	**Method A (Determination of refractive index by refractometer)** Apparatus: A suitable refractometer (like Abbe Refractometer), source of daylight or any convenient artificial light **Method B (Determination of relative density by automatic digital refractometer)** Apparatus: Automatic digital refractometer with a suitable measuring range of 1.330 0 to 1.500 0 or higher, Temperature Control Unit, Temperature Measuring Device (a platinum resistance probe or equivalent), Light source (filtered white light such as that obtained using a tungsten-halogen lamp or a light emitting diode (LED)), Light Filters Reagents: n-Pentane (purity 95, per cent, minimum), Toluene — HPLC Grade, 1-Bromonaphthalene (purity 98, percent minimum), Primary Reference Materials, Solid reference standard, Distilled or deionized water, 2, 2, 4-trimethylpentane (purity 99 percent, minimum), Methylcyclohexane (purity 99 percent, minimum), Toluene (purity 99 percent, minimum), Secondary Reference Materials, Mineral oil calibration standards **Method C (IS 1448 (Part 158))** Apparatus: Refractometer (as per cl. 5.1 of the ISS), Glass certified reference material, White light source, Sodium arc lamp, Thermostatted bath and circulating pump

4	Freezing point, Cl. 3.2	**Method A (determination of freezing point in equilibrium with air atmospheric pressure)** Apparatus: Thermometer as per specification given in E.2.2.1 of IS 4105:2023, Freezing Point Apparatus made of glass conforming to IS 2303 (Part2) as per Fig. 1 of A-4, Bath Thermometer capable of reading as low as -50°C and least count of 1°C, Dewar Flask, Dark Bottle, refrigerator Reagents: acetone and carbon tetrachloride, Carbon Dioxide Solid (Dry Ice), Bromobenzene (Extra Pure),p-tertiary butyl catechol **Method B (determination of freezing point by phase transition method)** Apparatus: Automatic Freeze Point Chamber, Optical Detectors, Thermoelectrical Device, Temperature Sensor,
5	Assay, per cent by mass, Cl 3.2	Apparatus: Gas chromatograph capable of being operated under conditions suitable for resolving the individual constituents into distinct peaks. Reagents: Pure ethylebenzene, Pure alphamethylstyrene
6	Aldehyde, percent by mass (as benzaldehyde), Cl. 3.2	**Method A (determination of aldehyde content by potentiometric titration)** Apparatus: 250 ml glass stoppered Erlenmeyer flask, Potentiometric titration apparatus and other laboratory glassware Reagents: Hydroxylamine hydrochloride (reagent grade), methanol, thymol blue indicator, Standard Sodium Hydroxide Solution, Hydrochloric Acid **Method B (determination of aldehyde content by UV spectrophotometry)** Apparatus: UV- Spectrophotometer, Sample Tube , Pipette, Microcentrifuge tube, Stopwatch Reagents: Benzaldehyde, Acetonitrile (HPLC grade), Toluene (HPLC grade), 2,4-Dinitrophenylhydrazine, Hydrochloric acid, Benzaldehyde
7	Peroxides, Cl 3.2	**Method A (determination of peroxides by titrating material with titanous chloride solution)** Apparatus: 50 ml long-tipped burette, 250 ml wide- mouth conical flask and other laboratory glassware,Steam bath, hot plate Reagents: concentrated hydrochloric acid, 20 percent titanous chloride, crystallized ferrous ammonium sulphate, concentrated sulphuric acid, Potassium Thiocyanate solution, Methanol

