【欧州】【海事】

Maritime Issues - Internal regulation on gas emissions: The VLSFO blends' black carbon problem

Andrea Antolini Former Researcher JTTRI

【概要：Summary】

The new global sulphur limit of 0.50% m/m (mass by mass) was implemented for the shipping industry on 1 January 2020 and is expected to significantly reduce the amount of SOx emitted from ships. Considering the various options to comply with the new limit, the shipping industry is also using very low sulphur fuel oil (VLSFO), which has a maximum sulphur content of 0.50% as the new number one bunkering choice. The switching to VLSFO seems to be the most practicable solution, as no further retrofitting or change of propulsion system was necessary in order to meet the new low sulphur limit standard. The VLSFO utilisation seems only to pose a challenge due to the rising costs, as the price of this fuel is increasing. However recently, there have emerged concerns regarding the VLSFO, due to the higher emissions of black carbon, compared to the high sulphur fuel oil (HSFO).

In a project, funded by the German Environment Agency, the new IMO 2020-compliant 0.50% sulphur fuel blends were tested and found to contain higher aromatic compound levels, which can directly lead to an increase of black carbon (BC) emissions. As indicated in the submission, the emphasis of the measurement campaign was to analyse the BC emissions of hybrid fuels with 0.50% sulphur content from different sources and different production processes, in comparison to two conventional fuels, heavy fuel oil and Distillate Marine Fuel (DMA), and a possible future synthetic Gas to Liquid (GtL) fuel, at varying engine ratings. The detailed Finnish/German submission to the International Maritime Organisation (IMO) shows that new VLSFO blends with 0.5% sulphur content can contain a large percentage of aromatic compounds, which results in an increase of BC emissions in a range of 10% to 85% compared to HFO. Therefore, the Finnish/German submission urges that aromatic content be included in the specification of marine fuels of the ISO 8217 petroleum standard. It would enable a better assessment of bunker fuels also regarding their BC emissions and could also help to decide whether a fuel is suited for the use in the Artic.

Already in 2015, scientists regretted the ban of HSFO, as high SOx and NOx have a positive cooling effect. They called for a hybrid system of using HSFO at high seas, where the SOx emissions would not harm the environment but they would help cooling, and to use the low sulphur marine fuels near coasts and in ECAs to improve air quality.

In a reaction on the Finnish/German submission to the IMO, refiners and the shipping industry have rejected the study result, that the VLSFOs have a negative impact by increasing BC emissions. The industry criticised the study assumptions against the VLSFO for being flawed.

【記事：Article】

1. Propulsion and fuel options under the new global sulphur limit

The International Maritime Organisation (IMO)'s new regulation limits the sulphur content of bunker fuel to 0.50% m/m since 1 January 2020. Nations and parties who are signatories of the MARPOL Annex VI currently include 95 parties, with 96.71% of the world merchant shipping fleet. They have to comply with the new 0.5% m/m sulphur limit for ships operating outside designated ECAs. The expected significant reduction of SOx emissions from ships should have major health and environmental benefits, particularly for populations living close to ports and coasts.

In order to comply with the new sulphur limit rule, the international shipping industry can mainly choose between the use of exhaust gas cleaning system (EGCS), e.g. scrubbers and continue to use high-sulphur fuel oil (HSFO), or they opt for a switch to using LNG-powered vessels or they retrofit the existing ships with LNG power systems. Other options like electric and alternative fuel-ready propulsion systems are still in the early adaptation phase in maritime transport.

However, the global shipping fleet's majority seems to have switched to the utilisation of the more expensive very low-sulphur fuel oil (VLSFO), in order to comply with the new global sulphur limit. VLSFO is defined as fuel oil with a maximum sulphur content of 0.50% m/m. Currently, two thirds of shippers are bunkering their ships with this more expensive low sulphur fuel oil, whereas only 13% considered to retro-fit scrubbers to their ships. Only 8% considered LNG as an option. However, over time these figures could still change, and the number of ships with EGCS installed is expected to exceed 4,000 during 2020.

Regarding the new fuel types and recipes, the refineries change their production accordingly. The main challenges are related to the proper supply of compliant fuels with lower sulphur contents, law enforcement and control in port states. The VLSFO was already available in various locations across Asia, Middle East, Africa and the Americas since mid-October 2019 and the most desirable solution seemed to be the switching to very low-sulphur fuel oil (VLSFO). VLSFO-type fuels are also preferred over other compliant fuels, due to viscosity and other factors, like technical issues, related to running on distillate fuel as opposed to heavy fuels. However, now a new problem is emerging regarding the utilisation of VLSFO, due to the possible increase of black carbon emissions.

2. Black Carbon emissions

Since the discussion of introducing a new global limit of sulphur contents in marine fuels started, the low sulphur fuel oil's negative characteristics were considered. One of the negative characteristics of VLSFO, compared to high sulphur fuels, is related to a possible increase of Black Carbon (BC) emissions. BC particulates are mainly a result of the incomplete combustion of fossil fuels, biofuels, and biomass and have emerged as a major contributor to global warming and climate change. In contrast to CO2, which has a long atmospheric lifetime, BC remains in the atmosphere for only a few weeks so cutting its emissions would immediately have an effect. However, BC particles strongly absorb sunlight and cause the quicker melting of ice in the arctic region. Global shipping emits about 2% of total global BC and since more northern shipping routes open up, it leads to an increase of BC emissions in the Arctic region, which could lead to an accelerated melting of sea ice.

