

Response By Australian Biofuels Association

**National Fuel Quality Standard for Biodiesel
Discussion Paper No. 6 March 2003**

by

Environment Australia

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Forward

The Australian Biofuels Association (ABA) represents the Australian commercial producers, marketers and sellers of fuel ethanol and biodiesel in Australia. The two known commercial scale biodiesel plants in Australia – Biodiesel Industries Australia (BIA) and the Sidebottom Group – are members of the ABA, and the ABA maintains contacts with three new potential commercial scale biodiesel plant projects that could enter the Australian renewable fuels market over the next one to two years.

The **National Standard for Biodiesel-Discussion Paper No. 6** is a generally positive document in support of the introduction of a national fuel quality standard for biodiesel. The position of the ABA has been that for biodiesel to be accepted by the Australian market, quality standards need to be set, adhered to and wherever possible, exceeded.

Biodiesel, like ethanol, has the advantage of a history of development and use in the United States and Europe over the past 20 years. For this reason there are few mysteries associated with the well-known qualities of biodiesel as a transport fuel. It has the added advantage in that the major diesel engine and equipment manufacturers in both the United States and Europe generally recognise both the American (ASTM), and European (DIN) standards. This provides Australia with the option of recognising both standards, or basically adopting the standard most widely used and recognised in Australia – a choice that would largely be dictated by the country that is the largest manufacturer of diesel engines and vehicles in use within the Australian transport fleet.

Summary and Recommendations

Background

Biodiesel is a globally recognised transport fuel with a history of 20 years of safe on-road use and extensive trials behind it. It is a fuel with a favorable emissions profile. Biodiesel also has a positive energy balance 390% greater than petroleum distillate: i.e. 3.24 units of energy are gained for every unit of input energy compared with petroleum distillate (however clean), with a net loss at 0.83 units of energy per unit of input energy.

The ABA believes that the demand for domestic energy security, cleaner burning fuels that are also renewable fuels, and transport fuels with environmental and greenhouse benefits, will force all diesel engine vehicle users to investigate and adopt biodiesel as a fuel of first choice in the future.

Future research and development in the production and use of biodiesel will inevitably lead to improvements in production technologies, greater cost efficiencies, performance, and even greater emission benefits.

Recommendations

Biodiesel is currently in limited supply in Australia, and this situation will persist for some years as new investment in plant and equipment is made, and an infrastructure of assured feedstock supply is developed. With this in mind we consider that the most likely applications for biodiesel use over the next five to 10 years will be in a combination of neat biodiesel (100% or B100) or in blends with diesel fuel ranging from a 20% blend (B20), and above, in diesel transport vehicles and in stationary power applications. This is the pattern that has evolved in the U.S. and Europe and there is no reason to anticipate that the trend in Australia will be different.

A minimum B20 blend and blends ranging from 30% to 40% biodiesel with diesel transport fuel is an obvious initial choice.

- Per litre of biodiesel, 5 vehicles using B20 produce greater environmental outcomes than one vehicle using B100.
- On-road use of B20 in America, and Australia have shown little to no reductions in horsepower or fuel economy. Drivers also report that it minimizes ping-pong ("diesel rattle").

Choice of Fuel Quality Standard

Our industry members clearly favour the adoption of the American **ASTM D 6751** standard as the fuel quality standard model for Australia. The reasons for this include:

- Commonality of testing protocol for both biodiesel and automotive diesel fuel (petroleum distillate). Australian Standard™ AS 3570-1998, the automotive diesel fuel standard primarily prescribes ASTM standards and test methods.
- Australian mining regulators recognise only ASTM fuels and additives as well as US EPA data. Significant opportunities exist for Biodiesel to be used as a BACT (Best Available Control Technology) for use in confined space uses such as mining, tunneling, warehousing etc.
- By its design the ASTM standard encourages further research and development by not limiting feedstocks or alcohols.
- Ability to utilise a wide variety of feedstocks.
- Testing methods are simplified.
 - *Flashpoint only, not flashpoint and residual alcohol.*
 - *Viscosity indicates ester content therefore viscosity only.*

Australian testing laboratories are familiar with ASTM D 6751 test protocols. This expedites quality analysis as well as maintaining control over compliance costs.