		Method B (determination of peroxides by titrating material with sodium thiosulfate solution) Apparatus: Erlenmeyer Flasks, Electric Hot Plate, Boiling Chips Reagents: Glacial Acetic Acid, Isopropyl Alcohol, Sodium iodide, Sodium thiosulphate **Method C (determination of peroxides by UV spectrophotometry)** Apparatus: UV-Spectrophotometer, Sample Tube – 24 mm, Vortex Mixer, Pipettes, Stopwatch Reagents: Benzoyl Peroxide, N,N-Dimethylformamide (DMF), Tetrabutylammonium Iodide (TBAI), Toluene – HPLC grade, Glacial Acetic Acid, Ethyl Acetate – HPLC grade, Peroxide Stock Solution
8	Sulphur, Cl 3.2	**Method A (Combustion method)** Apparatus: Air purifying train(as specified in figure 3 of the ISS), Chimney and absorption train, Lamp, Nessler tubes Reagent: Absolute Alcohol, Potassium Hydroxide Solution, Lead Acetate Solution, Sodium Peroxide Solution, Conc. HCl, Barium Chloride solution, Standard sulphate solution **Method B (Reduction method)** Apparatus: Reduction Apparatus (as per J.3.2.1 of IS 4105:2023), Burette – class A, 10 ml capacity Reagents: Nitrogen gas, Acetone, Raney Nickel, Sodium Hydroxide solution, Hydrochloric acid, Mercuric Acetate solution, Methanol (Sulphur free), Dithizone **Method C (IS 1448 (Part 160) – UV Fluoroscence method)** Apparatus: Furnace, Combustion tube, Flow controllers, Vapour drier, UV Fluoroscence detector, Microlitre syringe, Sample inlet system, Balance (L.C.- 0.1 mg), Volumetric flasks Reagents: Solvent (Toluene, Iso-octane), Sulphur compounds - Dibenzothiophene (DBT), Dibutyl sulfide (DBS), Thionaphthene (Benzothiophene) (TNA), Quartz wool

9	Chlorides, Cl. 3.2	**Method A (determination of chloride by turbidimeter)** Apparatus: Air purification apparatus, Lamp, Alcohol Lamp,Turbidimeter Reagents: Sodium hydroxide, Nitric Acid — 1 N, Phenolphthalein Indicator, Ethanol, Nitric acid, Silver nitrate, Sodium chloride (reagent grade) **Method B (determination of chloride by microcoulometer)** Apparatus: Microcoulometer, Syringe – 50 µl capacity Reagents: Chloride Standard Stock Solution, any suitable solvent capable of dissolving chloride sample.
10	Polymer Content, Cl. 3.2	**Method-A (determination of polymer content by turbidimeter or colorimeter)** Apparatus: Turbidimeter or Colorimeter, Pipette, 25-ml and 10-ml, air oven, analytical balance and other laboratory glassware, Reagents: Methanol Dry **Method- B (determination of polymer content by spectrophotometer or photometer)** Appartus: Spectrophotometer or photometer, Pipette – 10 ml, 15 ml, Bottle or Flasks – with glass stoppers, separating funnel, rapid filtering folded filter paper, Hot air oven, analytical balance capable of weighing 0.1 mg, volumetric flasks and other laboratory glassware Reagents: Hexane-dry, Methanol-dry, Toluene-dry, Sodium Hydroxide, Poly styrene **Method-C (Visual method)** Test Tube – 25 x 125 mm, Pipette – 2 ml and 10 ml, Daylight Fluorescent Tube – equipped with curved reflector, test tube with a cork, stopper, aluminum foil and other laboratory glassware Reagents- Methanol-dry, Polystyrene – uncolored, unlubricated (see L-3.3.4), Toluene – dry,
11	Inhibitor content (p-tertiary butyl catechol) , Cl 3.2	**Method A (determination of inhibitor content by colorimeter)** Apparatus: Colorimeter, Pipette-50 ml, SeparatingFunnel-125 ml, Analytical balance capable of weighing 1 mg, refrigerator, Coarse filter paper, Nessler tube- 100 ml and other laboratory glassware Reagents: Sodium Hydroxide Solution, Standard Inhibitor Solution **Method-B (determination of inhibitor content by spectrometer)** Apparatus: Visible Range Spectrophotometer – with absorption cell having light paths 1 cm to 5 cm, Volumetric pipettes, Analytical balance capable of weighing 1 mg, refrigerator, Coarse filter paper, Amber glass bottle,