The IMO had been asked to consider adopting a neutral definition of BC. In 2015, the PPR Sub-committee agreed that the Bond et al. definition of BC should be recommended for approval to the MEPC68 in May 2015, stating that Bond et al. definition was "widely supported by the scientific community." However, the PPR Sub-committee was not able to select a single measurement method. Some delegations at the MEPC74 stated that the recommended BC measurement methods needed further work and that the

impact of the 0.50% global sulphur limit needed to be taken into account. The problem of BC has also been discussed in relation to the "International Code for Ships Operating in Polar Waters", the Polar Code, which entered into force on 1 January 2017. However, the Polar Code does not address the emissions of BC, and the most recent new study results regarding the utilisation of VLSFO has increased the pressure to deal with the BC problem.

3. The problem of VLSFO blends' higher black carbon emissions

Also before this recent discussion on the disadvantages of fuels with low sulphur contents, there were some scientists voicing their support for a hybrid utilisation of low and high sulphur content fuels in maritime transport. In 2015, the Senior Research Engineer of the Norwegian Marine Technology Research Institute (MARINTEK) Haakon Lindstad had already pointed out the warming effects of a global sulphur limit on the GHG emission situation. He criticised that the global 0.5% sulphur limit would be changing shipping's contribution from cooling into contributing to warming. Lindstad supported to continue the use of HSFO on the high seas for it cooling effects, while fuels with low sulphur limits should be applied in emission control areas (ECAs) near to shore to improve air quality.

According to Lindstad and the final results of the study on "Maritime shipping and emissions: A three-layered, damage-based approach" of October 2015, considering the 20- and 100-year horizons, the reduction of SOx and NOx emissions through IMO legislation would have a negative effect of increasing global warming rather than having a cooling or neutral effect. The positive effect of higher sulphur on the high seas has been eliminated by the introduction of the global 0.5% sulphur limit.

Meanwhile, a submission made by Finland and Germany to the IMO's Pollution Prevention and Response (PPR) sub-committee includes findings, indicating that the new IMO 2020-compliant 0.50% sulphur fuel blends VLSFO contain high aromatic compound levels, which can directly lead to an increase of BC emissions.

The Document MEPC 74/10/8 (Finland et al.) suggested that there is an impact of the fuel oil quality on Black Carbon emissions. The detailed submission was funded by the German Environment Agency and assisted by class society DNL GL and engine producer MAN ES. The BC measurement campaign was carried out with two of the three identified appropriate BC measurement methods (FSN and PAS) to analyse the impact of different fuel oil qualities on BC emissions. The measurement campaign was conducted by WTZ Roßlau and was assisted by MAN ES, DNV GL and Marena Ltd..

The measurement campaign's emphasis was to analyse the BC emissions of hybrid fuels with 0.50% sulphur content from different sources and different production processes, in comparison to two conventional fuels, HFO and DMA, as reference (Ref.), and a possible future synthetic Gas to Liquid (GtL) fuel. None of 0.50% fuels showed any reduction in BC emissions compared to HFO, but there was a reduction in the BC emissions of conventional DMA grade distillate and particularly the GtL fuel. The highest BC emissions were said to be detected at 75% and 25% engine load. The new hybrid fuels with 0.5% sulphur content used in the study contained a high proportion of aromatic compounds in a range of 70% to 95%, which resulted in increased BC emissions in a range of 10% to 85% compared to HFO and in a range of 67% to 145% compared to DMA. The combustion of fuels with higher aromatic content emits higher concentrations of BC.

Regarding the differences in BC emissions between the fuels with the following order (in brackets: aromatic compounds): GtL (0%) < DMA (20%) < HFO (50%) < 0.50% sulphur (70%) < 0.50% sulphur (80%) < 0.50% sulphur (95%). This leads to the assumption that the concentration of aromatic compounds might have an impact on the BC emissions of the various fuels. There is a clear trend for increasing BC emissions with increasing aromatic content in the fuels. The study concludes that: "It is necessary to implement aromatic content, or H/C ratio, in the specification of marine fuels of the ISO 8217

petroleum standard. This would enable a better qualification of marine fuels with respect to their environmental performance in terms of BC emissions and benefit their characterisation for ignition and combustion quality." Therefore, the study suggests that it is necessary to include aromatic content in the ISO 8217 specification to enable a better assessment of bunker fuels regarding their environmental performance and their BC emissions. Accordingly, and based on the study results submitted, Finland and Germany invited the PPR Sub-Committee to take note of the information contained in the submission and to take action as appropriate at its next meeting from 17 to 21 February 2020.

4. Reaction on the study results

The study submitted by Germany and Finland to the IMO has pointed out the negative impact that VLSFO blends could have due to their high aromatic contents. However, meanwhile, the refining and shipping industry have rejected the assumptions regarding the higher black carbon emissions caused by VLSFO. The industry rejects the study results that VLSFO blends would lead to higher BC emissions than high sulphur fuel oils. While environmental NGOs have called on the IMO to ban the VLSFO blends in question from the use in the Arctic region, refiners, bunker suppliers, classification societies and others question the scientific basis of the study. The IMO's Pollution Prevention and Response Sub-Committee should consider all of the submissions relating to the issue of black carbon emissions and the use of heavy fuel oil in the Arctic. According to the IMO, the PPR Sub-Committee will have the opportunity to discuss the submission made by Finland and Germany and report back to the Marine Environment Protection Committee (MEPC), which will have its next meeting at the end of March 2020.

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