

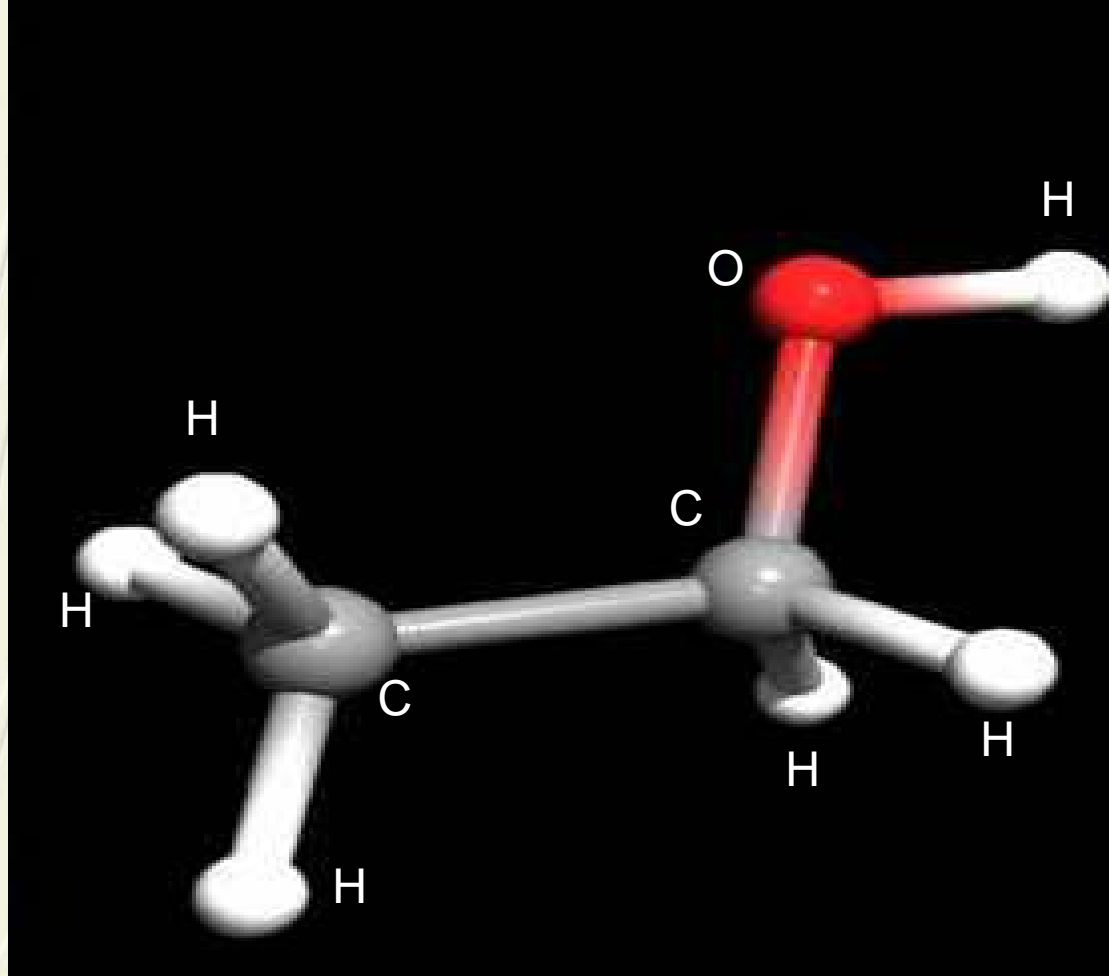
Specification and Trading of Ethanol



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