



Reviewing the ASTM Standard

Denatured Ethanol for Use as Cooking and Appliance Fuel

November 15, 2016

Kampala, Uganda

3 BILLION PEOPLE ARE COOKING WITH SOLID FUEL



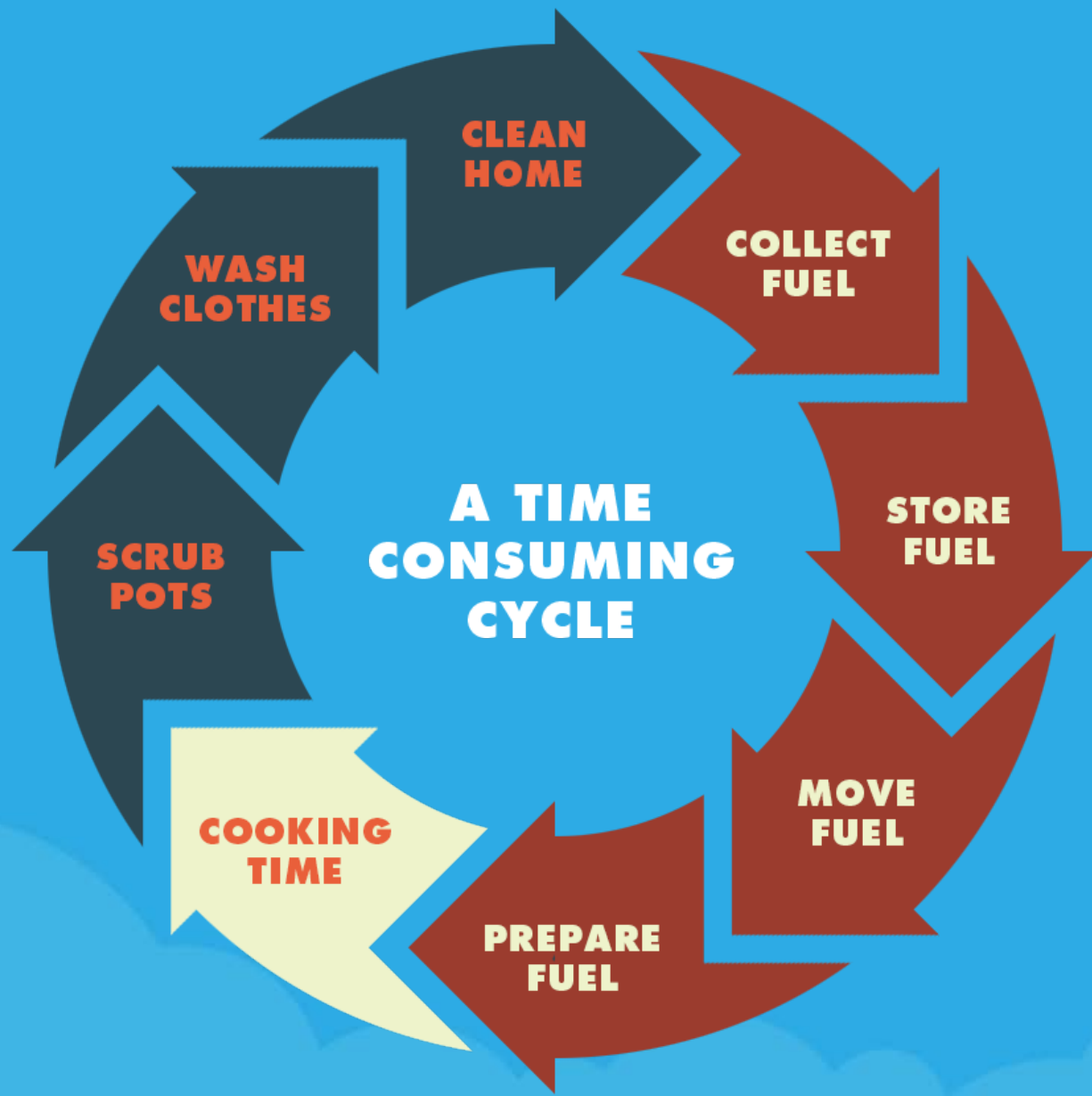


4.3 MILLION DEATHS PER YEAR

LINKED TO AIR POLLUTION VIA SOLID FUEL COOKING

BURNING TRADITIONAL BIOMASS FUELS LIKE WOOD AND CHARCOAL IS A MAJOR DRIVER OF DEFORESTATION





**140 MILLION
PERSON-YEARS**

WASTED ON COLLECTION &
AVOIDABLE COOKING TIME



CLEAN RENEWABLE ETHANOL FUEL



- Ethanol fueled cookstoves address these issues
- Approximately 70,000 stoves distributed in over ten countries
- Very few ethanol standards specifically for ethanol as a cooking and appliance fuel



