

Update: Fuel Quality for Ethanol Plants

Fuel Ethanol
Laboratory Conference

Kristy Moore
Technical Consultant, Growth Energy
October 2018



Just a bit about me....



1994: Started at largest distillery in the world.

2000: Transferred to largest corn processing plant in the world.

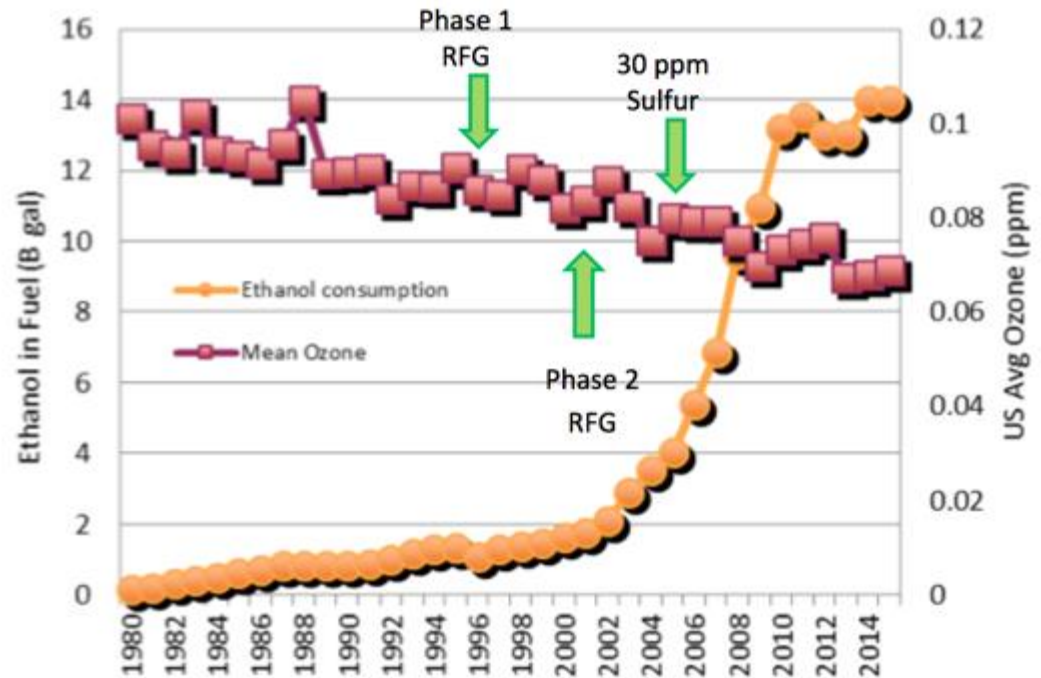
2007: Worked for ethanol trade association.

2015: KMoore Consulting formed.

2018: Building global markets.

Ethanol's Value to Air Quality

- Valuable octane increase.
- Valuable sulfur dilution.
- Valuable benzene dilution.
- Valuable volume extension.
- Valuable greenhouse gas reductions.



Points in Today's Presentation



- Importance of ASTM International, Global Fuel Specifications.
- How ethanol markets are impacted by ASTM and other standards.
- Fuel Ethanol Quality issues.
- Know your process!
Know your product!
- Market Development.

ASTM and Ethanol

- ASTM Standards are important to all of us!
 - Ethanol industry posting improved participation and attendance.
 - D02 Main Committee has 2,500 members.
 - Ethanol industry has ~50 members.
- Commercial contracts typically reference consensus standards for motor fuels such as ASTM D4806 for denatured fuel ethanol.
- International specs based on ASTM.



ASTM: How do I get involved?

- Stakeholder involvement
 - Two face-to-face meetings per year, voting rights throughout the year.
- Balanced stakeholder input. Producer not more than User + General Interest.
- Level of participation is up to you.
- Unlimited committee memberships.
- Starts with \$75 annual membership
- Very active efforts at ASTM D02, E48.
- Developing succession plan to bring ethanol stakeholders into leadership.
- Government agencies must adopt consensus standards when available.
- Advancing our industry goals with standards, methods, specifications.

ASTM D02 Efforts

- D7795 will be the only acidity test method in ethanol specifications. Already removed D1613 from D4806.
- D5501 specific gravity adjustment.
- Improve significant figures in D381.
- Copper in D4806, DRA discussions (future).