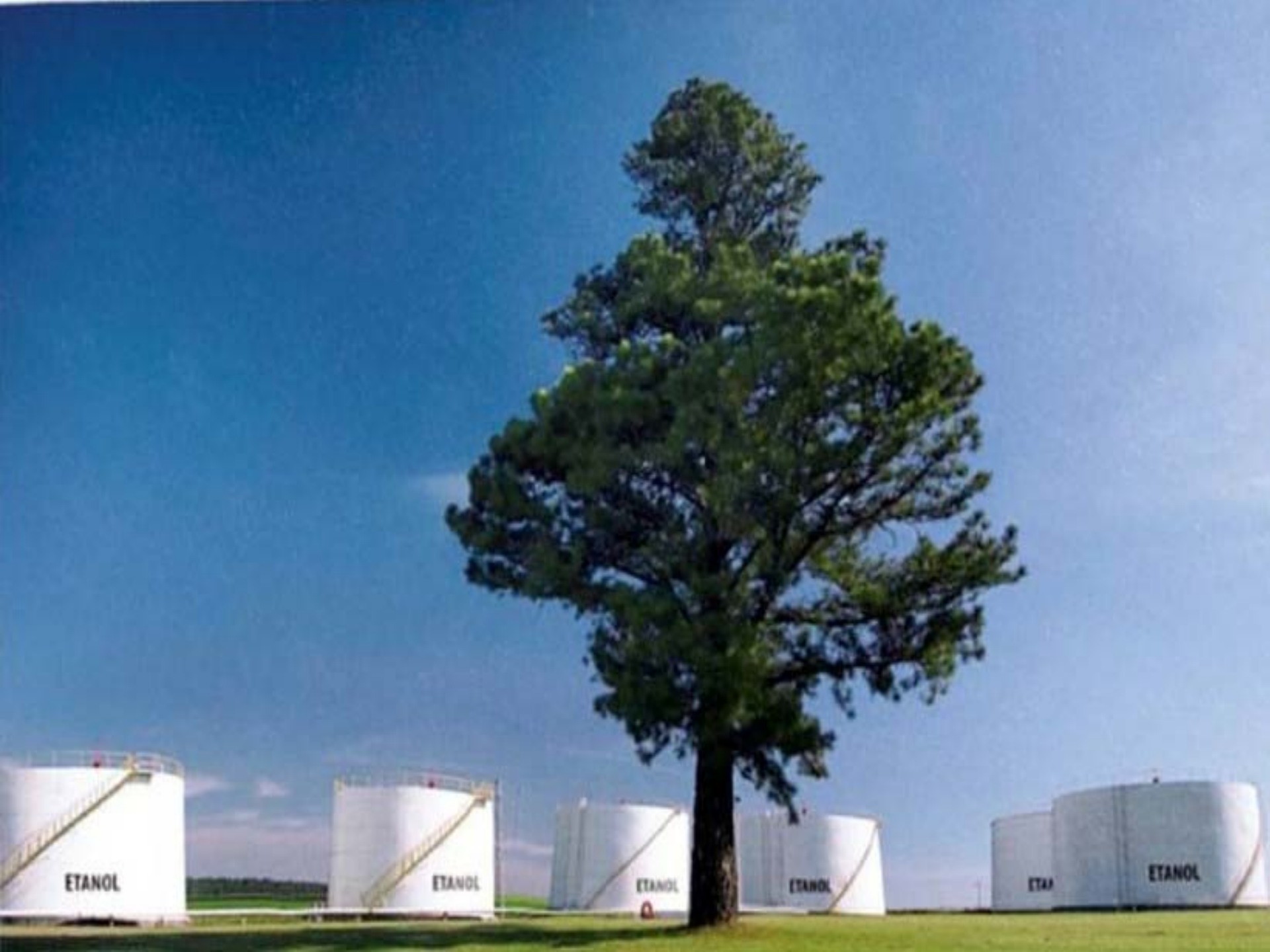
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Ethanol Molecule

