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Standard Specification for Rubber—Concentrated, Ammonia Stabilized, Creamed, and Centrifuged Natural Latex[1]

This standard is issued under the fixed designation D1076; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers requirements for first grade concentrated natural rubber latex (see Table 1) of the following categories:

Category 1—Centrifuged *Hevea* natural latex stabilized with ammonia only.

Category 2—Creamed *Hevea* natural latex stabilized with ammonia only.

Category 3—Centrifuged *Hevea* natural latex stabilized with low ammonia.

Category 4—Centrifuged, or centrifuged and creamed, guayule latex, or other natural rubber latex, containing less than 200 µg total protein per gram dry weight of latex, with ammonia or other hydroxide.

Category 5—Centrifuged Hevea natural latex treated with aluminum hydroxide or by other means, stabilized with ammonia only containing less than 0.5 % non-rubber content.

1.2 This specification is not necessarily applicable to latices prepared, stabilized, or preserved by other methods, and shall not be construed as limiting the desirability or usefulness of other categories of latices. It does apply to natural latex sources other than *Hevea brasiliensis* but does not apply to compounded latex concentrates.

1.3 The analytical procedures applicable to the specifications are included and appear in the following order:

	Section
Sampling	6 and 7
Total Solids	8 – 17
Dry Rubber Content	18
Protein Content	19
Total Alkalinity	20
Viscosity	21
Sludge Content	22
Coagulum Content	23
KOH Number	24
pH	25
Mechanical Stability	26
Copper and Manganese	27
Density	28 – 40
Volatile Fatty Acids	41 – 45
Boric Acid	46
Dry Films	47
Precision for All Test Methods	48

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1278 Test Methods for Rubber from Natural Sources—Chemical Analysis

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

D5712 Test Method for Analysis of Aqueous Extractable Protein in Latex, Natural Rubber, and Elastomeric Products Using the Modified Lowry Method

D6499 Test Method for Immunological Measurement of Antigenic Protein in Hevea Natural Rubber (HNR) and its Products

E70 Test Method for pH of Aqueous Solutions With the Glass Electrode

3. General Specification Requirements

3.1 In manufacturing, the material shall be processed in accordance with the best commercial practice and shall be of uniform composition.

3.2 The material shall conform to the chemical and physical requirements prescribed in Table 1.

[1] This specification is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.22 on Natural Rubber.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Requirements for Specified Latex Categories

	Category 1	Category 2	Category 3	Category 4	Category 5
Total solids, min,%	61.3	66.0	61.3	44.0	61.3
Dry rubber content (DRC),[A] min, %	59.8	64.0	59.8	42.0	60.8
Total solids content minus dry rubber content, max,%	2.0	2.0	2.0	2.0	0.5
Protein content (µg/g dw latex)					
Total protein by D5712				200 max	
Hevea antigenic protein by D6499				None detectable	
Total alkalinity calculated as ammonia, as % latex	0.60 min	0.55 min	0.29 max	0.60 min	0.60 min
Or: total alkalinity calculated as KOH, as % latex				0.10 min	
Sludge content, max, %	0.10	0.10	0.10	0.10	0.1
Coagulum content, max, %	0.050	0.050	0.050	0.050	0.05
KOH number, max[B]	0.80	0.80	0.80	0.80	0.8
Mechanical stability, s, min	650	650	650	90	650
Copper content, max, % of total solids	0.0008	0.0008	0.0008	0.0008	0.0008
Manganese content, max, % of total solids	0.0008	0.0008	0.0008	0.0008	0.0008
Color on visual inspection		no pronounced blue or gray[C]			
Odor after neutralization with boric acid		no putrefactive odor			

[A] Dry rubber content by definition and use is the acid coagulable portion of latex after washing and drying.
[B] It is accepted that KOH numbers for boric acid preserved latices will be higher than normal, equivalent to the amount of boric acid in the latex.
[C] Blue or gray color usually denotes iron contamination caused by improper storage in containers.