D4806 – 18

TABLE 1 Performance Requirements

Property	Limit	Method
Ethanol, % by volume, min	92.1	D5501
Methanol, % by volume, max	0.5	D5501
Solvent-washed gum content, mg/100 mL, max	5.0	D381
Water, % by volume (% by mass), max	1.0 (1.26)	E203, E1064, or D7923
Inorganic Chloride, mg/kg (mg/L), max	6.7 (5)	D7319 or D7328
Copper, mg/kg, max	0.1	D1688
Acidity (as acetic acid CH ₃ COOH) mg/kg, (% by mass) [mg/L], max	70 (0.0070) [56] (Note 2)	D7795
pHe	6.5 to 9.0	D6423
Sulfur, mg/kg, max	30.	D2622, D3120, D5453, or D7039
Existent sulfate, mg/kg, max	4	D7318, D7319, or D7328

ASTM E48 Bioenergy and Industrial Chemicals from Biomass

- Development of Standards and Specifications supporting the commercial activity of bioenergy, biomass conversion:
 - Many methods on biomass characterization.
 - Standard Practice for Determination of Converted Fraction of Starch and Cellulose co-fermentation.
 - Undenatured ethanol specification development.

International Analysis of Ethanol

- Careful review of international analytical specifications and test methods ensures appropriate analysis.
- Many times ASTM International Standard Test Methods (STM) are referenced.
 - If you are using an ASTM STM and the international specification is not, then equivalence must be demonstrated.
 - ASTM D6708 is a great tool to help with this demonstration.
- Some countries with a standards organization develop their own methods.
 - Netherlands has NEN, EU has CEN, Brazil has ABNT, Canada has the CGSB.
- Identify the referee method to ensure awareness of fuel quality resolution.

ASTM - D02 Ethanol Related Specifications

D4806 – Denatured Fuel
Ethanol Specification

D4814 – “Gasoline”
Specification

D5798 – Ethanol Flex Fuel
Specification

D7794 – Mid Level Ethanol
blends Practice

D8011 – Natural Gasoline

D8076 – 100 RON (High
Octane Fuel)

D8181- Microemulsion



ETHANOLCMP

ASTM Standards for Denatured Fuel Ethanol
and Ethanol Flex Fuels

Online!

This 1-year Online+ subscription includes redline, historical, and withdrawn standards.

Published: Updated weekly

Format	Pages	Price	
Online		\$239	ADD TO CART

[ASTM License Agreement](#)

[CHECK THE CONTENTS](#)

[CONTACT SALES](#)

[RELATED PRODUCTS](#)

There are 38 ASTM standards included in this price! And the compilation is updated weekly- so you keep on top of all of the latest test methods, specifications!

Keeping up the Ethanol Presence!

- Active participation in ASTM for standard and specification improvement, ensure presence of voters.
- Active participation in NCWM to ensure market access, no limitations on ethanol content, uniform requirements for E10 and E15.

Know Your Process!

Know Your Product!

- This session is a real example of how your process affects your fuel quality!
- Fuel quality incidents have caused numerous issues at plants, terminals, and consumer issues and rejection incidents with your customer and/ or regulatory authority.
 - Costs time and money to your company.
 - Run the risk of losing customers and markets.

Fuel Quality Issues Facing the Industry

- Filtration
 - The cheapest, best line of defense. Drag Reducing Agent, Gasoline Detergent, Molecular Sieve Bead Dust, ...
 - Let's talk seriously about this!! If particulate gets to consumers, the cost starts in the \$Millions.
- Ethanol Flex Fuel
 - Water limit is lower for D5798 Ethanol Flex Fuel than D4806 Denatured Fuel Ethanol.
 - Rejections from customer and regulatory authority.
 - Modifications to vol.%/ wt.% in D5798 underway.

Provide Good Customer Service!

- When a report of a concern with fuel quality is received, TAKE IT SERIOUSLY!
- Review plant operations and laboratory performance.
- Re-evaluate sample retain.
- Follow up with person with concern. Everyone's fuel quality affects the industry, both the ethanol and oil industry.

Complete a thorough investigation. If there has been a fuel quality event: own it, correct it, and learn from it!