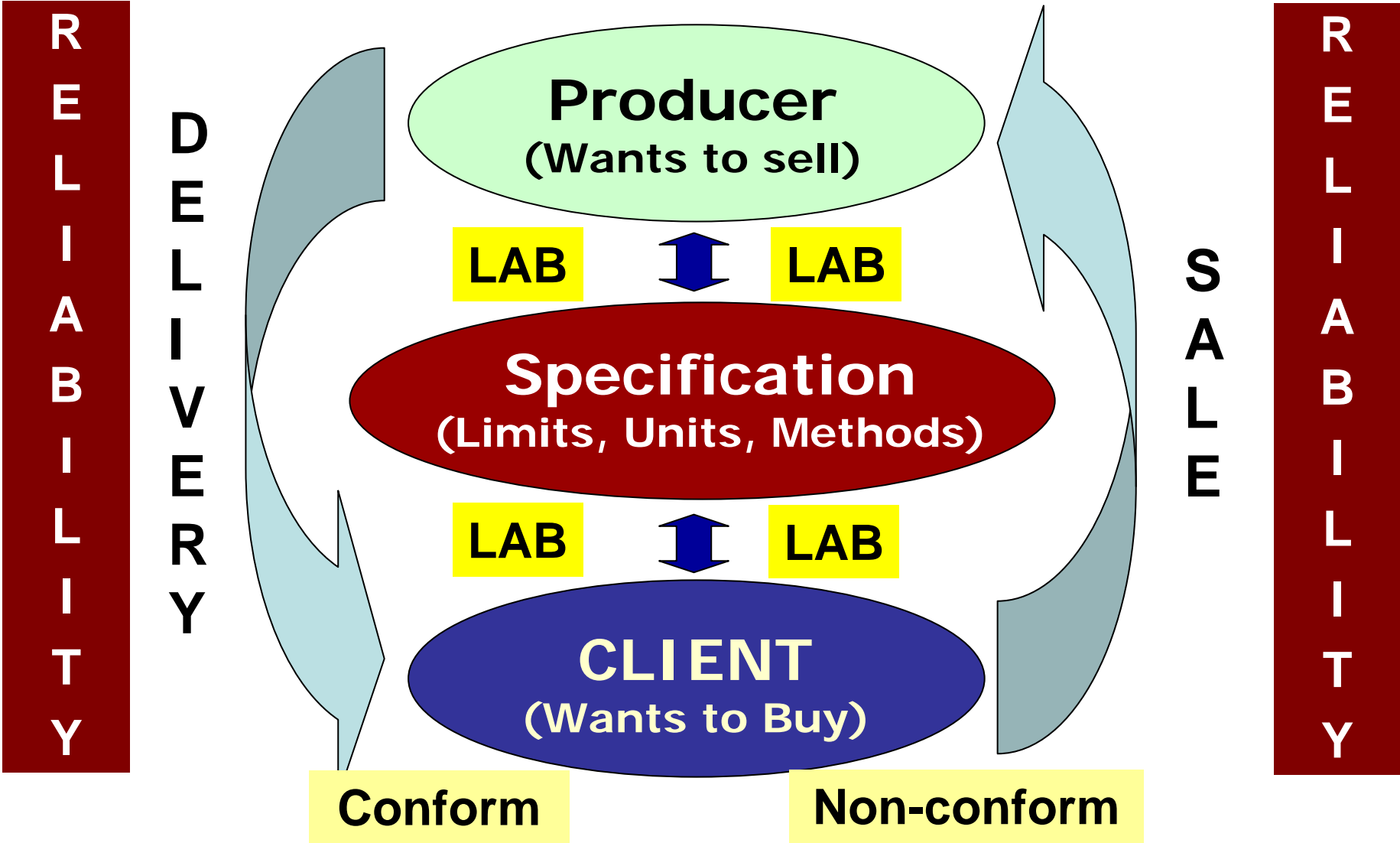


Agenda

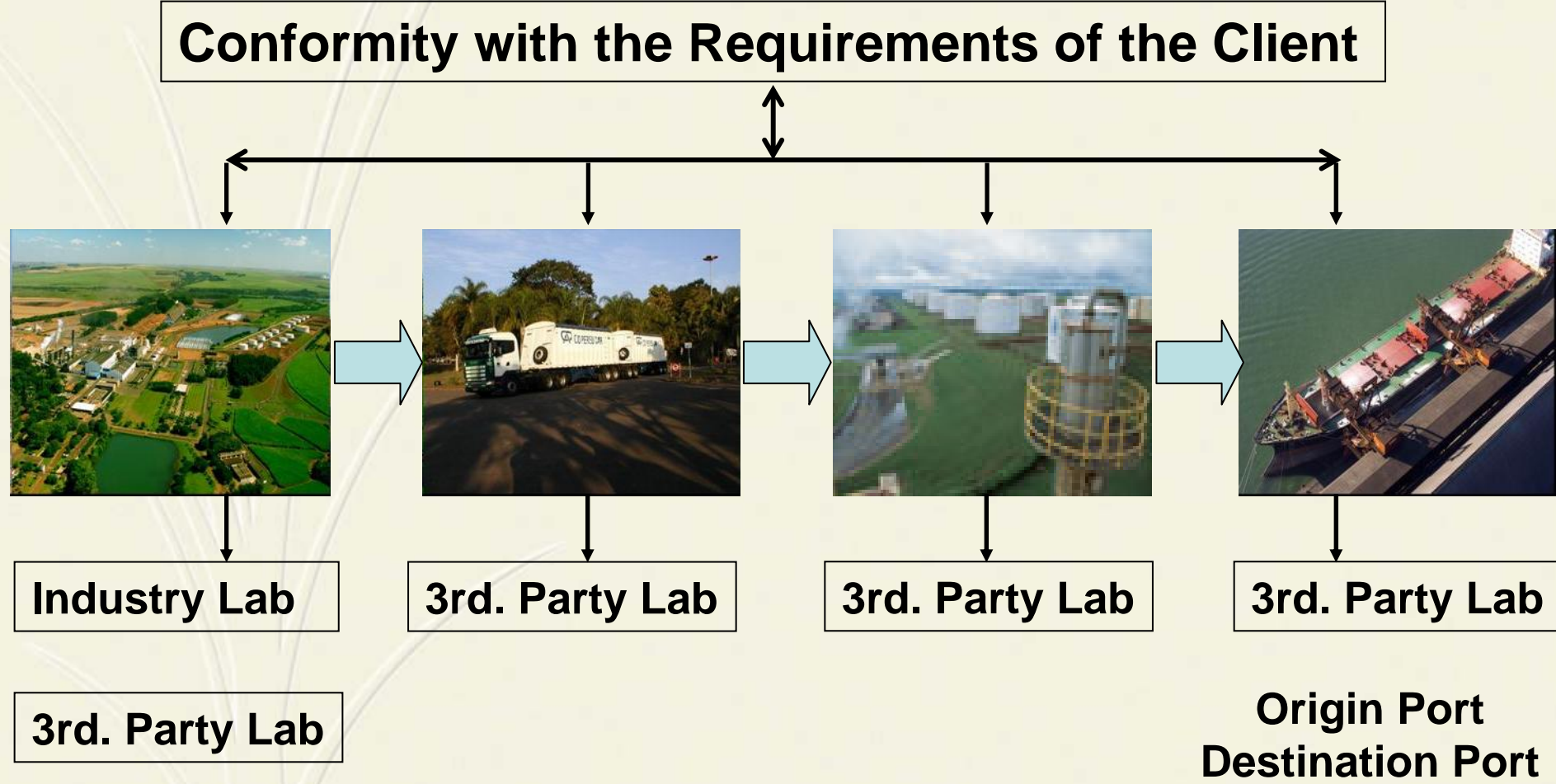
- **Trading of Ethanol**
- **Ethanol specifications and tests methods**
- **Steps to conformity with the specification**
- **Work that should be done**



Trading of Ethanol



Quality Assurance



Ethanol Specifications and Tests Methods

Anhydrous Ethanol Specification

Characteristics	Unit		Brazil	USA	Europe
Density (20°C)	kg/m ³	max.	791.5		
Alcoholic strength @ 20°C	INPM, %m/m	min.	99.3*		
Etanol content**	%v/v (%m/m)	min.	98,0*	92.1*	(96.7*)
Water (Karl Fischer)	%v/v (%m/m)	max.	-	1,0	0,300
Total Acidity - max.	mg/L (%m/m)	max.	30	56 (0.007)	56 (0.007)
Electrical Conduvity	uS/m	max.	500	-	
pHe	-		-	6.5 a 9.0	
Copper	mg/kg	max.	0.07	0.1	0.100
Chloride	mg/kg (mg/L)	max.	-	40 (32)	(20.0)
Solvent-washed gum	mg/100 mL	max.	-	5.0	
Aspect	-		Clear	Clear	Clear
Methanol	%v/v (%m/m)	max.	-	0.5	(1.0)
C3-C5 max.	%v/v	max.	-		2.0
Denaturant content	%v/v		-	1.96 a 5.0	