Both BIA and the Sidebottom Group have adopted the ASTM D 6751 standard as their production model, and this is the preferred choice of the three potential major new industry entrants we are aware of. Strong relationships have already been developed with the U.S. industry and with respected U.S. industry organisations such as the U.S. Biodiesel Board. These relationships bring with it significant intellectual property that provides advantages in dealing with issues such as;

- Cold flow
- Microbial growth
- Stability
- Storage and handling

There are no domestic diesel engine or equipment manufacturers in Australia. Surveys that we are aware of clearly indicate that the U.S. is the largest overall supplier of diesel engines in the Australian transport sector. Adoption of the U.S. standard would not disadvantage European manufacturers as the U.S. standard is widely acknowledged and recognised in Europe.

The case for a national Biodiesel standard in Australia

The biofuels industry in Australia recognises the need for appropriate Biodiesel standards to guarantee consumer confidence for a product new to the Australian fuel market, and long-term policy certainty for future industry growth.

The case for the development of a domestic biodiesel industry is beyond argument. In a recent statement, the Australian Department of Tourism Industry & Resources estimated that global oil supplies were sufficient for only 40 years and natural gas for 61 years.

The ABA believes that cleaner engines and ULSD (ultra low sulphur diesel) are important initiatives that should run in parallel with sustainable and renewable energy development in Australia..

As noted above the biofuels industry believes that fuel made to ASTM D 6751 is the most beneficial for Australia, and should be adopted as the model for an Australian Standard. The US standard as a model has the advantage that it accommodates the European specifications.

3.2 Feedstocks

The ABA does not consider that an Australian standard for biodiesel should include limitations on the types feedstocks or production technologies that might be employed by the industry. To do so would be inconsistent with world trends and normal business practice. Sustainable feedstock availability and use are commercial issues. This does not negate a cooperative approach between industry and government on maintaining environmentally sustainable practices. Imposing bureaucratic limitations of this kind could stifle rather than promote industry initiative and development in this area.

4.1 Emissions

The CSIRO/RMIT study is limited by the fact it was a desk/literature study, not a study based on actual agricultural and production data and practices followed in Australia. What is evident is that there is general acceptance of the greenhouse life-cycle benefits of biodiesel, and the exhaust emissions benefits associated with its use as a transport fuel.

A major benefit associated with the development of a domestic biodiesel industry is that future life-cycle analysis will be based on actual Australian production data, and not desktop and literature studies.

4.2 Toxicity

Both 4.1 & 4.2 make mention of particulate matter (PM). Biodiesel does reduce the percentage of PM emission. The pertinent fact is that the impact of biodiesel in reducing PM emissions have been soundly proven by the US EPA in a major Tier 1&2 Study to be much less toxic than petroleum distillate, and these results are widely accepted around the world. It is anticipated that the demand for PAH reductions will also act as a driver for future incentives to produce and use biodiesel.

4.3 Lubricity

The value of biodiesel as a source of lubricity in low sulphur diesel fuel is a good example of its flexibility as both a lubricant and a safe and reliable transport fuel. The use of a 2% biodiesel as a lubricant, should not provide cause for placing limits on biodiesel blends in diesel transport fuel. This is an issue that should be determined by supply and demand factors alone.

4.4 Biodegradability

A major advantage of all biofuels over fossil fuels is their biodegradability in soil and water. The wide acceptance of this benefit should support recommendations for biodiesel to be promoted for use in the form of B100 or blends in sensitive areas such as marine parks, forests, the mining industry, and public transport.

4.6 Energy Balance

With an energy balance of + 3.24 the ABA agrees with BIA that biodiesel will one day, not only be less expensive, but will also be the diesel fuel of informed choice.

4.8 Storage, Handling and Distribution

4.8 Recommends good housekeeping. The ABA agrees that good housekeeping practices are the single best control available. US experience has shown that biodiesel pumped into an old tank having previously stored petroleum distillate will inevitably have water and microbial growth. The tanks should be drained / pumped free of water and a biocide should be added prior to storing biodiesel or blends.

N: B care should be taken selecting additives, US experience has seen additives cause problems such as destroying seals etc, problems that were wrongly attributed to Biodiesel.

Chapter 5. Biodiesel Blends

The ABA position is that the allowable percentage of biodiesel to be blended in Australia should be consistent with the policy adopted by the US EPA, which recognises the role of biodiesel as both a fuel and a fuel additive. Such an approach would support both the use of B100 and biodiesel in the form of blends with diesel fuel.

- Initially, it is believed that B20 and B30 will be favoured as blend levels.

An approach of this kind would also be consistent with the standards and recommendations set by both American and European diesel engine and equipment manufacturers.

