



WORKSHOP ON TECHNICAL SPECIFICATIONS AND STANDARDS FOR BIOFUELS

A Presentation on –

**BIO-ETHANOL – Specifications & Standards
(A Global Perspective)**

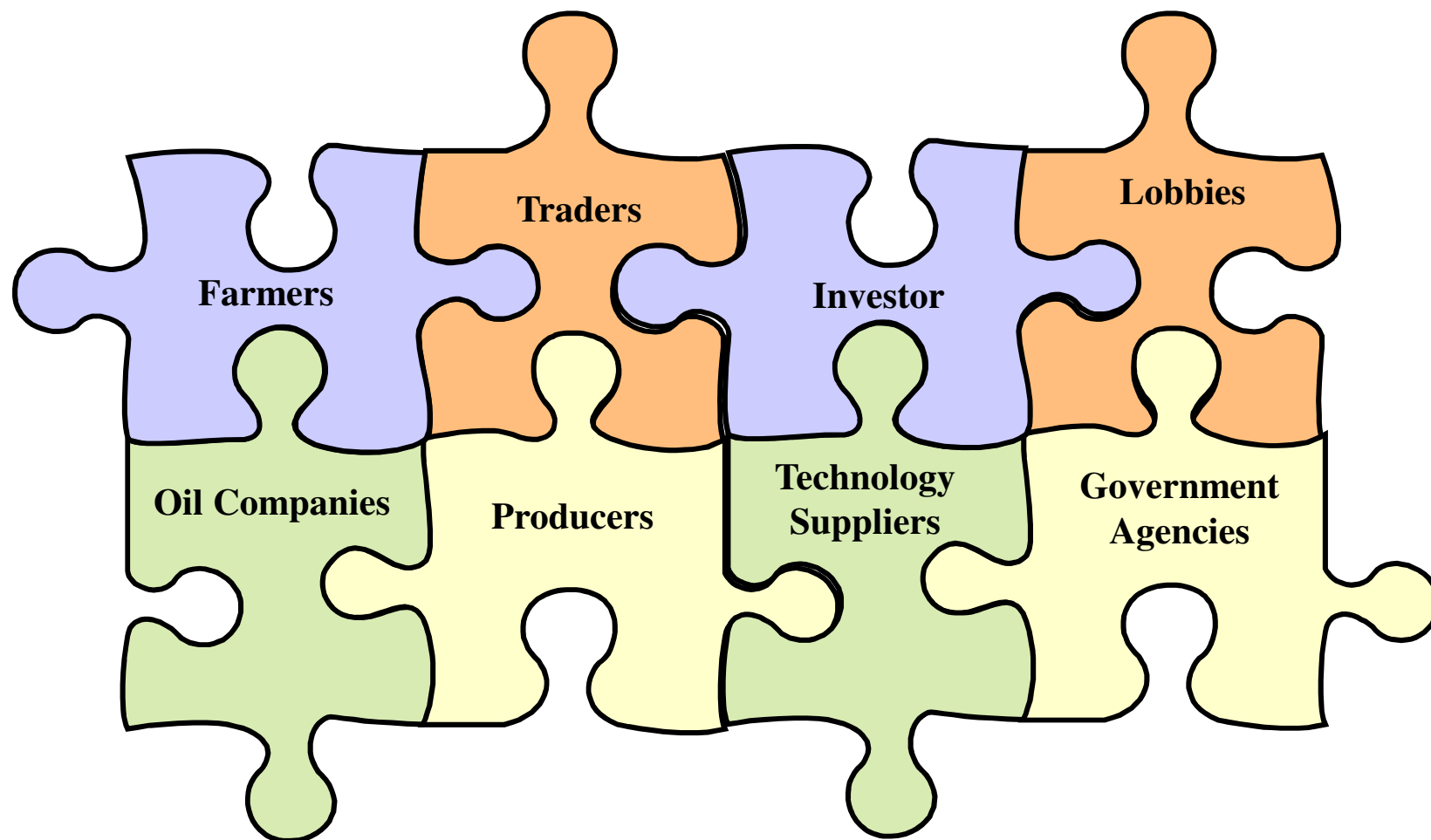
**S.M.FAROOQ ZAIDI
PRAJ INDUSTRIES LIMITED
India.**

02 & 03.12.2010, Johannesburg

All present in this room wish to see this



Which also meanssome basic level of standardization....



...to ensure seamless utilization of resources.