Sulfur	mg/kg	max.	-	30	10.0
Sulfate	mg/kg	max.	-	4	
Phosphorus	mg/L	max.	-	-	0.50
Involatile Material	mg/100 mL	max.	-	-	10.0

* Densimetry

ASTM International D 4806-07

** Gas chromatography

Europe - Draft prEN 15376 Aug/2007)

Brazil - ANP

Standard Tests Methods for Anhydrous Ethanol





Characteristics	Brazil - NBR	USA - ASTM	Europe - EN/EC
Density (20°C)	5992 / 15639	D 4052	-
Alcoholic strength @ 20°C	5992 / 15639	-	-
Ethanol %	-	D 5501	EC/2870/2000 method B
Water (Karl Fischer)	-	E 203	15489
Total Acidity - max.	9866	D 1613	15491
Electrical Conduitivity	10547	-	-
pHe	-	D 6423	-
Copper	10893	D 1688A	15488
Chloride	-	D 7319, D 7328	15484 / prEN 15492
Solvent-washed gum	-	D 381	-
Aspect	Visual	Visual	Visual
Methanol	-	D 5501	EC/2870/2000, method III
C3-C5 max.	-	-	EC/2870/2000, method III
Sulphur	-	D 2622, D 3120, D 5453	15485 / 15486
Sulfate	-	D 7319, D 7328	
Phosphorus	-	-	15487
Non-volatil material	-	-	EC/2870/2000 , method II prEN 15691:2007

