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HYBRID FUELS – AN ALTERNATIVE FOR THE NEW GLOBAL EMISSIONS LEGISLATION?

Levent ALI [1]
Anastase PRUIU [2]
Beazit ALI [3]
[1] Eng, PhD attendee Military Technical Academy, Bucharest
[2] Professor, PhD. Eng., "Mircea cel Batran" Naval Academy, Constanta
[3] Professor, PhD. Eng., "Mircea cel Batran" Naval Academy, Constanta

***Abstract**: Global emission legislation is reducing allowable sulfur levels in marine fuels, SOx regulation 14 of MARPOL is stating limits for sulfur emissions, inside ECA area will be 0,1% starting 01.01.2015. One of the outcomes of this legislation is increased use of distillate fuel in marine applications. Additionally, industry analysts predict a global increase in demand of distillates across all sectors, but oil companies have developed a new grade of marine fuel.*

1. INTRODUCTION

Various major bunker fuel suppliers are offering new grade fuels to meet the new ECA regulations coming into force 01.01.2015, and there are now 8 major suppliers offering this type of fuel: LUK oil, Exxon Mobil, Gazprom, BP, Shell, Phillips 66, CEPSA Marine and Neste Oil.

	Exxon Mobil HDME 50	LUKOIL	CEPA	BP	Phillips 66
Density	908,8	886	868	845,5	855,2
Viscosity	53,9	16	8,8	8,8	8,6
Micro Carbon	0,28	0,1	0,1	0,1	0,04
Sulfur	0,08	0,07	0,05	0,03	0,06
Pour Point	6	18	-12	21	-12
Flash Point	175	165	72	70	79
Water	0,05	0,05	0,004	0,01	0
Acid Number	0,1	0,5	0,27	0,04	NA
Vanadium	3	1	NA	1	0,1
Al + Si	2	2	NA	1	2
Lubricity	264	270	410	326	NA
ECN – cetanic number	60	NA	NA	80,4	58,5

2. EXXON MOBIL HDME50 CHARACTERISTICS

This fuel is being produced by Exxon Antwerp refinery as low sulfur residual.

The fuel has a relatively high pour point and is paraffinic in nature so will require storage at between 30 and 40 deg C, depending on actual pour point. Although the fuel has a very low Al+Si, it will require treatment in purifiers and will be subject to hot filtrations at less than 60 microns. The temperature at the engine will be about 60-70 deg C.

The fuel has reasonable reserve stability, but there is a risk of incompatibility when mixed with other residual fuel, the risk is elevated by the paraffinic nature of the fuel and the potentially large difference between the density\viscosity of the two fuels.

MAN in cooperation with DNV and Exxon Mobil conducted trials for 300 hours on a B and W 7L70MCE-C slow speed propulsion engine and 2000 hours on a MAN 6L28\32H medium speed diesel generator engine. It would be interesting to see some combustion pressure curves from actual sea trials tests, since the running hours mentioned above were conducted at MAN test bench facilities and not onboard of a ships. As per latest information, Jebsens Australia and Gearbulk Shipping conducted successfully sea tests using this grade of marine fuel. These tests reveals no issues or operational concerns, but some concerns regarding fuel supplying systems and fuel storage.

Below there are ignition and combustion results of HDME50 fuel:

Ignition Delay	3,23 ms
Main Combustion Delay	3,52 ms
End of Main Combustion	9,37 ms
End of Combustion	13,31 ms
Pre Combustion Period	0,21 ms
Main Combustion Period	5,85 ms
After Burning Period	3,94 ms
Maximum Rate of Heat Release	3,35 Bar\ms
Position of Maximum Rate of Heat Release	3,74 ms
Accumulated Rate of Heat Release	7,38 ms
Maximum Pressure Increase	7,52 bar

At present, due to different composition is relatively difficult to compare HMDE50 against another existing fuel. For example Cetane Index is not an applicable measure of its ignition qualities and CCAI is used instead.(Calculated Carbon Aromaticity Index). Likewise the product is not clear and bright but opaque green\brown in color. The coloration is not caused due to presence of any residual product, but rather is due to refining and processing.