Industry Collaboration

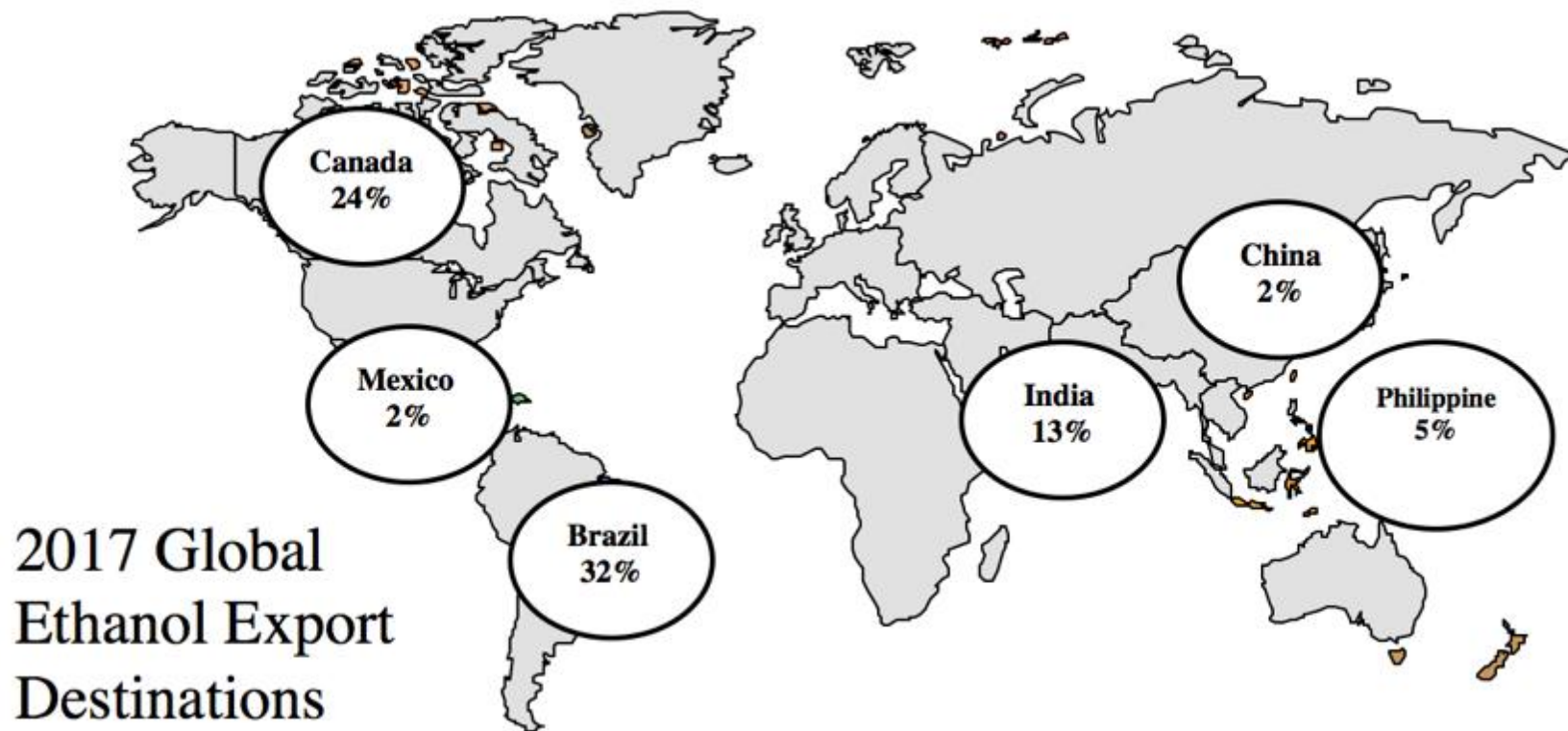
➤ Fuel Ethanol Technical Advisory Group (FETAG)

- Originally came together through ASTM
- Bigger opportunities for this group to collaborate
- No trade group ties
- Industry outreach and communication

➤ Current Objectives

- ASTM “Know Before You Go” Webinar
- FEW Panel Discussion on topics impacting DFE
- Potential for Industry Led Research Efforts

U.S. Ethanol Export Destinations: How will this picture change over the next years?



Global Ethanol Specifications

- Each country, each state, each customer may have their own specifications.
- Pay close attention to the analytical methods.
 - Methods may appear identical, but must be proven.
 - Retail records of method equality.
- Pay close attention to the units of measure.
 - Watch volume vs. weight %
 - Similar to water limit of D4806 vs. D5798.
- Confirm with customer the data to be listed on the Certificate of Analysis.

Comparison of Global Ethanol Specs

Parameter	United States ASTM D4806	Canada CGSB 3.516	EU EN15376	China NG18
Ethanol, % vol.	92.1	92.0	98.7	92.1
Methanol, % vol.	0.5	0.5	1	0.5
Water, % vol.	1.0	0.8	0.300	0.8
Acidity, mg/ kg	70	70	0.005% wt.	56



Thank you!

KMoore Consulting LLC, Email: fueltechservice@gmail.com, Phone:
309.275.9433

Importance of Fuel Quality

One tanker load (9,000 g) of denatured fuel ethanol makes 90,000 gallons of E10 gasoline.

Let's say: Most consumers fill up with 15 gallons of E10, that's 6,000 fill ups for consumers.

Math for railcar: 29,000 g makes 290,000 gallons of E10.

That's 19,500+ consumers!

Estimate fuel usage time:

- Truckload used in <30 days.
- Railcar used in <60 days.
- Barge/ international used in >90 days.

Keep sample storage per the average transit time for product to get to the market and ensure there are no issues.