Results of Testing of Oil Skimmers and Pumps in VLSFO ; Case studies of incidents of South Korea - Contact: Jeong-ock Won wjo202@korea.kr

There was a problem that VLSFO, which lowered the sulfur content of existing marine fuel oil due to atmospheric environment regulations, which solidified below the pour point, making mechanical recovery difficult to recover. In the incident that it occurred in December 2019, the VLSFO was solidificated, that made it difficult to oil spill response, We need to know KCG's skimmer and pump work on which types of VLSFO, to make the right choice. Testing the ability of currently available skimmers and pumps is of great importance for preparedness against pollution. To be able to make operational assessments of which oil skimmers are best suited to a given situation, we must know how the skimmers work on VLSFO.

We have tested various oil skimmers and pumps in two different types of VLSFOs and two different temperature. Two different VLSFOs have been tested: pour point 8℃, 27℃. Three types of oil skimmer were tested. The types are with low viscosity disc, high viscosity disc, brush. Three types of pump were tested. The types are with diaphragm, gear, screw. The tests are performed at water temperatures corresponding to winter temperature(7℃), summer temperature(20℃). The results gave us the answer that the all selected skimmers and pumps work in VLSFO1(pour point 8℃) at all temperature(7℃, 20℃), However, in VLSFO2(pour point 27℃), it works partially in summer temperature(20℃) but not in winter temperature(7℃). None of the skimmers worked in VLSFO2(pour point 27℃) at winter temperature(7℃). Only the screw pump was worked.

Table. Results of operation skimmers and pumps

water(oil) tem.(°C)	VLSFO1 (pour point 8℃, 49 mPa·s at 50.°C)						VLSFO2 (pour point 27℃, 153 mPa·s at 50.°C)					
	Disk1	Disk2	brush	Dia.	gear	screw	Disk1	Disk2	brush	Dia.	gear	screw
20~23	y	y	y	y	y	y	n	y	y	n	y	y
7~10	y	y	y	y	y	y	n	n	n	n	n	y

* disk1: the most frequently used skimmer, ** disk2, brush: the most quantity of skimmer

VLSFO1 has a viscosity of 49 mPa·s at 50°C, 668 mPa·s at 20°C, 5,170 mPa·s at 10°C and exhibits a similer behaviour as intermediate bunker fuel oil. The viscosity of VLSFO2 is higher than VLSFO1. VLSFO2 has a viscosity 153 mPa·s at 50°C, 24,369 mPa·s at 20°C, 118,000 mPa·s at 10°C. VLSFO1 was capable of mechanical recovery even as solidification

progressed, but VLSFO2 became more difficult to recover mechanically as it solidified. The result from the testing indicate that the mechanical recovery operation has a great influence on viscosity as before bunker fuel oil.

In conclusion, for VLSFO with low pour point(<+10) and viscosity(<~5,000 mPa·◌S), the mechanical recovery(testing skimmer and pump) can be used regardless of summer or winter. But for VLSFO with high pour point(>+20) and viscosity(>~20,000 mPa·◌S),in summer, disk1 is not worked. Particularly, in winter, all skimmers can not be used..

Many types of VLSFO have come onto the market. As various types of VLSFO produced in Korea, it was found that the range of pour point and viscosity of VLSFO were very wide. In early 2020, VLSFO has viscosity of 11 ~ 267 mPa·◌S at 50°C, pour point of average 7℃. But in 2021, VLSFO has viscosity of 3 ~ 90 mPa·◌S at 50°C, pour point of averager 0.8℃. The viscosity and pour points are getting lower. So there is less concern about the use of skimmers and pumps

There have been occurred about 40 VLSFO incidents in South Korea, from December 2019 to September 2021. In the incident that it occurred in December 2019, the VLSFO was solidificated, that made it difficult to oil spill response, but there has been no major problem in the recent accident. The accident in 2019 was the viscosity of 150 mPa·◌S at 50°C and pour point was 17°C. In this accident, the mechanical recovery was impossible. The accident in 2021 was the viscosity of ~30 mPa·◌S at 50°C. Mechanical recovery was performed. As can be seen in the case of accidents, viscosity is decreasing, and it can be said that mechenical response is possible through the equipment we have.