ASTM International EC - European Community EN - European Norms / prEN - Draft method
NBR - Associação Brasileira de Normas Técnicas

Client Specification and Certificate

Analysis	Specification	Methodology	Unit	Results
Ethanol	99,5 Min	ASTM D 5501	Vol %	99,4 *L
Methanol	0,5 Max	GLC	Vol %	0,0069
Solvent - washed gum	5,0 Max	ASTM D-381	mg/100mL	1
Water	1,0 Max	ASTM E 203	Vol %	0,554
Chloride Content	32 Max	ASTM D-512	mg/L	< 1
Copper content	0,10 Max	ASTM D 1688	mg/kg	< 0,05
Acidity (Acetic acid)	0,007 Max	ASTM D 1613	Wt %	0,0011
pH	6,5 to 9,0	ASTM D 6423	--	6,5
Sulphur	10 Max	ASTM D 3120	ppm	3
Sulphates	4 Max	Turbidimetric	ppm	< 1
Appearance	Clear	Visual	--	Clear

More Client Specification

PROPERTIES	SPECIFICATION / UNITS	TEST METHOD
Alcohol Strength	minimum 99.4% weight	ASTM D5501
- Ethanol	minimum 98.4 %wt	
- Methanol	Maximum 0.6 % wt	
water content	0.6% weight max	ASTM D1744
Higher alcohols	max 200g/hl (= max 0.25% weight)	ASTM D5501
Acidity as acetic acid	max 100 ppm	ASTM D1613
Chlorure	max 10 ppm	IMPCA-002 
Esters	max 50 g/hl (= max 0.06% weight)	CEE.L.130 
Aldehydes	max 50 g/hl (= max 0.06% weight)	CEE.L.130 
Sulfur	max 10 ppm (= max 0.001 % weight)	ASTM D-3961
Cyclohexane	max 20 ppm (= max 0.002 % weight)	ASTM D3054
Benzene	max 10 ppm (= max 0.001 % weight)	ASTM D4534
Iron	Max 1 ppm	
pHe	< 7.5 	
Suspended matters	Free	
Non volatiles	Max 50 ppm	



Conformity with the Specification

Steps to Quality Assurance

- **Production**

- **Process modification for each specification: pH, sulfur, water and ethanol content, etc.**
- **Loss of production – water content (10% to 22%).**

- **Process control**

- **What and how to control variables at the process (distillation) to obtain ethanol in the specification.**
- **Analytical equipment to assure that the product is in the specification of the client.**
- **Trained technicians for process and laboratory.**

Steps to Quality Assurance

- **Storage in the Producer Site**
 - Different tanks for different products.
 - Independent lines to and from tanks to prevent contamination between different products.
- **Transportation**
 - Trucks, railroad cars – cleaned to prevent contamination.
 - **Pipeline – Prevention of cross contamination from different producers or lots, difficult and increase risk of product out of specification.**

Steps to Quality Assurance

- **Storage in the Port**
 - Segregation in tanks exclusively for ethanol.
 - Prevention of contamination in pipes during the ship loading.
- **Shipment**
 - Cleaning of the ship tanks – contamination tests.
 - Cleaning of the connections pipes to ship.
 - Quality maintained during the trip period.

Steps to Quality Assurance

- **Quality Assurance - Analytical Control**
 - Quality has to be known to guarantee the specification from the producer to the shipment
 - Validated methods for the specific matrix
 - Laboratory instruments to measure the quality according the specification
 - Equipment calibrate and validated
 - Trained technicians to perform the analysis
 - Reliability of the measurement – repeatability, reproducibility, uncertainty
 - Certified Reference Material

Steps to Quality Assurance

The mentioned steps increase direct and indirect costs in:

- » **Process**
- » **Control**
- » **Laboratory**
- » **Storage**
- » **Transportation**
- » **Shipment**

Different Specifications, Methods and Units increase probability of non conformity risks