4. Significance and Use

4.1 This specification denotes limits on the 5 categories of latex as defined in the scope and defines the test methods to use for the specified properties. These test methods may be used for production control or for referee purposes.

5. Inspection

5.1 Inspection of the material shall be made as agreed upon between the purchaser and the seller as part of the purchase contract.

SAMPLING AND METHODS OF TESTING

6. Preparations for Sampling

6.1 *Drums:*

6.1.1 *Open-Head Drums*—The top shall be removed and the contents stirred with a high-speed stirrer for 10 min.

6.1.2 *Closed-Head Drums*—If the drum has at least 2 % air space, which is 20 mm (0.75 in.) on a standard drum, lay it on its side and roll for not less than 10 min. Up end the drum to its original position and allow to stand for 15 min and then repeat the rolling operation for at least a further 10 min. In the case of drums with less than 2 % air space, all of the latex in the closed-head drum shall be transferred to a larger vessel and mixed with a high-speed stirrer for 10 min.

6.2 *Tank Cars/Tank Trucks*—Samples shall be taken from the top and bottom of the car/truck. If the total solids in the top and bottom samples agree within 0.5 %, the car shall be considered uniform enough for sampling. If top and bottom samples do not agree within 0.5 %, the contents of the car shall be agitated until samples taken from the top and bottom do agree on total solids within 0.5 %.

7. Sampling

7.1 *Drums*—After preparations for sampling, sample without delay. A suitable method is by slowly inserting a clean, dry glass tube of 10 to 15 mm internal diameter and open at both ends, until it reaches the bottom of the container. Then close the upper end of the tube and transfer the contents to a clean, dry sample bottle. Repeat the operation until sufficient latex has been obtained. Alternatively, a specially constructed metal sampling tube may be used, the bottom of which can be closed by remote control. No copper or brass shall be used in any part of its construction. At least 10 % of the drums in a shipment shall be sampled.

7.2 *Tank Cars/Tank Trucks*—Separate samples of at least 475 cm^3 each shall be taken from the top, center, and bottom of the tank car/tank truck. Take the top sample first, then the center sample, and the bottom sample last. Use a weighted sampler with a remotely operated removable top, or other suitable sampling device that will accomplish the same results. Blend the three samples thoroughly. Each sample shall be poured immediately into a tightly stoppered container. The three samples shall be combined and thoroughly blended into a composite sample. At least 950 cm^3 of this composite sample shall be used for test. One composite sample only is required from each tank car/tank truck.

TOTAL SOLIDS

8. Scope

8.1 Two methods are described for determination of total solids: Direct Method and Indirect Method.

8.1.1 *Method A, Direct Method*—In Method A the total solids of the latex are determined by calculating with the result of mass of the original sample and the mass of the dried sample pre-dried to a constant weight under defined conditions.

8.1.2 *Method B, Indirect Method*—In Method B the total solids of latex are determined through microwave transmission method. The total solids content of latex is the mass percentage of the remaining solid part after the water of the latex has been removed. This method is more suitable for on-site test or rapid measurement.

METHOD A—DIRECT METHOD

9. Apparatus

9.1 Tared, covered, flat-bottom weighing dish, approximately 60 mm (2.5 in.) in diameter, which may be made of glass, tinned metal, or aluminum.

10. Reagent

10.1 Distilled water.

11. Procedure

11.1 Weigh 2.5 ± 0.5 g of the latex to the nearest 1 mg in the tared, covered weighing dish. Remove the cover and distribute the latex over the bottom of the dish over an area of approximately 32 cm^2 (5 $in.^2$). This may be facilitated by carefully adding approximately 1 cm^3 of distilled water to the latex and gently swirling the dish. With the dish uncovered, dry the specimen in a vented air oven for 16 h at 70 ± 2°C or 2 h at 100 ± 2°C. Replace the cover, cool in a desiccator to room temperature, and weigh. Repeat drying and weighing until the mass is constant to 1 mg or less. Tests shall be run in duplicate and shall check within 0.15 %. The average of the two determinations shall be taken as the result.