Chapter 6. Biodiesel Parameters

Table 6. Australian Biodiesel Standard

			Australia	USA	EU	Recommended Test Method	Reference
Specification / Standard		Units	AS 000?	ASTM D 6751	prEN 14214		
Application					FAME		
Density	15° c	Kg/m	860 - 900		860 -900	ASTM D 1298	6.24
Kinematic Viscosity	20° c	mm ² /s	-	-	-		
	40° c	mm ² /s	1.9-5.0	1.9-5.0	3.5-5.0	ASTM D 445	6.5
Distillation	95 %	°c	Ω 360	Ω 360		ASTM D 1160	6.2
Flashpoint		°c	Ω 130	Ω 120	Ω 130	STM D 93	6.25
CFPP	Summer	°c	Ω 6 /Ω 0	-	Ω 5 /Ω 0	ASTM D 4539	If Required
	Spr / Aut	°c	Ω 6 /Ω 0	-	Ω -5 /Ω -10	ASTM D 4539	If Required
	Winter	°c	Ω 6 /Ω 0	-	Ω -15 /Ω - 20	ASTM D 4539	If Required
Cloud Point		°c	-	-	-		
Total Sulphur		%Mass	Ω 0.01	Ω 0.05	Ω 0.01	ASTM D 5453	6.1
CCR	100%	%Mass	Ω 0.05	Ω 0.05		ASTM D 5430	
	10%	%Mass			Ω 0.30		

Sulphated Ash		%Mass	Ω 0.02	Ω 0.02	Ω 0.02	ASTM D 874	6.7
Ash (oxid ash)		%Mass	-	-	-	None	
Water Content		mg/kg	Ω 300	-	Ω 500		6.26
Total Contamination		mg/kg	Ω 24	-	Ω 24	ASTM D 5452	If Required
Water and Sediment		% vol	Ω 0.05	Ω 0.05	-	ASTM D 2709	6.27
Corrosion (cu)	3h @ 50°C		Ω No.3	Ω No.3	Class 1	ASTM D 130	
Cetane No.			Ω 47	Ω 47	Ω 51	ASTM D 613	6.6
Acid No.		Mg KOH/g	Ω 0.8	Ω 0.8	Ω 0.5	ASTM D 664	
Oxidation Stability	110°C	hours			Ω 6	—	
Methanol Content		%Mass			Ω 0.2	—	
			Australia	USA	EU	Test Method	Reference
Saponification No.		Mg KOH/g	-	-	-	—	
Ester Content		%Mass	-	-	Ω 96.5	—	
Triglycerides		%Mass	-	-	Ω 0.20	—	
Diglycerides		%Mass	-	-	Ω 0.20	—	
Monoglyceride		%Mass	-	-	Ω 0.80	—	
Free Glycerol		%Mass	Ω 0.02	Ω 0.02	Ω 0.02	ASTM D 6584	6.12 - 6.15
Total Glycerol		%Mass	Ω 0.24	Ω 0.24	Ω 0.25	ASTM D 6584	6.12 - 6.15
Iodine Value					Ω 120	—	
Phosphorous		mg/kg	Ω 10	Ω 10	Ω 10	ASTM D 4951	6.3
Alkaline Metals		mg/kg			Ω 5	—	6.16
Calorific Value (net)		KJ/kg	-	-	-	—	
Linolenic acid methyl ester		%Mass			Ω 12	—	
Polyunsaturated Methyl esters		%Mass			Ω 1	—	

6.1 Sulfur

The ABA supports the EU limit for Biodiesel at % Mass Ω 0.01

The ABA supports the use of the ASTM 5453 test method. The is consistent with the current Australian practice of adoption of ASTM test protocols.

6.2 Carbon Residue

The ABA supports the US standard of % Mass Ω 0.05.

The ABA supports the use of ASTM D 4530 as the appropriate test method.

6.3 Phosphorous

As the US and European standards share the same limit < 10ppm there is no need to review this limit.

The ABA considers ASTM D 4951 as the appropriate test method.

6.4 Ester Content

The ABA supports the ASTM methodology of not performing a specific test for Ester content.

6.5 Kinematic viscosity

The ABA supports the ASTM D 6751, as a major OEM (Caterpillar Machinery) set this standard.

The ABA supports the use of ASTM D 445.

6.6 Cetane

The ABA supports the ASTM @ Ω 47.

The ABA recommends ASTM D 613 as the test method.

6.7 Sulphated Ash Content

As the US and European standards share the same limit < 10ppm there is no need to review this limit.

The ABA considers ASTM D 874 as an appropriate test method.

6.8 Total contamination

The ABA supports the EU Standard where necessary.

The ABA recommends ASTM D 5452 as the test method.

6.9 Acid Value

The ABA supports the ASTM standard.

The ABA recommends ASTM D 664 as the test method.