GOALS

- Create a standard based on performance parameters which will:
 - Protect the consumer from purchasing sub-par quality fuel
 - Prevent ethanol as a cooking fuel from being consumed
 - Identify ethanol as a *cooking fuel* from other types of ethanol
 - Provide a benchmark for the classification of a new product



ASTM INTERNATIONAL

- One of the largest voluntary standards developing organizations in the world
- Representation from more than 140 countries
- Over 30,000 members
- Over 12,000 ASTM standards operate globally

THE PROCESS

- E48 Committee (Bioenergy and Industrial Chemicals from Biomass)
- E48.05 Subcommittee (Biomass Conversion)
- Task group assembled
- Met seven times in 2015
- Comprised of 32 members representing various areas related to:
 - the production of ethanol
 - the regulatory implications of denatured ethanol
 - the packaging and transportation of ethanol
 - the safe handling of alcohol fuels
 - the international distribution of ethanol

THE STANDARD



Designation: E3050 – 16

Standard Specification for Denatured Ethanol for Use as Cooking and Appliance Fuel¹

This standard is issued under the fixed designation E3050; 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.

Keywords: appliance fuel, cooking fuel, denatured ethanol, ethanol fuel, stove fuel

SCOPE

1.1 Denatured fuel for cooking and/or appliance fuel

1.2 Not to preclude observance of other regulations (federal, state, local)

** Not addressing regulatory compliance

1.3 Denatonium benzoate required in addition to any other denaturants

** Deterrent to consumption of fuel. Amounts must meet min/max levels in spec table

1.4 Colored dye also required. Must meet min/max levels in spec table

** Visual indicates that the product is not potable

1.5 Values stated in SI units regarded as standard. No other measurement units included

1.6 Does not purport to address all safety concerns, if any, associated with use.

REFERENCED DOCUMENTS

ASTM Standards

- D381
- D4057
- D4177
- D4306
- D4815
- D5854
- D7795
- E203
- E300
- E1064

TERMINOLOGY

Denatured ethanol – ethanol made unfit for beverage use by the addition of toxic or noxious materials

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

Hydrocarbon – those components in an ethanol hydrocarbon blend containing only hydrocarbon and carbon

WORKMANSHIP

- Should be visually free from sediment and suspended matter
- Should be free of any adulterant or contaminant that can render the material unacceptable for applications
- Additives beyond denaturants and colorants discouraged. Higher molecular weight additives can create issues with combustion or lead to deposits.
- Monitoring the fuel using Test Method D381 can determine if additives have been added. Can provide early indication of contamination.
- Care should be taken when selecting and choosing colorant. Not all colorants are soluble in ethanol.

TABLE 1 Denatured Ethanol Cooking and Appliance Fuel Specifications

Property	Units	Limit	Min/Max	Test Method
Ethanol	volume %	90	Min	D5501
Water	volume %	10	Max	E203 or E1064
Higher Alcohols (C ₃ -C ₈)	volume %	2	Max	D4815
Hydrocarbon ^A	volume %	1	Max	Documented Addition
Acidity (as acetic acid)	mg/Kg	40	Max	D7795
Denatonium Benzoate	mg/Kg	10-20	Min-Max	Documented Addition
Colored Dye	mg/Kg	10	Max	Documented Addition

^A The hydrocarbons approved for use under this specification are as follows: gasoline, unleaded gasoline, natural gasoline, heptane, or rubber hydrocarbon solvent.

SAMPLING, CONTAINERS, AND SAMPLE HANDLING

- User strongly advised to review all intended test methods prior to sampling. Important to understand sampling technique, proper containers, and special handling required of samples.
- Correct sampling procedures critical to obtain representative sample.
 - *Automatic method sampling tests are provided.*
- Correct sample volume and appropriate container selection are important decisions that can impact test results.
 - *References to tests are included.*
- **Sample size** = minimum of 1 liter recommended
- **Lot size** = normally consist of the amount in the tanker compartment or other bulk container in which it is delivered. If this definition does not apply, definition should be agreed between supplier and purchaser.

TEST METHODS

Ethanol – Test Method D5501

Water – Test Methods E203 or E1064

Higher Alcohols – Test Method D4815 or other suitable gas chromatography method

Acidity – Test Method D7795

Solvent-Washed Gum Content – Test Method D381, air jet apparatus

Documented Addition – the process of providing written documentation on specific amount of a substance added

NEXT STEPS

- Other countries can consider adopting ASTM E3050 to ensure quality fuel reaches consumers
- Become a member of ASTM
 - Free ASTM membership for Uganda and other East Africa countries (MOU with ASTM)