

Analysis of Marine Exhaust Pollutant Emission Standard Research

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Abstract: Now, marine exhaust pollutant has occupied an important proportion in the atmospheric pollution. In the inland and offshore port, nitrogen oxides, sulfur oxides and particulate matter pollutants have become the main source of city air pollution. From the aspects of laws and regulations, standards and technical specifications, the paper expounds current situation and necessity of ship exhaust pollutant emission standard research. It gives three ways to do some research that conclude establishing ship exhaust pollutant emission standard system, formulating emission inventory and detailing emission standard. Finally the shore power and some other new technologies are proposed to promote the development of research.

Introduction

In recent years, the pollution of marine exhaust has occupied 10% of the whole atmospheric pollution^[1], which has become one important source of atmospheric pollution. According to International Maritime Organization, a medium to large container marine uses bunker fuel with 3.5% sulfur content, and travels in 70% of the maximum power. Its PM_{2.5} emissions a day is equivalent to emissions of 500000 phase IV standards trucks on the same day^[2].

In 2012, according to Hong Kong's environmental protection agency (epa) data, the marine was the largest emission source of particulate matter, nitrous oxides and sulfur dioxide, which accounted for 37%, 32% and 32% respectively in the city's total emissions^[3]. According to National Bureau of Statistics, there are about 180000 registered marine in China. Most ships are inland river ships and located in the Yangtze River, Pearl River and the Beijing-Hangzhou Canal. The ships exhaust will be transported hundreds of kilometers to inland by the solar wind. Therefore, even if the ocean carrier exhaust emission occurs mainly in the sea, it will also have an influence on the air quality, human health and ecological environment of inland and offshore port area^[4].

To prevent atmospheric pollution including SO₂ from ship, the Marine Environment Protection Committee (MEPC) of the IMO approved a recommendation for new MARPOL (International Convention for the Prevention of Pollution from Marine) Annex VI, which demands all the ships in the SO Emission Control Area must use low sulfur oil of sulfur content less than 0.1% m/m since January 1, 2015, or ensure that the total emission of ship sulfide is not more than 0.4 g/kWh by using authorized exhaust treatment system and other technologies, and after January 1, 2020, the worldwide marine have to use low sulfur oil of sulfur content less than 0.5% m/m or ensure that the total emission of marine sulfide is not more than 2.0 g/kWh by using authorized exhaust treatment system and other technologies^[5]. However, the MARPOL Annex VI did not explicitly pointed out the index of SO₂ and other sulfur oxide. Therefore, to formulate marine exhaust pollutant emission standards is a problem to be solved.

Research status of marine exhaust pollutant emission standards

Laws and regulations. Up to now, Ministry of Transport has awarded a series of policies and regulations about marine emission pollution, including Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution, Regulation on the Prevention and Control of Vessel-induced Pollution to the Marine Environment, Legal Rules of Inspection Technology of Home Trade Vessel (2011) and Legal Rules of Inspection Technology of Inland Craft. The thirty-second plank of Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution points it out that pollutant emission of motor vehicle and ships shall not exceed the prescribed emission standards ^[6].

The tenth plank of Regulation on the Prevention and Control of Vessel-induced Pollution to the Marine Environment prescribes ship shall obtain and carry the certificates and documents of the prevention and control of marine environmental pollution in accordance with the law, administration regulation, the government rules and other international agreements ^[7]. Legal Rules of Inspection Technology of Home Trade Vessel gives the emissions requirements about nitrogen oxides and sulfur oxide. Legal Rules of Inspection Technology of Inland Craft limits the sulfur content of oil to less than 4.5%. Being compared with the MARPOL Annex VI, the emission control about nitrogen oxides and sulfur oxide of laws and regulations have a lower rank ^[8].

Technical standards. In recent years, the Ministry of Environmental Protection and the Ministry of Transport have published a number of standards or technical specifications relating to marine emission pollution.

In 1983, Environmental Protection Department (formerly as the Ministry of Urban and Rural Construction and Environmental Protection) published national standard GB 3552-83 Effluent Standard for Pollutants from Ship and made a provision for the discharge of oily sewage, domestic sewage and garbage discharged from the ship, because of which has been used for a long time and could not be applied to the current industry development.

In 1984, the Ministry of Environmental Protection published the national standard GB 4286-84 Emission Standards for Pollutants from Shipbuilding Industry. The standard made provision for emission value limit of organic solvent and steel furnace soot volume from the exhaust gas of shipbuilding industry, but not emission value limit of gas including in marine emission pollution. The Ministry of Transport published the transportation industry standard JT/T827-2012 Limits and Verification methods of CO₂ Emission for Commercial Ships. It gave the specific rules of verification method, calculation formula and determination method about CO₂ emission index in 2012. Last year, the Ministry of Environmental Protection put forward the standard for comment of Limits and Measurement Methods for Exhaust Pollutants from Marine Compression Ignition Engines (CHINA I, II). Meanwhile, the national standards of GB3552-83 and GB4286-84 have been listed in the standard revised plan.