6.10 Iodine Number

The ABA supports the ASTM in not using an Iodine No.

The ABA sees the EU Iodine No. as an unnecessary restrictive measure as the stability issues can readily be addressed by means of a commercially available additive package.

6.11 Linoleic acid methyl esters and polyunsaturated methyl esters (<4 double bonds)

6.12 The ABA supports the ASTM with regard to Linoleic acid methyl esters and polyunsaturated methyl esters (<4 double bonds)

6.12 to 6.15 Glycerin

As the US and EU standard for free glycerin are very similar, the ABA has no issue with the level set.

The ABA regards the ASTM method of testing for free & total glycerin only as the most efficient as Mon, Di & Tri glycerides will show up as total glycerin.

Therefore test method ASTM D 6584 is appropriate. The ABA is aware of a simplified test in development using enzyme technology that may replace Gas Chromatography.

6.16 Alkaline Metals

The ABA is of the opinion that the Sulphated Ash test as per the ASTM is sufficient indication of the presence of alkaline metals.

The EU and US standard for Sulphated Ash is equivalent.

6.17 Thermal Stability

Both the EU & US set no limit for Thermal Stability, Therefore the ABA sees no need for a separate Australian standard or limit.

If in future a test regime were deemed necessary the ABA would recommend ASTM D 6468 as the test method.

6.18 Oxidation Stability

The ABA regards data on Oxidation Stability as beneficial.

BIA has indicated that it intends to test using both the BSI IP 306 and the ASTM D 4625 tests.

BIA also intends to test pure Biodiesel against BIA Biodiesel with its proprietary additive package, and will provide details of test results.

The ABA recommends that Oxidation Stability not be tested on a regular basis but to simply establish a profile of behaviour patterns.

6.19 Alcohol Content

The ABA supports the ASTM methodology of not performing a specific test. Our reason is that residual alcohol will lower the flash point.

The ASTM D 93 test for flash point will identify any residual alcohol.

6.20 Cloud Point

The ABA feels a specific test for Cloud Point is not necessary.

If required ABA would recommend ASTM D 2500.

6.21 Cold Filter Plugging Point

The ABA considers the US position simple, efficient and therefore desirable. BIA has as part of its additive package a cold flow additive that will be used all year round.

The ABA consider the Caterpillar Machinery recommendation of a seasonal range of between 6°C - 0°C as reasonable for Australian conditions.

If required the ABA recommends ASTM D 4539 as the appropriate test method.

6.22 Distillation Temperature

The ABA recommends that Distillation Temperature be treated similarly to **6.18** in accumulating Data on the typical properties.

6.23 Calorific Value

Biodiesel is almost 11% oxygen. This accounts for the lower calorific value.

Conversely, oxygen makes the fuel burn more completely and thus delivers, in the form of greater engine efficiency, more of the inherent energy in diesel fuel. Due to its positive impact on fuel combustion efficiency biodiesel assists in producing lower and less toxic emissions & PM at the tailpipe. It is for these reasons that the use of theoretical calorific value as a measure is of limited value with respect to oxygenated fuels.

Research conducted by BIA on B20 has shown that in some applications B20 provides more power. B100 easily outperforms diesel in stall tests compared to other varieties of clean diesel such as Eromanga, Shell Purinox, and underground mining diesel fuel.

6.24 Density

The density for both the European and US standards are the same therefore we see no reason for an Australian standard to differ.

The ABA supports the use of ASTM D 1298 as the appropriate test method.

6.25 Flash Point

The ABA support the US specification @ 130°C.

The ABA supports the use of ASTM D93 as the appropriate test method.

NB. Point **6.19**.

6.26 Dissolved Water Content

Water is detrimental to fuel quality. If Biodiesel with a high dissolved water content is blended with petroleum distillate the biodiesel percentage will become cloudy and a threat to engine components and filters. This is readily offset by practical and well-developed good housekeeping practices followed in both the U.S. and Europe.

6.27 Free Water and Sediment Content

As EU and US standards are common the ABA have no issue with the set level.

The ABA recommends ASTM D 2709 as the test method.

6.28 Corrosion

The ABA believes the ASTM standard of No.3 max is appropriate.

The ABA recommends ASTM D 130 as the appropriate test method.

7.0 Alcohol

BIA has no experience with ethanol. The Sidebottom Group has found that methanol is the logical and most efficient alcohol for use at its Moama biodiesel plant.

Logically the choice of alcohol use should be left with individual producers, unless environmental considerations dictate otherwise.

The ABA does not support the EU in specifying alcohol use. Doing so may impose restrictions in future advancements in process or chemistry.