3. EXXON MOBILHDME50 OPERATIONAL CONCERNS MAN AND WARTILLA RECOMMENDATIONS

3.1 Pour point – This fuel has a high pour point which gives operational concerns during cold waters. The problem with the pour point is storage in the tanks. If these tanks are hull tanks and if sea temperature goes down, which is very likely, below the pour point, wax crystals will form and ultimately leading to complete tank freezing up, therefore the tank heating has to be efficient. If wax crystals will form, heating it back to the pout point will not be enough, and it has to be heated to at least 10 or 15 deg C more for wax to re-melt.

3.2 Compatibility with existing fuels – New type of fuel being paraffinic, it may be intolerable to blending with existing fuels. Laboratory tests showed that mixing with more than 2% of an existing fuel may result in instability of the HDME50.

3.3 Long term storage – It is safe to assume that any storage in excess of 6 months will require additional tests for bacterial, fungal growth or any other deterioration, since any presence of the water is the breeding ground bacteria.

3.4 Cylinder lubrication – oil suppliers developed new type of lubricating oils to use with 0,1% low sulfur fuel. Exxon Mobil(Mobilgard 525 CLO), Chevron(Taro Special HT LF), Shell(Alexia S3) and Total(Talusia LS 25) have introduced new lubes recently. All these lubes have a low Total Base Number(TBN) 25, comparing with regular lubes(TBN40-100), and are engineered to address engine issues such as deposits formations and scuffing.

3.5 Viscosity–a low viscosity fuel oil challenge the function of fuel pumps in three ways: breakdown of hydraulic oil film, insufficient injection pressure(resulting in difficulties at start and low load operation), insufficient fuel index margin resulting in limitation in acceleration. However many factors influence the viscosity during start and low load operation:

- engine condition and maintenance
- fuel pump wear
- engine adjustment
- actual fuel temperature in the system
- human factors

To be able to maintain the required viscosity of the engine inlet, MAN recommends installation of a cooler and chiller in the fuel system.

3.6 External pumps – Not only the engine fuel pumps will be influenced by the change of fuel type, but also external pumps such as supply pumps, circulating pumps, transfer pumps, and feed pumps. It is recommended to contact pump maker for advice.

3.7 Fuel change over – procedures should be clearly established and communicated to ship's staff.

4. CONCLUSIONS

Frequently Asked Questions

Q1: How this fuel is classified in ISO8217?

A: This fuel has not yet received a special classification in ISO 8217.

Q2: Can this fuel be used in boilers?

A: The answer is yes, having in mind that higher flash point of the hybrid fuel compared to conventional fuels, may lead to furnace explosions. Like the fuel systems for main engine, boiler fuel supply system must be modified to avoid risk of explosions.

Q3: Is this fuel acidic?

A: HMDE50 has a low acidic value, but it is not known if after long storage the acidity will increase.

Q4: Can HMDE50 be affected by esterification?

A: Since this fuel is a straight refinery product, esterification problems should not occur, unless is contaminated with Fatty Acid Methyl Ester.
(FAME).

Q5: Can this fuel degrade if used in high pressure engines such as common rail engines?

A: This fuel was not tested in common rail engines. No data available.

Q6: How to store HDME50?

A: HDME 50 must be stored in heated tanks. Should not be stored in MGO tanks, which usually don't have heating arrangements, but tanks used for low sulfur in ECA areas can be used. LSFO tanks must be cleaned before using for HDME 50, Exxon Mobil says it can have a detergent effect which can dislodge sediments and cause operational issues.

Q7: What is the price of HDME50?

A: Exxon says it will be with 50USD less than MGO, which makes it around 500 USD.

5. REFERENCES

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