Contents -

- **Some Major specifications of Bio-Ethanol.**
- **Testing methodologies**
- **How to Achieve conformity with Specification !**
- **Work - Needs to be done !**

Bio-Ethanol Specifications – A comparative

Anhydrous Ethanol Specification



Characteristics	Unit		India	RSA	Brazil	USA	Europe
Density (20°C)/ (Relative Density 15.6°C)	Kg/m ³	max.	(0.7961)	--	791.5	--	--
Alcohol strength @ 20°C	INPM, %m/m	min.	--	--	99.3*	--	--
Ethanol content**	%v/v (%m/m)	min.	99.5	92.1	98,0*	92.1*	(96.7*)
Water (Karl Fischer)	%v/v (%m/m)	max.	--	1.0	-	1,0	0,300
Total Acidity – max.	mg/L (%m/m)	max.	30	55	30	56 (0.007)	56 (0.007)
Aldehyde Content	mg/ L	max.	60	--	--		--
Electrical conductivity	uS/m	max.	300	--	500	-	--
pHe	-		--	6.5 to 9.0	-	6.5 to 9.0	--
Copper	mg/kg	max.	0.1	0.1	0.07	0.1	0.100
Chloride	mg/kg (mg/L)	max.	--	40 (32)	-	40 (32)	(20.0)
Solvent – washed gum	Mg/100 mL	max.	--	5	-	5.0	--
Aspect	-		Clear	--	Clear	Clear	Clear
Methanol	%v/v (%m/m)	max.	300 mg/ L	0.6	-	0.5	(1.0)
C3-C5 max.	%v/v	max.	--	--	-		2.0
Denaturant content	%v/v	--	--	1.96 to 4.75	-	1.96 to 4.75	0 to 1.3
Sulfur	mg/kg	max.	--	30	-	30	10.0
Sulfate	mg/kg	max.	--	--	-	4	--
Involatile material	mg/100 mL	max.	0.005 % (m/m)	--	-	-	10.0

