

Bio-diesel Standard in Japan

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Fuels and Lubricants Committee

Japan Automobile Manufacturers Association

Outline

1. Study of Bio Diesel Fuel Specification in Japan

2. Fuel Regulation in Japan

3. Conclusions and JAMA Recommendations

Study of Bio Diesel Fuel Specification in Japan

- ✓ **Period of Study**
Oct. 2003 – Mar. 2006 (more than two years)
- ✓ **Total Budget**
about 400 million JPY
- ✓ **Research Institutes and Associations**
METI, AIST, JARI, JAMA, JPI, PAJ
- ✓ **Assumption of Study**
 - Evaluation Items** : All issues related to
Safety and Environment
 - Base Specification** : **European Spec. (EN14214)**
 - Target Concentration** : up to 5%

FAME Properties to be remarked

Estimated Trouble

➤ Damage on Fuel line parts
metal corrosion, rubber swell
etc.

➤ Pump failure sticking
adhesive material
➤ Filter plugging
→ Engine stop
by stopping fuel supply

➤ Worsen exhaust gas

➤ Hard start
at low temperature

➤ Deterioration of
after treatment system

Properties to be remarked

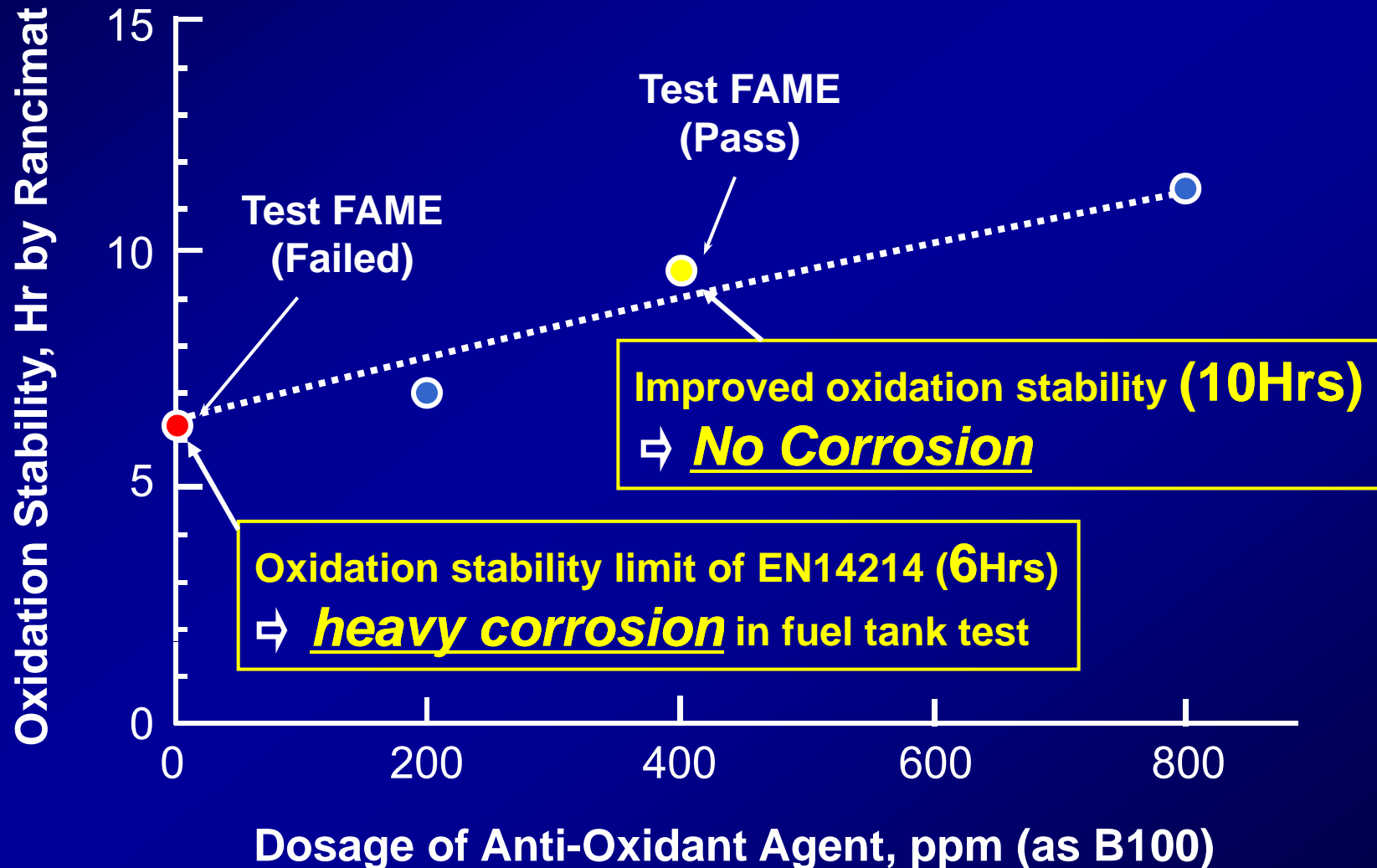
- Acid Value
- Methanol
- Oxidation Stability
- Poly unsaturated fatty acid
methyl ester content
- Ester content
- Tri-glyceride
- Mono-glyceride
- Di-glyceride
- Glycerine
- Solid foreign material
- Water
- Cold performance
- Metals
- Phosphorous

