

Purdue University Road Show, Biodiesel Update

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Agenda

- Benefits
- Quality Control
- Maintenance of Systems
- Storage Precautions
- Cummins Biodiesel Position
- Cummins Engine Warranty Impact
- Frequently Asked Questions
- It's The "Team" That Makes It Work





Benefits of Biodiesel

Biodiesel is good for the environment

Biodiesel helps reduce green house gases

Biodiesel is renewable fuel

- Almost like operating a diesel engine on solar energy
- This is “Red, White, and Blue” for the country

Reduces dependence on foreign oil

Reduces smoke emissions

Biodiesel helps businesses recycle cooking oils and animal fat

Biodiesel is good for the farmers

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Quality Control

Quality = BQ-9000

Fuels should be purchased from:

- BQ-9000 Certified Marketer, who purchase their B100 fuels from BQ-9000 Accredited Producers
- This insures the fuel meets the ASTM D6751 and, for B20 biodiesel, that it meets the EMA B20 specification

BQ-9000 Producers have COAs (Certificate of Analysis) for every production load of B100 fuel

- The COA is the best way to insure the fuel will be the highest quality available

Cummins will continue to participate in improving biodiesel specifications and quality



**BQ-9000
Accredited Producer**



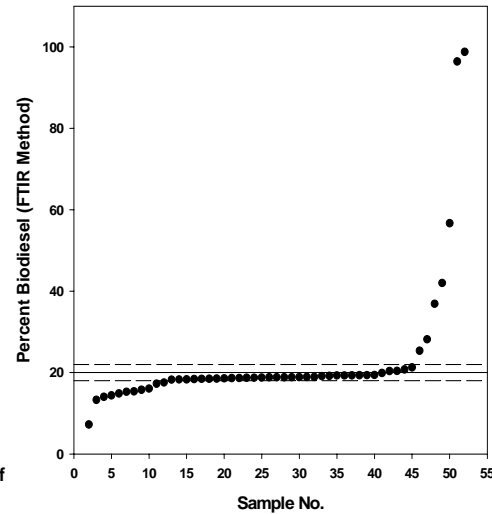
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Fuel Quality



• Blending Process

- Recent study (*) by DOE's NREL on B20 biodiesel blend suppliers determined that 36% of the samples didn't meet the 18-22% blend ratio



* <http://www.nrel.gov/docs/fy06osti/38836.pdf>

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Maintenance of Systems



Biodiesel requires more overall maintenance to ensure reliable performance.

- Fuel storage tanks need periodic cleaning
- Take periodic fuel samples from the top, middle and bottom of the tank to insure quality top to bottom
- Inspect fill caps and vents for proper sealing against water intrusion, drain water when needed.
- Treat fuel with biodiesel approved biocide
- Fuel filters could need more frequent changing
- Engines fuel filtration must have water stripping capability
 - Use StrataPore™ filtration media or its' synthetic equivalent

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BY THE SAMPLE TO LEFT, THIS TANK HAS A PROBLEM WITH EXCESSIVE WATER ACCUMULATION. YOU CAN ALSO DETECT THIS MUCH WATER WITH WATER-INDICATING PASTE ON A STICK.

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THIS SAMPLE CONTAINS HEAVY AMOUNTS OF DEGRADED FUEL PRODUCTS AND WATER.

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Storage Precautions

Fuel oxidation stability protection

- Do not store fuel longer than 6 months in bulk tanks
- Do not store fuel longer than 3 months in vehicle
- Seasonal fuel users need to purge the biodiesel by running 30 minutes on pure petro diesel
- Cummins does not recommend running stand-by generators or other engines that do not burn enough fuel to keep the fuel fresh
- Do not use storage tank materials or fuel lines made from: brass, bronze, copper, lead, tin, or zinc.... as these materials will accelerate the oxidation of biodiesel.
- Avoid using natural, nitrile, or butyl rubber fuel lines / gaskets

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EXAMPLE OF DISTILLATE FUEL HAZE RATING STANDARD USING ASTM CLEAR AND BRIGHT TEST



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Fuel Filter Plugging

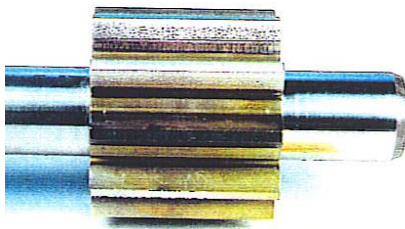


- **Concern:** Fuel Filter Plugging due to degraded fuel, poor quality fuel, microbe growth, cleaning effect on tanks. Emerging issue regarding cold weather filter plugging not well understood.
- **Countermeasures**
 - Require use of BQ9000 Accredited Producers only (for NA). Other quality programs World Wide
 - Require that B20 fuel meets the EMA specification
 - Specific procedures available detailing storage recommendations, cold weather operation, etc.
 - New ASTM group assigned to improve spec. for cold weather operation. Started work in Dec 2006

