ADERCO
SMART SOLUTIONS

IMPACT REPORT
MARINE

FUEL STABILITY
CASE STUDY ON VLSFO

TEC_IR_STAB_16092020V1

BACKGROUND

Fuel stability is an important parameter when considering the use of Very Low Sulphur Fuel Oil 0.5% S – VLSFO.

Fuel stability is defined as - the **ability of a fuel to retain asphaltenes in solution**, it is known as the fuel's "Stability Reserve". A fuel oil with a high Stability Reserve can quickly "break down" and asphaltene (heavy polycyclic aromatics compounds) will form sludge or "sediments". A quick or slow build-up of sediments will be detrimental to the vessel operation.

The measurement of such sediment potential for Marine fuel oils is done according to standard ISO 10307. The test method ISO 8217 for Marine fuel oils include **ISO 10307-2 procedure A** for **Total sediment Potential – TSP**.

This breakdown is dependent of the nature of the fuel. If the fuel is higher in aromatic compounds, in which hydrocarbons are in a ring formation, the asphaltenes will tend to remain in suspension. If the fuel is higher in paraffinic compounds, they may coalesce into sludge.

VLSFO's blend components can vary wildly and the viscosity range noted so far is important.

We had many cases of unstable fuels in 2020 with various blends of VSLFO. Most of these unstable fuels were categorized as having low viscosity, usually under 60 centistokes at 50°C. They tend to have higher Total Sediment Potential, but this variable can be affected by many other contaminants as well.

CASE STUDIES – VLSFO WITH ADERCO 2055G

CASE 1 – REAL LIFE CASE.

One of our clients bunkered a fuel in Houston, USA in March and the fuel was within the ISO 8217 specifications. Upon further testing, it was noted that stability reserve was at doubt.

The Annex 4 test was based on ASTM D4740 cleanliness and compatibility of residual fuel by spot test.

Annex 4 - Stability

S.No.	Test (units)	Results	Normal range* (spec limit)	Remarks	On spec?
14	Stability	3	1.2	Caution	Not specified

The fuel was tested for chemical contamination as these deleterious materials may cause a fuel to become unstable. The GCMS test was NORMAL, allowing us to rule out chemical contamination as the cause of instability.

S.No.	Test (units)	Results	Normal range* (spec limit)	Remarks	On spec?
4	Total Acid Number (mgKOH/g)	0.19	Up to 0.50 (2.5 mg KOH/g max)	Normal	Yes
5	pH	7.3	Around 7.8	Normal	Not specified
6	GCMS screening	No significant contaminants found		Normal	Not specified
7	Toluene Insoluble (mg)	0.3	< 7mg	Normal	Not specified

However, in the breakdown of the GCMS test, Naphthalene was present in the fuel. Naphthalene usually indicate presence of shale oil components in the fuel blend. Naphthalene is a polycyclic aromatic hydrocarbon and with the VLSFO being higher in paraffinic factions, presence of a PAH such as Naphthalene could lead to instability in the fuel.

Test name: GCMS Screening

S No	Compound	Observation	Levels
1	1,2-Dichloroethane	Absent	BD*
2	1-Butanol	Absent	BD*
3	Tetrachloroethylene	Absent	BD*
4	Styrene	Absent	BD*
5	Alpha-pinene	Absent	BD*
6	Phenol	Absent	BD*
7	DCPD	Absent	BD*
8	Indene	Absent	BD*
9	Naphtalene	Present	Present

BD* - Below Detection

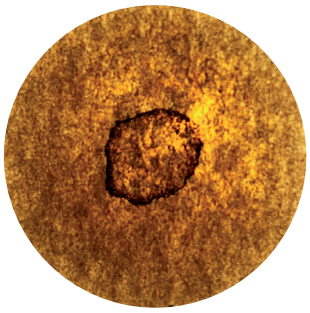
The vessel was advised by Aderco to start our Bad Fuel Procedure with a special dosage of Aderco 2055G to treat the fuel and protect the purification system from excessive sludge that could be caused by the heating of this fuel. Upon implementation of this procedure, vessel managed to successfully consume the entire fuel batch without any problems.

CASE 2- LABORATORY TESTING.

As stability is a major concern with VLSFO fuel blends, Aderco has performed in-house stability test as well as test with independent accredited laboratory.

An unstable fuel with low viscosity was used for the test to reflect our understanding of the viscosity/stability relationship.

In our spot test, the fuel clearly showed instability with a clear visible ring in the center of the chromatography paper.



Fuel 1B

We performed a TSP/TSA/TSE analysis on this fuel in an independent fuel laboratory and all three parameters were above the ISO 8217 specifications.

EZ601	Total Sediment, Accelerated (No Dose)	%(m/m)	0.27	ISO 10307-2:2009
-..	Total Sediment, Accelerated (Dose 2055G)	%(m/m)	0.12	ISO 10307-2:2009
EZ605	Total Sediment, Existent (No Dose)	%(m/m)	0.21	ISO 10307-1:2009
-.-	Total Sediment, Existent (Dose 2055G)	%(m/m)	0.10	ISO 10307-1:2009
EZ603	Total Sediment, Potential (No Dose)	%(m/m)	0.41	ISO 10307-2:2009
..	Total Sediment, Potential (Dose 2055G)	%(m/m)	0.03	ISO 10307-2:2009

Tests have been realized on the same batch of fuel for comparison. The first sample has not been treated and the second one has been treated with Aderco 2055G.

Tests were conducted on the standard TSP procedure but also the other variants TSA (Total Sediment Accelerated - ISO 10307-2 procedure B) and TSE (Total Sediment Existent – ISO 10307-1).

The results were clear, and all three parameters showed drastic decrease, especially TSP, which is an ISO 8217 parameter. The fuel oil sample which was clearly out of specification at **0.41%(m/m)** sediments was brought down way below the max limit of 0.1%(m/m) to precisely **0.03%(m/m).**

This achievement clearly demonstrated that Aderco 2055G can lower the TSP, which measures the potential of sludge precipitation.

However, it must be noted that this repeatability of this results is based on the type of fuel blend used and in cases of instability caused by chemical contamination, the results may not reflect the same rate of decrease in TSP, as the chemicals react very differently with the fuel and cannot be fully removed.

CONCLUSION

The use of ADERCO 2055G as shown in these 2 cases clearly demonstrates a drastic fuel stability improvement – significant improvements of TSP/TSA/TSE parameters.

The results will always be linked to the composition of the VLSFO and some cases could not give identical re-sults.

Treating the fuel on continuous base can definitely be an insurance to avoid excessive sludging issues and al-lowing burning VLSFO's with TSP close to the limit or even off-specs ones.