Summary of Conformity Tests

Test Items	Results	Summary
Material Compatibility		
Metals	Fail	Corrosion in Tern Sheet
Rubber & Plastics	Pass	No effects of Ester as far as less than 5v%
Cold Performance	-	Poor Startability
Long Storage Test	Pass	Slight Degradation
Fuel Line Parts Test		
Fuel Filter Test	Pass	Same as diesel fuel with B5
Fuel Tank Test	Fail	Corrosion and melting plating in lead-tin alloy coated and electrolytic zinc-coated steel sheets
Fuel Pipe Test	Pass	Same as diesel fuel with B5
Fuel Hose Test	Pass	Same as diesel fuel with B5
FIE Durability Test	Fail	Wear in Injectors with B5
Engine Durability Test		
LD, ID&DI	Pass	Observation of no trouble with B5
HD, DI	Fail	Flow loss and Wear in Injectors with B5
Vehicle Durability Test (LDV, IDI)	Pass	Observation of no trouble with B5
Emission Test	Pass	Little Impact with up to 10v%

Note) Test FAME consists of PME:RME:SME=60:38:2 and is blended in commercial diesel fuel by 5%.
 JAMA

Oxidation Stability and Fuel Tank Corrosion



Effects of Improved Oxidation Stability on Fuel Tank Corrosion

Test Fuel:

Commercial diesel fuel blended with the FAME meeting EN14214 by 5vol%

Oxy. Stab
of B100
: **6 Hrs**



Test Fuel: Same FAME as above with 400ppm of anti-oxidant (20ppm as B5)

Oxy. Stab
of B100
: **10 Hrs**



Conclusion of METI Conformity Test

- Oxidation stability requirement in EN14214, that is 6 Hrs minimum with Rancimat method, is **not** enough for preventing metal corrosion.
- When the test FAME (B100) has **10 Hrs** of oxidation stability, which was improved by anti-oxidant agent, no metal corrosion was observed.
- There were no other troubles caused by FAME. It means that other specification in EN14214 will be enough as the FAME specification for B5.

Japan's B5 Specification

Items	Level
Sulfur	10 ppm max
Cetane Index	45 min
T90	360 deg.C max
FAME content	5 mass% max
Methanol	0.01 mass% max
Triglyceride	0.01 mass% max
TAN	0.13 mgKOH/g max
Individual Organic Acid	30 ppm max
Oxi. Stability (Acid)	0.12 mgKOH/g max

FAME related Properties

Monitor for refining level of FAME.
If FAME meets JASO M360/EN14214,
B5 will meet these requirements.
Triglyceride is also a monitor for
blending crude oil and/or cooking oil.

This level of oxidation stability is
essential to prevent metal corrosion.
Even though FAME has 6 Hrs of
oxidation stability, B5 will not be able
to meet this requirement.

Specification of FAME in Japan

Items		Specification	
		Limit	Test method
Ester content	mass%	96.5 min	EN 14103
Density	g/ml	0.86 - 0.90	JIS K 2249
Kinematic Viscosity	mm ² /s	3.5 - 5.0	JIS K 2283
Flash Point	Deg.C	120 min	JIS K 2265
Sulfur	ppm	10 max	JIS K 2541-1, -2, -6 or-7
10% Carbon Residue	mass%	0.3 max	JIS K 2270
Cetane Index		51 min	JIS K 2280
Sulfated Ash	mass%	0.02 max	JIS K 2272
Water	ppm	500 max	JIS K 2275
Total contamination	ppm	24 max	EN 12662
Copper Corrosion		1 max	JIS K 2513
Acid value	mgKOH/g	0.5 max	JIS K 2501, JIS K0070
Oxidation Stability		Meet diesel fuel specification	
Iodine Number	gl/100g	120 max	JIS K 0070
Linolenic acid methyl ester	mass%	12.0 max	EN 14103
Methanol	mass%	0.20 max	JIS K 2536, EN14110
Mono glyceride	mass%	0.80 max	EN 14105
Di glyceride	mass%	0.20 max	EN 14105
Tri glyceride	mass%	0.20 max	EN 14105
Free glycerine	mass%	0.02max	EN 14105, EN14106
Total glycerine	mass%	0.25 max	EN 14105
Metals (Na + K)	ppm	5max	EN 14108, EN 14109
Metals (Ca + Mg)	ppm	5 max	prEN 14538
Phosphorus	ppm	10 max	EN 14107
Pour point	Deg.C	Meet diesel fuel specification	
CFPP	Deg.C		