		Nessler tube- 100 ml and other laboratory glassware. Reagents: 4-tert-butylcatechol, Toluene, Methanol, n-Octanol, Sodium Hydroxide- 10 N
12	Ethyl benzene, Cl. 3.2	Gas chromatograph capable of being operated under conditions suitable for resolving the individual constituents into distinct peaks may be used. Reagents: Pure ethylebenzene, Pure alphamethylstyrene
13	Alpha methyl styrene, Cl. 3.2	Gas chromatograph capable of being operated under conditions suitable for resolving the individual constituents into distinct peaks may be used. Reagents: Pure ethylebenzene, Pure alphamethylstyrene
14	Benzene, Cl. 3.2	Gas chromatograph capable of being operated under conditions suitable for resolving the individual constituents into distinct peaks may be used. Reagents: Pure ethylebenzene, Pure alphamethylstyrene

ANNEXURE B

SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that manufacturers (licensees/applicants) will implement a Quality Assurance Plan i.e. a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan defining the control unit (i.e. lot/batch etc.) and the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and submit the same to BIS Branch Office for information. The manufacturer shall comply with the same and maintain test records in accordance with para 2.4.

1.3 **RECOMMENDED LEVELS OF CONTROL/CONTROL UNIT**:

1.3.1 A single batch of Styrene (Vinyl Benzene) produced from same raw materials and under similar conditions of production.

1.3.2 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in **Table 1**.

1.3.3 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan. Alternatively, the manufacturer has the option of adherence to the quality plan as per levels of control recommended in column 3 of Table 1.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING- It is expected that manufacturers (licensees/applicants) will establish a suitably equipped and staffed in house laboratory (In house testing facility) for testing at least those parameters of the Indian Standard which require routine testing for ensuring quality of the product. This includes in-process controls as may be defined and put in place by the manufacturer and testing parameters/requirements which can only be performed in the factory.

2.1 For the guidance of manufacturers, Table 1 giving the recommended levels of control is given below. Column 2 of Table 1 indicates routine tests where test equipment is required in house as “R” or other tests which can be subcontracted as “S”. Subcontracting is permitted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.2 For MSME manufacturers, the requirement of maintaining a laboratory/in-house testing facility for routine tests (indicated as “R” in Column 2 of Table 1) is also optional.

2.2.1 MSME manufacturers may utilize common cluster based facilities as per guidelines for the utilization of cluster based test facilities by MSMEs or the provisions of Sharing of testing facilities or get testing done from BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.3 **Large Scale manufacturers shall maintain an in-house laboratory equipped at least with test facilities for routine tests (indicated as “R” in Column 2 of Table 1)**, where different tests given in the specification shall be carried out in accordance with the method given in the specification**.** They shall also implement a calibration plan for the in-house test equipment.

2.3.1 Alternatively, in lieu of an in-house laboratory, large scale manufacturers can also utilize the provisions of Sharing of testing facilities as per the Guidelines for Grant of Licence available on BIS website www.bis.gov.in. (Under Conformity Assessment>Product Certification Process). Even for subcontracted tests, provisions for sharing of testing facilities can be utilized.

2.4 **TEST RECORDS**- The manufacturers maintaining an in-house laboratory or utilizing common cluster based facilities or shared test facilities shall maintain test records for the tests carried out to establish conformity. For the tests being subcontracted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025, test reports issued by the laboratories shall be available for inspection by BIS.

3. PACKING AND MARKING - The Standard Mark as given in the Schedule of the licence shall be incorporated legibly and indelibly on each packaging provided always that the material so marked conforms to each requirement of the specification.

3.1 Packing and Marking shall be done as per the Indian Standard.

3.2 If material is supplied in tank cars, tank trucks, container ships etc. the Standard Mark as given in Schedule of the licence and Licence Number (i.e. CM/L .....) shall be incorporated on a test certificate to be provided along with each tank car/tank truck/container ship as per the format at Appendix-1 enclosed, provided always that the product thus marked conforms to all the requirement of the specification. Packing shall be done as per provisions of Indian Standard and the marking details as per IS 4105:2023 shall also be indicated on the test certificate.

