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Ethanol gel for cooking and other burning appliances — Specification

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 574 was prepared by Technical Committee RSB/TC 024, Organic and Inorganic chemicals

In the preparation of this standard, reference was made to the following standards:

SANS 448, *Ethanol gel for cooking and other gel burning appliances*

ZS 1238, *Ethanol gel for cooking and other gel burning appliances*

The assistance derived from the above source is hereby acknowledged with thanks.

Committee membership

The following organizations were represented on the Technical Committee on Organic and Inorganic chemicals (RSB/TC 024) in the preparation of this standard.

University of Rwanda/College of Science and Technology (UR/CST)

HORIZON /SOPYRWA

National Industrial Research and Development Agency (NIRDA)

Rwanda Forensic Laboratory (RFL)

Rwanda Inspectorate, Competition and Consumer protection Authority (RICA)

University of Rwanda -College of Education (UR-CE)

Rwanda Standards Board (RSB) – Secretariat

Ethanol gel for cooking and other burning appliances — Specification

1 Scope

This Draft Rwanda Standard specifies the requirements, sampling and test methods for ethanol gel for cooking and for other burning appliances.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS ISO 3170, *Petroleum liquids – Manual sampling*.

RS ISO 3165, *Sampling of chemical product for industrial use – Safety in sampling*.

ISO 10101-2, *Natural gas - Determination of water by the Karl Fischer method - Part 2: Titration procedure.*

ISO 1388-2, *Ethanol for industrial use – Methods of test – Part 2: Detection of alkalinity or acidity to phenolphthalein*.

ASTM D4815, *Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C1 to C4 Alcohols in Gasoline by Gas Chromatography published by ASTM International*.

ASTM D6045 – 20, *Standard Test Method for Colour of Petroleum Products by the Automatic Tristimulus Method, published by ASTM International*.

ASTM D5501– 20, *Standard Test Method for Determination of Ethanol and Methanol Content in Fuels Containing Greater than 20 % Ethanol by Gas Chromatography.*

ASTM D 4052 – 22, *Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter.*

ASTM D7795 – 15, *Standard Test Method for Acidity in Ethanol and Ethanol Blends by Titration.*

ASTM D7319, *Standard Test Method for Determination of Existent and Potential Sulfate and Inorganic Chloride in Fuel Ethanol and Butanol by Direct Injection Suppressed Ion Chromatography.*

RS ISO 1253, *Determination of flash point – Closed cup equilibrium method*

RS ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity.*

ISO 1928, *Coal and coke – Determination of gross calorific value*

RS ISO 3219, *Plastics – Polymers/resins in the liquid state or as emulsions or dispersions – Determination of viscosity using a rotational viscometer with defined shear rate.*

RS ISO 3837, *Liquid petroleum products – Determination of hydrocarbon types – Fluorescent indicator adsorption method.*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1

acceptable

acceptable to the authority administering this standard or to the parties concluding the contract, as relevant.

3.2

higher alcohols

n - aliphatic alcohols of general formula $C_nH_{2n+1}OH$ with n being 3 to 8.

3.3

hydrocarbons

n - components in an ethanol-hydrocarbon blend containing only hydrogen and carbon.

3.4

denatured ethanol

n—ethanol made unfit for beverage use by the addition of toxic or noxious materials.

3.5

gel

semi-solid that can have properties ranging from soft and weak to hard and tough.

3.6

burning appliances

device that is installed in a building and burns fossil-fuel or carbon-based fuel where carbon monoxide is a combustion by-product, including stoves, ovens, grills, clothes dryers, furnaces, boilers, water heaters, heaters, fireplaces and stoves.

3.6

cooking appliances

appliance intended to be used for the preparation of food and that makes use of a heat source.

4 Requirements

4.1 General requirements

4.1.1 The product shall be visually free of sediment and suspended matter.

4.1.2 The product shall be free of any adulterant or contaminant that can render the material unacceptable for its commonly used applications.

4.1.3 The product shall be colored to visually indicate that it is not potable.

4.1.4 The ethanol content of the gel (expressed as 100 % ethanol) shall be not less than a mass fraction of 90 % as indicated in the product Material Safety Data Sheet (MSDS).

4.1.5 Additives beyond the denaturants and colorants are discouraged.

4.1.6 When determined in accordance with the test methods given in RS ISO 1253, the flashpoint of the ethanol gel shall be not less than 23 °C.

4.1.7 aromatic content of not more than a mass fraction of 2.0 % when determined in accordance with the test method given in ISO 3837

4.2 Specific requirements

The product shall comply with the requirements given in Table 1 when tested in accordance with test methods specified therein.