* Densimetry

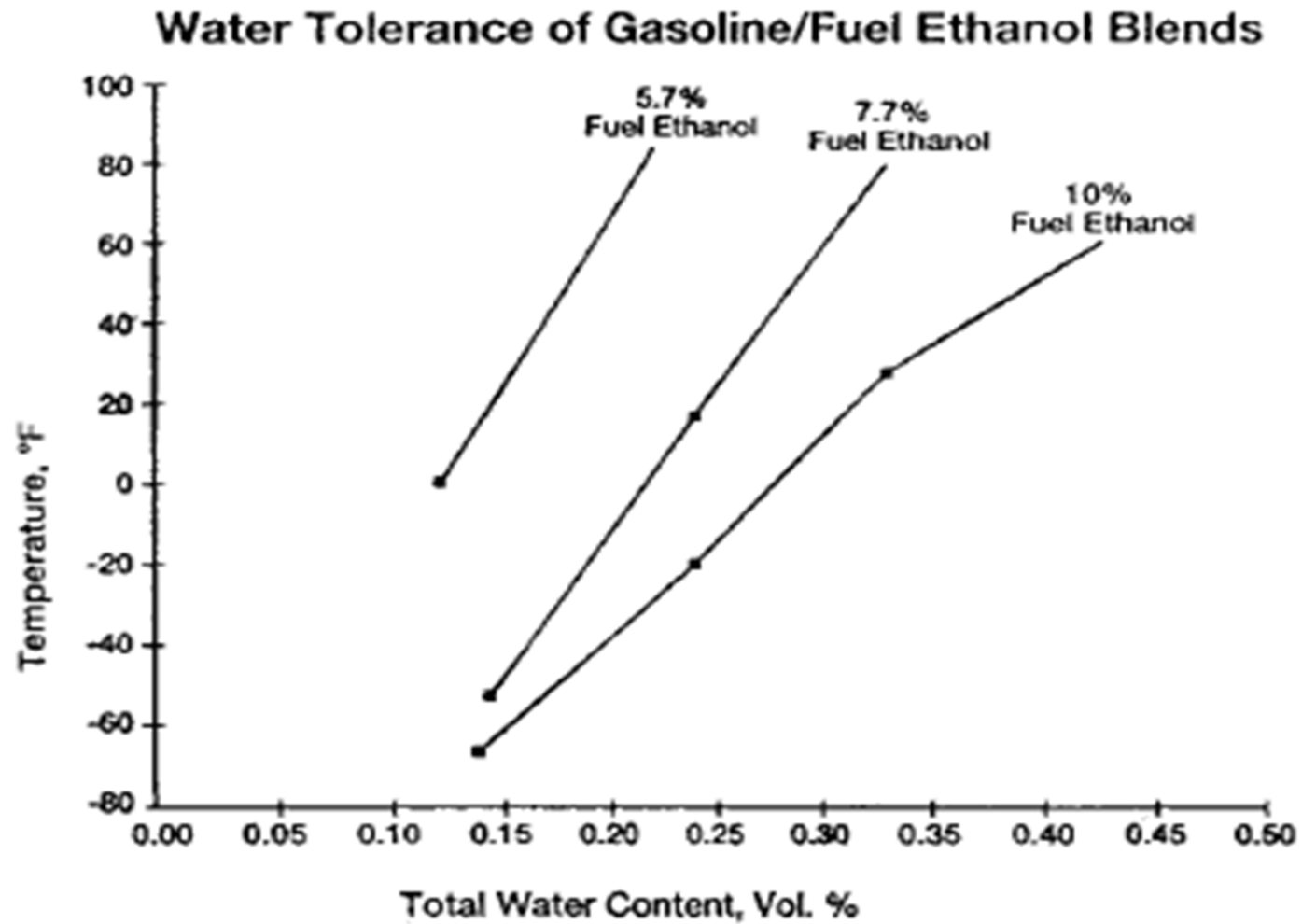
** Gas chromatography

Brazil : DNC - 01/91

ASTM International D 4806-07 SANS 465:2005

EN 15376:2007+A1:2009 India - IS 15464:2004

Water levels



The Test Methodologies

Standard Test Method for Anhydrous Ethanol







Characteristics	Brazil - NBR	USA - ASTM	Europe – EN/EC
Density (20°C)	5992 / 15639	D 4052	-
Alcohol 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 Conductivity	10547	-	-
pHe	-	D 6423	-
Copper	10893	D 1688 A	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 II
C3-C5 max.	-	-	EC/2870/2000, method II
Sulphur	-	D 2622, D 3120, D 5453	15485 / 15486
Sulfate	-	D 7319, D 7328	
Phosphorus	-	-	15487
Non-volatile 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

Trade Client Expectations (Typical)



PROPERTIES	SPECIFICATION / UNITS	TEST METHOD
Alcohol Strength	minimum 99.4% weight	ASTM D 5501
- Ethanol	minimum 98.4% wt	--
- Methanol	maximum 0.6% wt	--
Water content	0.6% weight max	ASTM D 1744
Higher alcohols	max 200g/hl (= max 0.25% weight)	ASTM D 5501
Acidity as acetic acid	max 100 ppm	ASTM D 1613
Chloride	max 10 ppm	IMPCA-002 
Esters	max 50g/hl (= max 0.06% weight)	CEE.L.130 
Aldehydes	max 50g/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 D 3054
Benzene	max 10 ppm (= max 0.001% weight)	ASTM D 4534
Iron	max 1 ppm	--
pHe	< 7.5 	--
Suspended matters	Free	--
Non volatiles	max 50 ppm	--

Conformity – How to Achieve !

Stepwise Approach for Q.A. -

- **Production**

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

- **Process Control**

- ✓ Control Logic to control variables at process (distillation) to obtain ethanol in specifications.
- ✓ Analytical laboratory to ensure product conformity to specification of the client.
- ✓ Manpower Training for smooth process & analysis.

Stepwise Approach for Q.A. -

- **Storage in the Producer Site**

- ✓ Separate tank for different products.
- ✓ Independent lines to and from tanks - Prevent contamination between various product grades.

- **Transportation**

- ✓ Trucks, railroad cars – cleaned to prevent contamination
- ✓ Pipeline – Prevention necessary to avoid cross contamination between products. Increase risks of off specs. product.

Stepwise Approach for Q.A. -

- **Storage in the Port**

- ✓ Segregation in the tanks exclusively for ethanol.
- ✓ Prevention of contamination in pipes during loading.

- **Shipment**

- ✓ Cleaning of the ship tanks – contamination tests.
- ✓ Cleaning of the connections pipes to ship.
- ✓ Quality checks/ maintenance during voyage.

Stepwise Approach for Q.A. -

- **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 to the specification.
- ✓ Equipment calibrate and validated.
- ✓ Trained technicians to perform the analysis.
- ✓ Reliability of the measurement – repeatability, reproducibility, uncertainty.
- ✓ Certified Reference Material.

Stepwise Approach for Q.A. -

The steps may increase costs on :

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

**...but necessary because....different Specifications,
Methods and Units increase probability of non
conformity risks !**

Work – Needs to be done

Specification and methods

- ▶ **Agree on common specification for anhydrous ethanol specification to be used as a fuel.**
- ▶ **Agree on tests method, units and acceptable limits for individual parameter for various grades of ethanol.**
- ▶ **Validate the methodologies for ethanol matrix.**

Specification and methods

- ▶ Ensure plant scale user friendly analytical methodology for effective process control.
- ▶ Awareness about repeatability and reproducibility of the results.
- ▶ Creation of certified laboratories to analyze ethanol.

Thanks



PRAJ : Global Presence



**Across 5 Continents.....in more than 45 Countries....
Over 450 References... From Australia to Peru...**