Quality of Bio-ethanol and Use of Ethanol-blended Gasoline

JAMA, Fuels & Lubricants Sub-committee

JAMA (Japan Automobile Manufacturers Association) has been, and is consistently in support of the use of bio-fuels complying with appropriate sustainability criteria as part of an integrated approach to the reduction of CO_2 emissions. Bio-ethanol, one of the bio-fuels, is renewable energy, and accordingly JAMA endorses automotive use of ethanol-blended gasoline from fossil fuel conservation and energy security points of view.

On the other hand, JAMA believes it imperative that ethanol-blended gasoline has equivalent quality to the conventional gasoline so as to achieve satisfactory safety and emission performance of vehicles. This in turn requires clear and harmonized fuel quality standards, which ensure vehicle and engine compatibility, and "fit-for-purpose" specifications for bio-ethanol and ethanol-blended gasoline. At the same time, appropriate handling rules to assure their quality control in the distribution process and quality-monitoring scheme to eliminate improperly prepared ethanol-blended gasoline from the market are also necessary.

1. Blending Ratio (Ethanol Content) and Compatibility with Vehicles

For the use of ethanol-blended gasoline as conventional gasoline for vehicles, JAMA recommends blending ratio of maximum 10% (E10). From the experiences in North America and some other regions where E10 is already introduced and used, adaptive technologies of up to 10% ethanol content have been established, and currently many of the new models are designed to be compatible with E10. However, so long as in-use vehicles that are incompatible with ethanol-blended gasoline remain in the market, it is necessary to provide all the fueling pumps with clear labeling of its ethanol content to prevent misfueling of the vehicles that are incompatible with ethanol-blended gasoline.

JAMA nevertheless cannot recommend the use of ethanol-blended gasoline of more than 10% ethanol content (ex. E20, E85) except for the vehicles specially designed or the FFVs (flexible fuel vehicles) since high ethanol content gasoline is regarded as alternative fuel. Furthermore, the fueling pumps of high ethanol content gasoline should be provided with clear labeling (indicating specific ethanol content) to prevent misfueling of regular vehicles.

2. Appropriate Specifications for Bio-ethanol and Ethanol-blended Gasoline

JAMA strongly recommends the attached quality specification for bio-ethanol to be blended with gasoline; in other words, bio-ethanol before blending must satisfy the attached ***"JAMA Recommendation on Bio-ethanol (E100) Specification for up to E10 Blends"*** to secure safety and emission performance of the vehicles. In addition, the properties of ethanol-blended gasoline as final fuel must conform to quality standard of conventional gasoline.

In this regard, the WWFC (World-wide Fuel Charter) ***"Guidelines for E100 Blendstock for use in up to E10 Blends"*** issued in March 2009 also gives a quality specification for bio-ethanol as automotive fuel, and complements the ***"World-wide Fuel Charter"***, which has been well recognized as guidelines for quality fuels. JAMA is an active formulator, and remains

a faithful supporter of the WWFC since it is all the automotive manufacturers' will to seek desirable automotive fuels. Furthermore, JAMA is confident that the WWFC ***"Guidelines for E100 Blendstock for use in up to E10 Blends"*** will contribute towards the optimization and global harmonization of respective countries' bio-ethanol specifications.

3. Points of Quality Control for Ethanol-blended Gasoline as Automotive Fuel

1) Materials compatibility

Metallic materials such as copper, brass, zinc and tin are widely used in the vehicle fuel-systems. According to the research results on compatibility of metals with poor-quality or deteriorated ethanol-blended gasoline, marked possibilities of corrosion were indicated. This is attributed to the fact that ethanol-blended gasoline has a tendency to hold more water, which is a promoter of corrosion, as compared with conventional gasoline. Similarly, rubber materials used in fuel hoses, sealing parts and so on are found to undergo degradation or deterioration of their properties, such as hardening and swelling. And this is attributed to the fact that due to the chemical affinity of ethanol as polar solvent, rubber materials used in the vehicle fuel-systems are affected more. Therefore, in order to secure materials compatibility with ethanol-blended gasoline, its quality control (with regard to pHe, acidity and water content) is extremely important and replacement of materials used in the vehicle fuel-systems with materials of proven compatibility with ethanol is essential. Taking these facts and blending ratio of ethanol in gasoline into consideration, the vehicles compatible with E10 or even high ethanol content gasoline are designed and developed.