Necessity of studying and establishing marine exhaust pollutant emission standards

Build national metering standard system of state environmental protection domain. The Development Planning of Metering (2013-2020) puts it forward that perfect the building of national metering standard and societal metering standard system related to environmental protection, to research and exchange environmental protection meter testing technology, and transform the research result. Carry out research on standard substance and meter testing methods for transport exhaust and

flue gas emissions. As important content of national metering standard and societal metering standard system, marine exhaust pollutant emission standards are necessary to be studied and formulate to promote the development of metering technology on traffic environment protection.

Expedite the research of measurement standard technology about green transportation, energy conservation and emissions reduction, environmental protection. The MEPC of IMO approved a amendment for new MARPOL Annex VI. As one signatory of amendment, China has to do something to limit marine exhaust emission. Therefore, it is need to research marine exhaust pollutant emission standard and set out a series of administrative rules and standards, to promote marine exhaust emission management, to expedite the research of measurement standard technology about green transportation, energy conservation and emissions reduction, environmental protection.

Protect and treat marine exhaust pollutant. Marine exhaust pollutants mainly consist of kinds of gas from ship engine fuel burning, which will have a serious impact on air for long-time emission and form mobile pollution source with ship sailing. With the unprecedented development of world trade, the number of transport industry ships grows so fast, the international community will gradually pay attention to atmospheric pollution problem for marine exhaust pollutants. As the principal pollutant of marine exhaust, sulfur oxide has had a great influence on human living environment. Therefore, to limit exhaust emission, improve emission requirements and reduce exhaust pollution to atmosphere, it is necessary to study and establish marine exhaust pollutant emission standards.

Thinking about studying and establishing marine exhaust pollutant emission standards

Establish the standard system for marine exhaust pollutant. To establish a scientific and reasonable standard system for marine exhaust pollutant, the main work is to determine the system structure and the content of the system. Normally, the first step is to establish the priority list of the marine exhaust pollutant emissions (control). There are many kinds of components in exhaust and it is no need to set standards for each kind of components. We can select the exhaust pollutants with high content of ingredients and great harm to human health and ecological environment or potential pollutants to list in priority list. On this basis, establish the frame of standard system by means of different levels, classification and other methods. Then according to the system frame, establish specific standards based on the industry requirements.

Establish the marine exhaust pollutant emission inventory. As the key technology of studying marine exhaust pollutant emission standard, Marine exhaust pollutant emission inventory can be used to identify marine exhaust pollution sources, support model simulation, explain measurement results and set control scheme to reduce emissions.

First of all, the content of marine exhaust pollutant emission inventory should be comprehensive. As is known to all, the atmospheric emission inventory includes the fixed source, unorganized emission source, natural source and moving source. Accordingly, the marine exhaust pollutant emission inventory should include all the atmospheric pollutants, including PM10 and PM2.5, DPM, NOX, SOX, CO and HC, and CO2, CH4 and other greenhouse gas. Secondly, inventory should be established based on relevant guidelines or standards. In August 2014, the Environmental Protection Department issued five guidelines about gas emission inventory to guide and standardize the national atmospheric emissions inventory compilation work. At the same time, the work should be undertaken by the related institutions, including the government administrative departments (such as environmental protection department, the maritime administrative department), marine energy factory

(ship fuel production organization, etc.), shipbuilding industry related factory (ship manufacturer), technology research institute (environmental monitoring center, etc.) and other institutions. In this way, the research results and data sharing platform can be set up and promote the emission inventory studying speed. The repeated work and research funding can be avoided.

Refine the marine exhaust pollutant emission standards. The marine exhaust pollutant emission standard and inventory are comprehensive, but also lack of refinement. According to different classification methods, the model of ship are numerous and complex, which leads to kinds of emission sources. It is necessary to refine the ship model and establish relative standard to put forward suitable emission stipulation. One kind of ship may be used of different industries, such as environmental protection industry and transportation, in which case, the standard should be established based on different technical requirements. Therefore, refining the marine exhaust pollutant emission standard is conducive to establish an impeccable standard system for marine exhaust pollutant.

Prospect of studying marine exhaust pollutant emission standards

Nowadays, compared with Europe and the United States, the research about marine exhaust pollution control and retard of China is still in its infancy. Studying marine exhaust pollutant emission standard is one key job and to be solved. Meanwhile, some new technologies and innovation policy have to used to standards, such as switching to low sulfur oil, employing Liquefied Natural Gas, voltage shore technology, exhaust treatment technology and establishing ECA, which can provide significant scientific basis for establish a scientific marine exhaust pollutant emission control system in China.

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