Table 1 — Specific requirements for ethanol gel for cooking

S/N	**Parameters**	**Requirements**	**Test method**
i.	Ethanol content, % v/v, min.	90	D5501-20
ii.	Water, % v/v, max.	8	ISO 10101-2
iii.	pH	6.5 – 7.5	pH meter
iv.	Calorific value, MJ/kg, min.	18	ISO 1928
v.	Density g/ml, at 20 ºC, max.	0.81797	ASTM D 4052
vi.	Colored Dye, mg/Kg, Max	10	ASTM D6045
vii.	Higher Alcohol (C3 – C8), % v/v, Max.	2	ASTM D4815
viii.	Acidity (as acetic acid), mg/kg max.	40	ASTM D7795
ix.	Denatonium Benzoate, mg/kg, (Min – Max)	10 - 20	Annex A
x.	Methanol, % v/v, max.	0.5	ASTM D5501
xi.	Dynamic viscosity at 25ºC, cP, 3 rpm	25000	RS ISO 3104
xii.	Residue on evaporation, %, m/v, max	0.01	ASTM D1353
xiii.	Inorganic chloride, mg/l, max.	10.0	ASTM D7319

4.3 Safety in use of the gel

When tested in accordance with the test given in Annex B, the ethanol gel shall ignite readily and shall burn steadily, without flaring, sudden deflagrations, sparking, spitting, popping, dripping or explosion, from ignition until it has burned to extinction.

4.4 Performance

When the ethanol gel fuel is tested in accordance with Annex B, it shall heat 1 L water from 25 °C to 90 °C in not more than 15 min.

5 Packaging

5.1 Ethanol gel for cooking shall be packaged in safe and suitable containers that shall not impart foreign substances and/or odours to the product.

5.2 Bulk delivery, packaging and storage of ethanol gel shall be done in containers that shall prevent contamination of the product.

6 Labelling

Each container shall bear the following information given in prominent, legible and durable labelling:

a) name of the product ‘Ethanol gel’;

b) name and address of manufacturer;

c) net contents;

d) list of ingredients

e) batch/lot number;

f) minimum ethyl alcohol content;

g) year of manufacture;

h) country of origin;

i) instruction of use;

j) pictograms;

k) the words “highly poisonous”; and

l) the words “highly flammable”.

Annex A
(normative)

Determination of Denatonium Benzoate in Alcoholic Products by HPLC-UV

A.1 Principles

This document describes a standard method for the determination of denatonium benzoate (DB) in CDA (completely denatured alcohol) formulations using HPLC with UV detection at 210 nm. The samples are directly injected into the HPLC system after membrane filtration. The working range for quantitative determination of DB is 0.5 to 20.0 mg / L.

A.2 Instrumentation and materials

A.2.1 HPLC system equipped with:

i) Pumping system suitable for isocratic elution.

ii) Solvent degassing system (on-line/off-line).

iii) Injection system with 20 µl loop.

iv) Analytical column, for example: LiChrospher 100 CN (5 µm) in LiChroCART 250-4 guard column

v) Thermostated column compartment (oven).

vi) Diode array detector (DAD) or UV detector.

vii) Integrator or computer with data acquisition software and printer.

A.2.2 Analytical balance

A.2.3 pipettes of 0.5, 2, 5, 10 and 20 ml

A.2.4 volumetric flasks of 100 and 1000 ml

A.2.5 Weighing bottle.

A.2.6 Syringes.

A.2.7 cellulose membrane filters of 0.45 µm

A.2.8 beaker of 250 ml

A.2.9 graduated cylinder of 1000 ml

With regard to the HPLC column, the recommended analytical column in this method is LiChrospher 100 CN (5 µm) as described above. However, alternative HPLC columns (C18 / C8), buffers and chromatographic parameters may be used provided that good peak shape is obtained for denatonium benzoate and good separation of denatonium benzoate from potential interferences can be achieved.

A.3 Reagents and solutions

A.3.1 Denatonium benzoate, purity ≥ 99 %. Handle it with gloves.

A.3.2 Ethanol 96 % vol.

A.3.3 Sodium chloride, extrapure.

A.3.4 Acetonitrile, HPLC grade.

A.3.5 Water, HPLC grade.

A.3.6 0.2 % sodium chloride solution.

Weigh 0.4 g of sodium chloride in a weighing bottle and dissolve it in a beaker with 200 ml of water HPLC grade.

A.3.7 Mobile phase Add in a 1000 ml volumetric flask, 200 ml of 0.2 % sodium chloride solution and 800 ml of acetonitrile HPLC grade.

A.4 Standard solutions

A.4.1 Preparation of the stock solution (100 mg DB / L).

Weigh, recording the exact weight, 0.1 g of denatonium benzoate in a weighing bottle and dissolve it in a 1000 ml volumetric flask with ethanol 96 % vol. Mix gently.

Measure the mass of this solution with a top loading balance and the density at 20ºC with an electronic densimeter.

A.4.2 Preparation of the working calibration solutions.

Add, in 100 ml volumetric flasks, 20 ml of ethanol 96 % vol. (to minimize weighing errors), then 0.5, 2, 5, 10 or 20 ml (weighing) of the stock solution and top up to the filling mark with ethanol 96 % vol. Mix gently.