12. Calculations

12.1 Calculate the percentage of total solids as follows:

$$\text{Total solids, } \% = [(C - A)/(B - A)] \times 100 \quad (1)$$

where:

A = mass of the weighing dish, g,
B = mass of the dish plus the original sample, g, and
C = mass of the dish plus the dried sample, g.

METHOD B—INDIRECT METHOD[3]

13. Definition

13.1 *microwave water determinator*—The instrument applied for determination of water and total solids of latex by microwave transmission attenuation method.

14. Summary of Method

14.1 Energy attenuation occurs when microwaves pass through the measured material. The attenuation of energy is characterized by the dielectric constant of the measured substance in a certain electric field, at a certain frequency, and a certain temperature. Calculate the dielectric constant as follows:

$$\varepsilon = \varepsilon' + \alpha\varepsilon'' \quad (2)$$

where:

ε = dielectric constant of measured substance,
ε' = permittivity of the material regarding energy storage,
ε'' = permittivity of the material regarding energy attenuation, and
α = constant regarding the material property.

NOTE 1—Dielectric constant of water $\varepsilon_{H2O} = 61.5 - \alpha_{H2O} \times 31.4$.

NOTE 2—Dielectric constant of latex $\varepsilon_{latex} = 2.4 - \alpha_{latex} \times 0.012$ at 9370 MHz.

14.1.1 The value of ε_{H2O} is much greater than that of ε_{latex}. The attenuation of the microwave signal caused by latex is measured with the microwave sensor and converted into the water content of the material.

14.2 The mass percentage of water content in the latex is recorded by the microwave water determinator. The total solids of latex is calculated from the mass percentage of water as follows:

$$\text{Total solids, } \% = 100 - D \quad (3)$$

where:

D = mass percentage of water in latex sample, %.

15. Apparatus

15.1 *Microwave Water Determinator (MWD)*—The minimum analytical capabilities of the MWD should include:

15.1.1 *Microwave Transmitters,* emitting a fixed microwave radiation over the range from 9.2 GHz to 9.3 GHz. The fixed microwave is transmitted by a waveguide through the latex sample in a flow cell.

15.1.2 *Microwave Detectors* detect the fixed microwave after passing through the latex sample and exchange microwave to analog signals.

15.1.3 *A/D Converter* converts the analog signal into a digital signal.

15.1.4 *Data Collection Device* that acquires, stores and displays the measured or calculated digital signals, or both. The output signals required for a MWD are moisture content, sample temperature and measured times.

15.1.5 The MWD capacity to determine moisture content should be in a 35.00 % to 99.99 % range.

15.1.6 A flow cell or pool a cell or pool used to measure the latex.

NOTE 3—The volume of the flow cell is closely related with the specimen container.

15.1.7 The specimen container holds the measured latex during testing. Its volume should be 20 times greater than the flow cell volume to ensure test accuracy.

15.1.8 The temperature sensor provides an indication of the latex temperature within a m 20°C to 30°C range, readable to ± 0.1°C.

15.1.9 The calibration device establishes the zero position of a MWD, provided by the the MWD's supplier.

15.2 *Analytical Balance*—The division value shall be no more than 1 mg.

15.3 *Test Vessels*—Standard beakers and cylinders.

16. Procedure

16.1 *Preparation of Specimen*—Filter a latex sample with a 20 ~ 50 mesh strainer. Set the latex sample in a temperature-controlled room for at least 2 h or until the latex temperature is stable at 25 ± 2°C.

16.2 *Preparation of Apparatus*—Follow the instructions in the MWD operation manual. Set the MWD on a flat surface devoided of vibration, electromagnetic interference and in

[3] This method is a contribution of the China Instrumental and Control Society.