Work that should be done

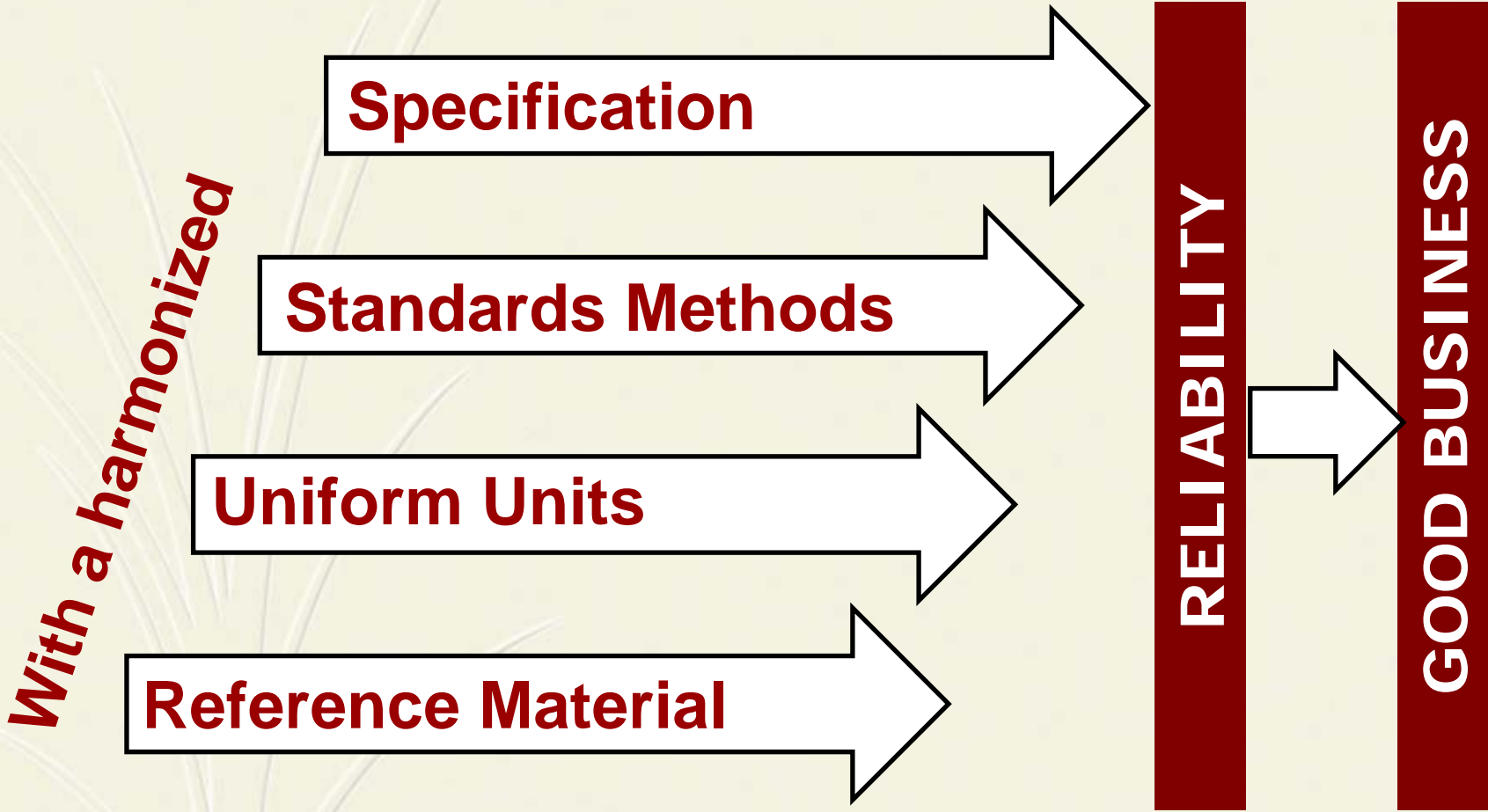
Specifications and Methods

- ➡ **Conclude the Harmonization of undenatured anhydrous ethanol specification to be used as a fuel . Rational**
- ➡ **Define method, units and acceptable limits for each parameter, considering the type of ethanol. Matrix consideration**
- ➡ **Validate the methodologies for ethanol matrix. Metrology**

Specifications and Methods

- ➡ For each complex or instrumental methods, find a simple one, to be performed at the industry, even with a low accuracy, but comparable between them. **Process control**
- ➡ Provide interlab tests to know the repeatability and reproducibility of the methods. **Reliability**
- ➡ Qualify laboratories to analyse ethanol with reliability. **Accreditation**

Harmonization Means Good Business



Thank you for your attention.



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