A.5 Chromatographic and calibration parameters

When using LiChrospher 100 CN (5 µm) column, chromatographic and calibration parameters recommended are:

i) Column flow: 1.2 ml / min.

ii) Stoptime: 14 min.

iii) Detector: signal 210 nm (bandwidth 8 nm), reference 360 nm (bandwidth 100 nm).

iv) Mobile phase: acetonitrile 80:20 0.2 % sodium chloride solution.

v) Injection volume: 20 µl.

vi) Column oven temperature: 27ºC.

vii) Calibration: external standard.

viii) Signal: peak area.

ix) Curve type: linear.

x) Origin: included.

xi) Weight: equal.

A.6 Calibration

Working solutions containing the following concentrations of denatonium benzoate 0.5, 2, 5, 10 and 20 mg / l are analysed by injecting one replicate of each working solution. Peak areas corresponding to denatonium benzoate are plotted according to the respective concentrations in order to obtain a linear regression line expressed by the formula $y = ax + b$. The correlation coefficient must be > 0.99. Otherwise, the system must be checked to improve the linear regression if possible, or the working solutions must be discarded and a new set of calibration solutions should be prepared.

A.7 Analysis of samples

No specific sample preparation is required. The samples are directly injected into the HPLC system after 0.45 µm cellulose membrane filtration.

A.8 Instrument Results:

The instrument denatonium benzoate results are calculated by comparing the sample denatonium peak area response to the calibration curve for the denatonium benzoate. This calibration curve is part of the instrument method.

Annex B
(normative)

Test of safety in the use of the ethanol gel

B.1 Test apparatus

B.1.1 **Laboratory fume cupboard** operated at the minimum extraction rate necessary to just safely evacuate the products of combustion produced by the burning ethanol gel.

B.1.2 **Fireproof bowl** with dimensions of approximately 125 mm in diameter and 35 mm in depth.

B.1.3 **Ignition source,** gas-based.

B.1.4 **Calibrated balance.**

B.1.5 **Stopwatch**, calibrated in seconds.

NOTE In the interest of safety it is recommended that the hands and face of the tester be adequately protected at all times when undertaking this test.

B.2 Ethanol gel test

Use the ethanol gel sampled in accordance with the sampling procedure given in annex C.

B.3 Procedure

B.3.1 Switch on the extractor fan of the cupboard and operate at the minimum extraction rate necessary to just safely evacuate the products of combustion produced by the burning ethanol gel.

B.3.2 Fill the aluminium bowl with 50 g of the ethanol gel. Place it on an isolating pad inside the fume cupboard and ignite immediately.

B.3.3 Observe the ethanol gel on ignition and immediately thereafter and record any signs of flaring, sudden deflagrations, sparkling, spitting, popping, dripping or explosion.

B.4 Combustion performance

B.4.1 Test apparatus

B.4.1.1 Test appliance, a tripod with a height of 7 cm between the top of the pot seat and the top surface of the gel container.

B.4.1.2 Laboratory fume cupboard

B.4.1.3 Fireproof bowl

B.4.1.4 Ignition source

B.4.1.5 Calibrated balance

B.4.1.6 Stopwatch

B.4.1.7 Aluminium pot, flat-bottomed 2 L aluminium pot of 220 mm diameter fitted with a thermocouple port.

B.4.1.8 Thermocouple.

B.4.2 Procedure

B.4.2.1 Ensure that the ambient air temperature of the laboratory is maintained at 20 °C ± 5 °C.

B.4.2.2 Switch on the extractor fan of the cupboard and operate at the minimum extraction rate necessary to just safely evacuate the products of combustion produced by the burning ethanol gel.

B.4.2.3 Pour 1 L of tap water into the aluminium cooking pot.

B.4.2.4 Fill the fireproof bowl with 200 g of the ethanol gel. Ignite the fire with the gas lighter.

B.4.2.5 Place the aluminium pot with water onto the fire. Record the time taken for the water temperature to rise from 25 °C to 90 °C.

Annex C
(normative)

Sampling and compliance with this standard

C.1 Sampling

C.1.1 General

The sampling procedure given in C.1.3 shall be applied in determining whether a lot complies with the relevant requirements of this standard. The samples so drawn shall be deemed to represent the lot.

C.1.2 Definitions

C.1.2.1

defective

test sample of the ethanol gel that fails in one or more respects to comply with the relevant requirements of this standard

C.1.2.2

lot

that quantity of ethanol gel in containers bearing the same trade name or trademark, grade designation and batch identification, from one manufacturer, and submitted at any one time for inspection and testing

C.1.3 Samples for inspection and testing

After checking the lot for compliance with the relevant requirements of 5 and 6, take from it at random.

a) five containers, if the lot is packed in containers of net mass not exceeding 5 kg; and

Price based on nnn pages

b) three containers, if the lot is packed in containers of net mass exceeding 5 kg.

C.2 Compliance

Deem the lot to comply with the relevant requirements of this standard if, on inspection of the containers or tankers in the lot, and on testing of the samples taken in accordance with Annex C.1.3, no defective is found.