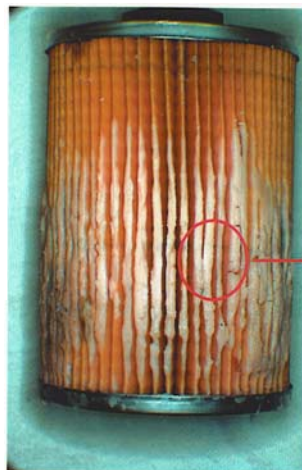


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Fuel Quality Effects (Oxidation)



High acid B20: pitting of fuel pumping gears in bench test



Deposits from oxidation in a B20 field test

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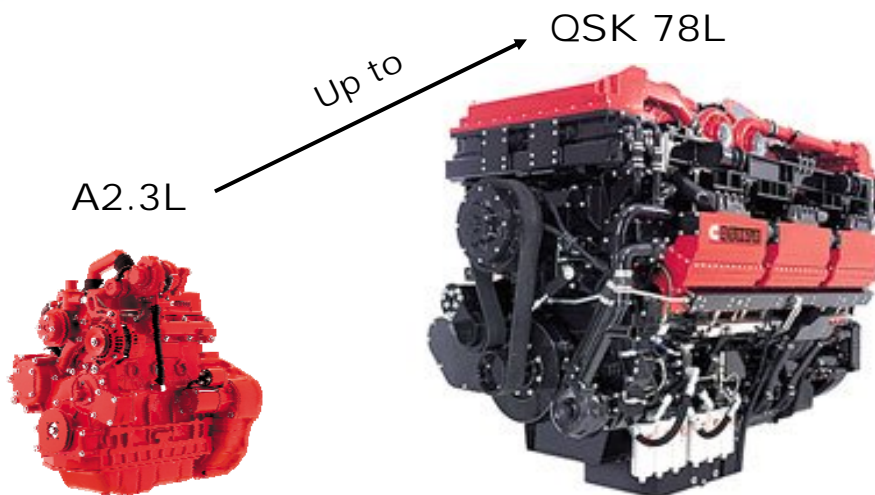
Cummins Biodiesel Position

- Cummins fully supports the responsible production and use of biodiesel fuel
- B5 is approved for use in all of our engines from A2.3L up to the QSK78L
- Cummins tests all Dodge Ram Cummins Turbo Diesel engines on B5 at our Walesboro IN. engine plant
- Cummins is working toward the approval of B20

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Cummins Approved for B5



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Cummins Engine Warranty Impact



- Cummins Inc. warranty covers the material and workmanship of our engines.
- High quality biodiesel from a BQ-9000 Accredited Marketer will be just as reliable a fuel as pure petro diesel fuel.
- If there are failures due to material or workmanship defects, they will be covered under normal warranty.
- Failures from water, dirt / debris and other contamination elements, that might be found in low quality contaminated biodiesel, would not be covered by warranty.
- This position is consistent with the position Cummins has always taken, when there is damage from water in pure petro diesel fuel, and is consistent with the other diesel engine manufacturers.

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Frequently Asked Questions



- **What is the “Black Stuff” in my fuel filter?**
 - Asphaltines (tar) from unstable diesel fuel
 - Microbial contamination from water in fuel
- **Do you need additives for the fuel to prevent fuel gelling, and are they compatible with ULSD?**
 - ULSD will be blended for winter fuel the same as in the past
 - Fuel additives should be labeled 2007 ULSD compatible
 - Contact your fuel supplier for additives that are biodiesel compatible. Some additives do not produce the expected cloud point reduction results when used in biodiesel.

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Frequently Asked Questions



- **What happens with Biodiesel that plugs fuel filters?**
 - Biodiesel acts as a solvent that cleans fuel tanks and fuel lines of many deposits. The deposits being cleaned from the tanks and lines can plug up the filters. This problem should go away as the fuel systems are cleaned.

- **What about water and biodiesel, what effect does it have?**
 - Biodiesel has a very high affinity for water and will pass more water through your fuel filter. It is recommended that customers use StrataPore™ filtration media, or its' synthetic equivalent, to strip out the water from B20 biodiesel.

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Frequently Asked Questions



- **What happens with biodiesel when there is water present in the fuel storage tank?**
 - Biodiesel will hold more water in solution. That is why biodiesel is more susceptible to microbial contamination, the black material that plugs filters.
 - Fuel tanks must be treated with biocide to prevent/control the biogrowth.
 - Users need a fuel tank maintenance program.

- **What about biodiesel shelf life or storage life?**
 - Biodiesel is not as stable as straight #2 petro diesel fuel. Users should not store biodiesel for more than 6 months, there could be some oxidation and sediment that collects in the bottom of the storage or fuel tank. This sediment will cause plugged filters

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It's The "Team" That Makes It Work



Cummins Building
Biodiesel Capable
Engines



OEMs Building
Biodiesel Capable
Vehicles



Quality Biodiesel Fuel