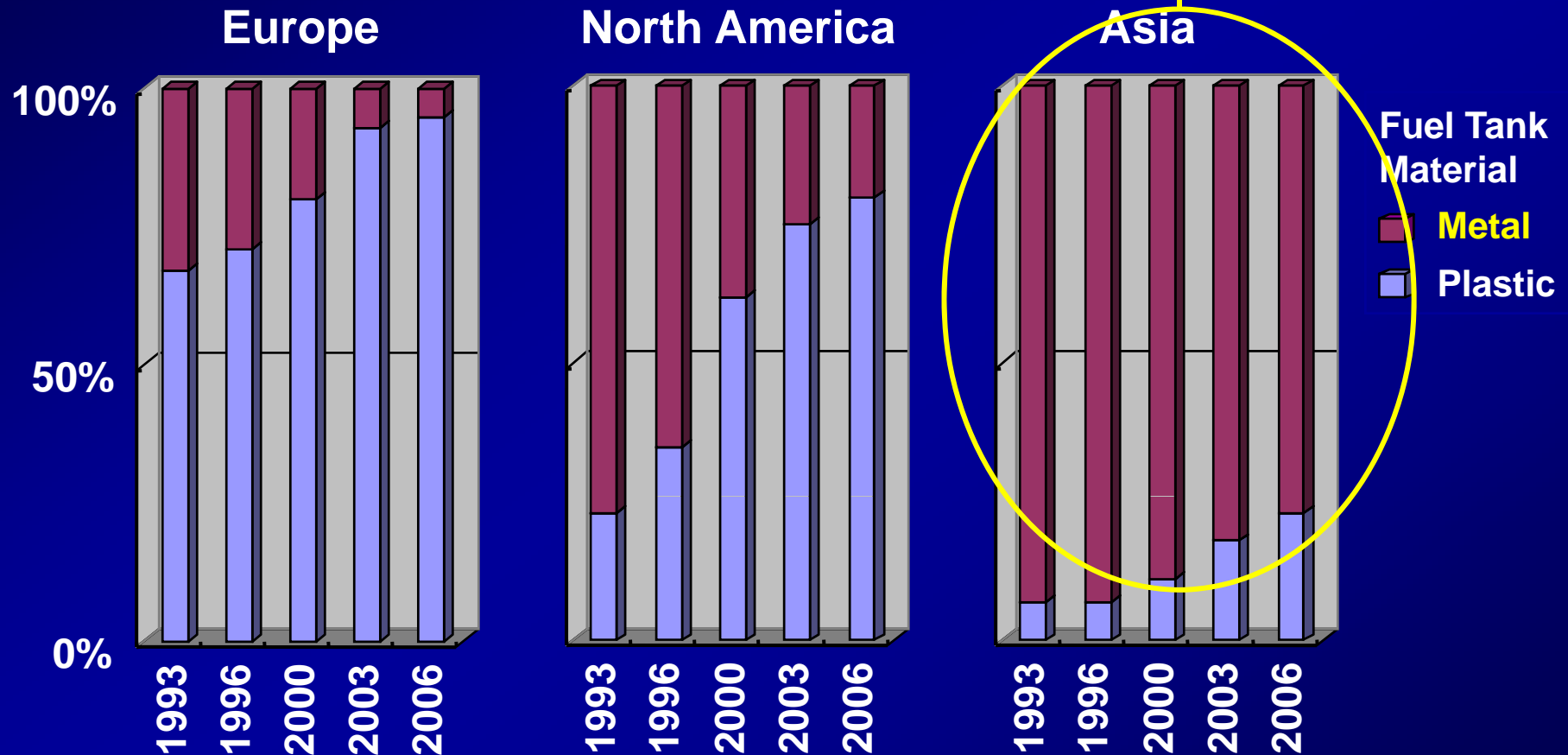
•Voluntary spec. as JASO

•Almost same as EN14214 except for oxidation stability and cold performance.

•Oxidation stability after blending is important because it is affected by base diesel fuel.

Fuel Tank Materials in Asia

About 80% is metal tank in Asia



Source: Data from Website of Plastics Fuel Systems Manufacturers Association and in-house information of a material company.

Conclusion of Bio Diesel Fuel Specification

- Specification of FAME blended diesel fuel in Japan was decided based on technical studies for more than two years testing.
- FAME is oxidized easily and absorb moisture, so that the specification of oxidation stability was added.
- If the regulation of B5 specification can be set, it would be desirable to adopt Japanese B5 specification. If not, specifications for B100 should include oxidation stability specification which is not less than 10 hr.

JAMA Recommendation (1/2)

- In Asian countries, many kind of vegetable oils and different amount of the oils are used. Fuel regulation is important for vehicle safety and consumer protection.
- JAMA strongly recommend Japanese specification to other countries.
- Japan's diesel fuel specification is for up to 5% of FAME blending. When introduction of more than 5% of FAME is discussed, both diesel fuel and B100 specification should be reviewed based on technical data.
- It will be more preferable to utilize "BTL (Biomass To Liquid)" or "Hydrogenated Vegetable Oil" as compared to the use of FAME from the technical view points.

JAMA Recommendation (2/2)

- In order to discuss bio-diesel fuel specifications in Asian countries, working group activity under ERIA* was started by the initiative of METI in Japan. It is desirable to have unified bio-diesel fuel specifications so JAMA supports this activities.

*ERIA : Economic Research Institute for ASEAN and East Asia

Thank you for your attention !