8.0 Technical Analysis of the Impacts of Blending Biodiesel with Petroleum Diesel

The ABA recommends that both the impending Biodiesel Standard and the existing AS 3570-1998 ADF standard be used concurrently with respect to biodiesel blends. The ABA believes that to have a separate standard for each % blend would be cumbersome and costly as issues of flash point, CFPP or density will vary depending on the % of either fuel.

In the interim BIA recommend that low blends of Biodiesel between 0 - 10 % be accommodated in **AS 3570 - 1998 ADF Section 4 part 4.1 Additives**; *chemical substances added to automotive diesel fuel, usually in small quantities to impart desirable properties to...*

The ASTM D 6751 standard is for biodiesel as a blend stock for petroleum distillate so the US standard does accommodate blends.

The ABA believe that the capacity to blend petroleum diesel with biodiesel is a benefit associated with this fuel. Major oil companies have in the past promoted limits being placed on biodiesel blends as a means of placing limits on market share for renewable fuels.

8.1.1 Ester Content

The ABA believes this paragraph to be irrelevant as under ASTM D 6751 biodiesel will be fully reacted.

8.1.2 Kinematic Viscosity

The ABA recommends that no specific limit be set if both biodiesel and petroleum diesel meet their respective standards.

8.1.3 Cetane Number

The ABA believes that in regard to Cetane Number petroleum distillate will be improved.

8.1.4 Sulphated Ash

The ABA believe that Biodiesel meeting either the US or EU standard will have no effect on a diesel engine.

8.1.5 Total Contaminants

No comment

8.1.6 Acid Value

The ABA Support the ASTM in regard to acid number.

An increase in acidity is linked to stability. The BIA has reported an additive package that will minimise this probability.

8.1.7 Iodine Number.

Refer to both 8.1.7 and 9.0

8.1.8 Linoleic Acid Methyl Ester

Refer to 8.1.6 & 9.0

8.1.9 Mono and Diglyceride Content

8.1.10 Triglyceride Content

8.1.11 Free Glycerin

Any Glycerin Mono, Di or Tri over set limits mean that the product is not fully reacted and therefore not biodiesel.

8.1.12 Alkaline Metals

No comment

8.2 Impacts on Emission

The ABA believes that the impact on petroleum diesel emissions by biodiesel blends is a positive for the environment as well as extending the life of a finite fossil resource.

The weight of the volume of trial data produced from the use of biodiesel blends is not disputed and is universally accepted as being highly beneficial.

9.0 Effect of Biodiesel on Engine Oil

Over the last decade diesel engines have reduced tail pipe emissions, a result of this has been an increased demand or load placed on engine oils.

In the mid 1990's soot was a major problem in engine oils. Engine oil development soon overcame this problem with the development of the CH4 Oils replacing the CH3.

One German specialty Oil Company Fuchs has already developed an ester-based synthetic oil **Fuchs GT1™**, This product is available in Australia. Synthetic lubricants

are manufactured to have molecular chains without variation or without weak links. These products can be modified to suit a particular demand.

Glycerol is used in specialist lubrication where oxidation stability is required such as in air compressors.

The point being that lubrication technology exists to work together with engine & fuel developments including ULSD and Euro 6 engines.

10. Vehicle Warranties and labeling

The ABA believes that the warranties provided by OEMs will stand as long as biodiesel is produced to ASTM standards, which are recognised by European standards. The development of a special Australian standards would inevitably come at a high cost as both American and European OEMs could be expected to demand extensive testing before warranties would be extended under a separate Australian standard.

The primary concerns of U.S. and European OEMs is that the standards meet those representative of reputable certified, or licensed suppliers – not a backyard industry using "Bucket Chemistry" practices. As a taker of diesel technologies Australia has no option but to adopt world best practices.

10.3 The Australian Situation

This section highlights the lack of knowledge and experience with biodiesel by Australian distributors and representatives. More work needs to be done by the biofuels industry and Government to inform the public, local dealers and representatives of the practical applications and benefits of biodiesel.

10.4 ADR compliance

This biofuels industry needs to work closely with ADR and CSIRO.

10.5 Labeling

The ABA supports the labeling of the contents of all transport fuels at the point of sale – not biodiesel only. The biofuels industry supports the labeling of biodiesel blend levels above 10%. BIA believes informed consumers make informed choices. Therefore labeling biodiesel blends would allow retailers to advertise the benefits of biodiesel, and satisfy demand for renewable and less toxic fuels.

An agreed form of labeling at the point of sale has not been determined by the ABA. BIA has proposed the following as an example for consideration.



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