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Maritime sector has always been influencing the global economy. Shipping facilitates the bulk transportation of raw material, oil and gas products, food and manufactured goods across international borders. Shipping is truly global in nature and it can easily be said that without shipping, the intercontinental trade of commodities would come to a standstill.

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STUDENTS SECTION

IMO SULPHUR 2020 CAP SOLUTIONS

Shivansh Tejashwi

Abstract

High Sulphur content in fuel oils is harmful to the marine ecosystem as crude oil containing sulphur when used for combustion, causes emission of sulphur oxides (SO\textsubscript{x}) along with other harmful substances which if inhaled, cause critical damage to human respiratory system as well as are also acidic in aqueous medium which is enough to hinder aquatic ecosystem in several obscure ways, one of the noted concerns being emission of ozone depleting substances (ODS).

Regarding this, International Maritime Organization (IMO) in October 2016 ruled out that sulphur emissions (permissible limit) are to be reduced from 3.5\% (m/m) to 0.5\% (m/m) by 1\textsuperscript{st} January 2020. The solutions suggested by IMO in accordance with the complex and ever-changing dynamics of the maritime sector are mentioned below.

I. Use of Very Low Sulphur Fuel Oil (VLSFO)
II. Use of Scrubbers
III. Use of Liquefied Natural Gas (LNG)
IV. Use of Marine Gas Oil (MGO)

This paper will further deal with the issues faced along the course of implementation of the respective regulation, such as initial setup cost, maintenance and repair, hiked fuel cost, availability and accessibility of quality resource and skill, dynamics of market and practical feasibility to name a few along with suggestive solutions and modifications.

Key words: Sulphur, Emissions, Sulphur 2020 Cap, VLSFO, MGO, Scrubbers, LNG, Synthetic Oil

1. SULPHUR IN FUEL:

Sulphur is a basic chemical component which naturally occurs in crude oil. HFO (Heavy Fuel Oil) is a heavy viscosity residual fuel oil having a tar like appearance extracted from the crude oil which is used as a prime fuel for ships because of its low cost. Basic composition of HFO includes 85\% Carbon, 11\% Hydrogen and 4\% Sulphur.

2. NECESSITY OF SULPHUR IN FUEL:

Sulphur in HFO provides lubricity for high pressure components such as injectors and fuel pumps. It also prevents severe wear and tear in “old seals” and lengthens the working life of pumps which may otherwise give in to critical damage and even breakdown. Reduced Sulphur content results in the reduction of aromatic compounds which can result in failure of some seals.
3. HARMFUL EFFECTS OF SULPHUR:

The high Sulphur content in fuel oil is harmful to marine environment, as when used for combustion it causes emission of high amounts of Sulphur oxides (Sox) which are harmful if directly inhaled leading to critical damage to respiratory system and also mix with water vapors to produce Sulphuric acid. Causing several hindrances to aquatic ecosystem in many obscure ways, one to be noted is aiding the depletion of ozone layer.

4. SULPHUR CAP 2020:

IMO’s Marine Environment Protection Committee (MEPC 70), in October 2016, decided that the global cap on the Sulphur content of fuel oil will be reduced from 3.5 percent to 0.5 percent m/m from 1 January 2020. The decision by MEPC in October 2016 to affirm the effective date of 1 January 2020 (more than three years before entry into effect of the 0.50% limit) is intended, in part, to provide sufficient time for Member States and industry to prepare for the new requirement.

5. GUIDANCE FOR COMPLIANCE WITH IMO SULPHUR 2020 CAP:

The new global limit for Sulphur that is 0.5 percent m/m is achievable in one of two ways: by burning fuel that has a Sulphur level that complies with the 0.5% m/m cap or by installing approved emission abatement technology – commonly referred to as scrubbers on board. Although the options suggested by IMO are efficient at cutting down SOX emissions to according to the regulations, they are still not peerless.

6. ENCOUNTERED PROBLEMS:

6.1. LNG

   a. methane slip
   b. low energy density (up to 75% more storage volume)
   c. handling and storage (up to $6-8 million for retrofitting)
   d. Low availability
   e. unstable long-term pricing
f. Increased CO emissions

6.2. MGO

a. Incompatible with existing engines for long term basis
b. low lubricity
c. low viscosity
d. higher pricing
e. low availability

6.3. VLSFO

a. High manufacturing cost ($450 per tonne)
b. specialized engine required (up to $3-4 million of retrofitting costs)
c. low viscosity (2.25 times more storage volume)
d. low availability (65% more expensive than MGO)
e. faster degradation in marine environment

6.4. Scrubbers

a. Heavy maintenance routines (can add up to 6-8% in fuel bill)
b. Handling of wash water
c. More space required
d. High installation cost (up to $3-9 million)

7. PROPOSED SOLUTIONS TO THE MENTIONED PROBLEMS:

- Low temperature operation: While dealing with VLSFO/ULSFO, which are less dense compared to HFO, engines can be made to run at a comparatively lower temperature than normal operating temperature as to deal with the density changes without altering the engine. It also lowers the thermal stress on the engine components, increasing its durability.
The suggested cooling is to be achieved by a dual network of seawater cooling and ammonia cooling networks. On top of being cost effective, the choice of coolants is easily available.

- **Selective separation of Sulphur:** The main reason of VLSFO/ULSFO being costly is the manufacturing process. Desulphurization processes are very costly, hence the increase in price of finished product. Selective adsorbents such as activated carbon and zeolite 13X can be used to separate out Sulphur from oil, reducing the overall cost of the finished product.

- **Use of catalytic bundles:** Catalytic bundles similar in construction to catalytic tubes being used in automobiles can be used in ships in the place of scrubbers. Usage of ammonia-based catalytic bundles is suggested rather than using platinum-based catalytic tubes which are relatively costly. Ammonia-based catalytic bundles are easily producible, cost effective and also occupy less space in comparison to scrubbers which require a water storage, wastewater storage and pumps to handle the water flow, along with rigorous maintenance routines.

- **Use of synthetic oil:** Synthetic oil can be produced onboard ships from CO₂ in flue gases through Fischer-Tropsch process and reused in the engine without any alterations. These synthetic fuels contain trace amounts of Sulphur and Nitrogen and, in theory, are carbon neutral. This negates the need for VLSFO/ULSFO and scrubber arrangements as the limit of SOX is m/m, i.e. it is based on the total mass of flue gases produced.

**8. CONCLUSION:**

Based on the above report, it can be concluded that the narrowed down limit of SOX emissions defined by the provisions ruled out by IMO Sulphur 2020 Cap have led to a contrasted change in the supply and demand levels of various fuels, along with opening up new opportunities for research, which will further lead to the creation of an even more cost effective and eco-friendly fuel in the near future.
REFERENCES:

Index of MEPC Resolutions and Guidelines related to MARPOL Annex VI


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