2) Water content

As mentioned above, higher water content in ethanol-blended gasoline promotes corrosion of metals used in the vehicle fuel-systems, and phase separation of ethanol and gasoline under the cold climate conditions may also arise. Inversely, in the case that water content is very low, ethanol induces dry-corrosion of aluminum alloys. That is why control of water content is vitally important factor in every process of the production, distribution and use of ethanol-blended gasoline.

3) Vapor pressure

Ethanol-blended gasoline generates higher vapor pressure than that of pre-blending gasoline and ethanol respectively because of azeotropic phenomenon, which results in the increased evaporative emissions from the vehicles. In addition, another reason for the increased evaporative emissions is that there exists some amount of ethanol escaping through rubber hoses and so on. If ethanol-blended gasoline, such as simple splash blend of bio-ethanol and gasoline lacks control of vapor pressure, problems in re-starting engine and/or poor accelerations under the hot climate conditions may arise. Therefore it is imperative for the producers of ethanol-blended gasoline to control vapor pressure of their products within the same range of specification for conventional gasoline (cf. AAF Recommendation for Euro4; max. 60 kPa).

4. Summary (Requests from JAMA)

1) Adoption of ***"JAMA Recommendation on Bio-ethanol (E100) Specification for up to E10 Blends"*** at the time of establishing or amending bio-ethanol quality standard.
2) Control of blending ratio of bio-ethanol as "maximum 10% (E10)". This is the most critical point of use of ethanol-blended gasoline as conventional gasoline and in the case that ethanol-blended gasoline of more than 10% ethanol content is to be introduced, clear labeling of specific ethanol content at the fueling pumps is required to prevent misfueling of regular vehicles.

Note that so long as in-use vehicles that are incompatible with ethanol-blended gasoline remain in the market, conventional gasoline has to be kept supplying and clear labeling is also required even with E10 to prevent misfueling of those vehicles.

(Writer; S. Ichikawa, Overseas Affairs Taskforce, AKG Approved)

＜Attachment＞

"JAMA Recommendation on Bio-ethanol (E100) Specification for up to E10 Blends"

Properties	Limit value	Units	Test Methods
Ethanol plus C3-C5 saturated alcohols (anhydrous)	min. 99.2	% m/m	EN 15721 ASTM D5501 Others：JAAS001-6.2
C3-C5 saturated alcohols (anhydrous)	max. 2	% m/m	EN 15721
Methanol	max. 0.5	% m/m	EN 15721 ASTM D5501 Others：JAAS001-6.4
Water	max. 0.7	% m/m	EN 15489 ASTM E203 JIS K8101
Density	Report	kg/m^3	ASTM D4052
Electrical conductivity	max. 500	μs/m	ASTM D1125 JIS K0130
Inorganic chloride	max. 10.0	mg/l	EN 15484 or EN 15492 ASTM D7319, D7328
Sulfate	max. 4	mg/kg (ppm)	EN 15492 ASTM D7318, D7319, D7328
Copper	max. 0.100	mg/kg (ppm)	EN 15488 ASTM D1688 mod./ Method A JIS K0101
Organic impurities	max. 1 （max. 10）	% m/m （mg/l）	Others：JAAS001-6.4
Phosphorus	max. 0.50	mg/l	EN 15487 ASTM D3231
Sulfur	max. 10	mg/kg (ppm)	EN 15486 ASTM D5453 (< 20ppm) JIS K2541-6 or -7
Heavy metals	Not detected, No intentional addition		Others：ICP-AES
Non-volatile material	max. 5	mg/100ml	pr EN 15691 ASTM D381 Others：JAAS001-6.3
pHe pHe-like	6.5-9 6-8		ASTM D6423 EN 15490 Others：JASO M361-6.10
Acidity (as acetic acid)	max. 0.007	% m/m	EN 15491 ASTM D1613 Others：ISO 1388/2
Appearance	Clear and bright, No visible impurities		Visual inspection
Color	Local requirement		Visual inspection