3.3 **Additional Marking requirements**: The material shall also be marked with the following additional requirement on each packaging:

a) “For BIS certification details please visit www.bis.gov.in”
b) Each container shall have a caution label ‘FLAMMABLE’ together with the corresponding symbol for labelling of dangerous goods in accordance to IS 1260 (Part 1).

4. REJECTION - All the production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act,201

TABLE 1

LEVELS OF CONTROL

(1)				(2)	(3)		
Test Details				Test equipment requirement R: required (or)S: Sub-contracting permitted	Levels of Control		
Cl.	Requirement	Test Methods Clause Reference			No. of Sample	Frequency	Remarks
3.1	Description	4.1	IS 4105:2023	R	Firm to have adequate in-process controls to check compliance of this parameter as given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity		
3.2	Requirements for Styrene (Vinyl Benzene)						
i.	Colour	B or IS 1448 (Pt-178)	IS 4105:2023	R	One	Each control unit	
ii.	Relative density at 27/27°C	C	IS 4105:2023	R	One	Each control unit	
iii.	Refractive index at 27ºC	D or IS 1448 (Pt-158)	IS 4105:2023	R	One	Each control unit	
iv.	Freezing point	E	IS 4105:2023	S	One	Each control unit	Optional requirement
v.	Assay, percent by mass	F	IS 4105:2023	R	One	Each control unit	

vi.	Aldehyde, percent by mass (as benzaldehyde)	G	IS 4105:2023	R	One	Each control unit	
vii.	Peroxides, percent by mass (as H_2O_2),	H	IS 4105:2023	R	One	Each control unit	
viii.	Sulphur	J or IS 1448 (Pt-160)	IS 4105:2023	R	One	Each control unit	
ix.	Chlorides	K	IS 4105:2023	R	One	Each control unit	
x.	Polymer content	L	IS 4105:2020	R	One	Once a month	
xi.	Inhibitor content (p-tertiary butyl catechol)	M	IS 4105:2023	R	One	Each control unit	Recommended for one month's safe storage under Indian climatic conditions. May be increased or decreased by mutual agreement between the purchaser and the supplier.
xii.	Ethyl benzene	F	IS 4105:2023	R	One	Each control unit	
xiii.	Alpha methyl styrene	F	IS 4105:2023	R	One	Each control unit	
xiv.	Benzene	F	IS 4105:2023	R	One	Each control unit	

Appendix-1

TEST CERTIFICATE XYZ COMPANY
(REGISTERED OFFICE ADDRESS AND WORKS ADDRESS)
TEST CERTIFICATE FOR STYRENE (VINYL BENZENE) AS PER IS 4105:2023

TEST CERTIFICATE NO._____
DATED_____
SUPPLIED TO M/s _____ (Name and Address of Consignee)
It is certified that the material described below fully conforms to IS 4105: 2023. The properties of the product, as tested in accordance with the Scheme of Inspection and Testing contained in the BIS Certification Marks License No. CM/L _____ are as indicated below against each order no. etc.
(PLEASE REFER TO IS 4105: 2023FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order no. and date	Control Unit/ Batch Number	Month and Year of manufacture	Quantity	Requirements															Remarks
				Description	Colour	Relative density at 27 °C /27 °C	Refractive index at 27 ºC	Freezing point	Assay	Aldehyde, (as benzaldehyde)	Peroxides, (as H2O2)	Sulphur	Chlorides	Polymer Content	Inhibitor content (p tertiary butyl catechol)	Ethyl benzene	Alpha methyl styrene	Benzene	

The material supplied conforms to specified requirements of IS 4105: 2023.
REMARKS: Tank Car / Tank Truck / Container ship no.

(Signature)
For XYZ Company