Oil Spill Incidents and Application of Dispersants

Hiroshi Tokuda
Ex Professor of the University of Tokyo

It is said that the first large scale application of dispersants was at the Torrey Canyon Incident, which happened to run aground and released crude oil, as a cargo, of 93,000 kl at the Scilly Island off Cornwall Peninsula, UK, in March 1967. Dispersants were adopted for both floating oil slick on the sea and coastline for cleaning. The latter application gave a serious affection to marine organisms in shallow waters. This information generated a rumor that dispersants are deadly poisonous, and scattered to in our country. As a result, many people, especially people who belongs to fishery got a potential rejection towards dispersants. The application of different kind of chemicals, namely dispersants and precipitants, made a misleading that every chemicals to use for oil spill made sediments containing oils and reached to the seabed, though the functional mechanism of those two chemicals is completely different. And unfortunately enough, many people in the country believed that misleading.

The first application of dispersants to oil spill incident in Japan was at the Juliana Incident, which happened to occur off Niigata Port in November 1971. The volume of spilt oil, Oman crude, after wreckage, was estimated to be 7,200 kiloliters. At that time period, there was no firm application procedures of dispersants to cope with spilt oil, nor regulatory arrangement for dispersants regarding to the toxicity for marine organisms. A procedure undertaken was to directly drop 5 gallon-cans(18 liters capacity) with their lids open, from helicopter, upon the oil slicks on the sea. As a result, observed many empty cans scattered on the shoreline of the spill site. Though it was hard to know what was the brand of despersant actually applied, some products in the market contained 100% pure aromatic hydrocarbons as the solvent, so that they could kill phytoplankton even at the concentration of several ppm by its high toxicity for marine organisms.

In 1973, a regulatory arrangement so called " Model approval and registration system , in which specified limitation for toxicity against marine organisms, degree of biodegradation, degree of emulsification etc., was enacted. Then we were able to get reasonably safe and indicating performance. With implementation of this system as a turning point, dispersants manufacturers made efforts for developing low toxic products. Thus, dispersants manufacturers in Japan became the ones indicating lowest toxicity in the world. However, though those dispersants did satisfy the criteria set for the regulation, emulsifying efficiency was getting decreased. Actually, those dispersants did not well perform even if sprayed exceeding a deemed proper amount of 20～25%; this means, if sprayed amount is in the range of deemed one or less than deemed proper amount, slicks can not be cleaned off.

On the other hand, there also seemed to be problems on the application procedure of the despersants against to the oil slicks. Generally speaking, to get deemed performance, many dispersant products should be sprayed directly on to the oil slicks, while other approach, for example, application of diluted dispersant mixture with sea water do not indicate effective dispersion. Regardless of such characteristics of the dispersant products, procedures applied for operations were spraying sea water solution of the dispersants to the slicks with pick-up nozzle and applied mechanical agitation. Those dispersants mentioned above, have been called conventional type" in this country. After that, so called concentrate type" products which are rich in dispersant and less in solvent have been developed and put into market. However, since these were also required mechanical agitation after spraying, it would be the same category of the conventional type ones.

The above mentioned dispersants can emulsify and disperse spilt oil on the sea surface very effectively when its kinematic viscosity is below 2,000 cSt. The more kinematic viscosity is, the less the effect is. 4,000 cSt is considered the limit for being emulsified and dispersed. However, heavy fuel oil is most likely to be spilt in the incidents around Japan. In Japan, the efficiency of dispersants has been decided by using Fuel Oil B as the testing oil by law(mentioned above as "Model approval and registration system"), 50 the products effective for more viscous oil have not been developed. Moreover, Fuel Oil B has been little demanded recently and is not produced anymore. Due to the situation mentioned above, there was an urgent need to develop dispersants that are also effective to highly viscous oil. Last November, D-1128, the

dispersants for highly viscous oil were developed in Japan for the first time. These dispersants were confirmed to be able to fully emulsify and disperse spilt oil in the laboratory test only when agitating is done after being sprayed. Adequate spraying rate was equal to 5% or less to the oil amount in case of its kinematic viscosity of below 10,000 cSt. Similarly 6% for 10,000 cSt, 5% for 50,000 cSt, and 10% for 100,000 cSt.

When the Nakhodka incident occurred in the Sea of Japan this January, these dispersants for highly viscous oil were applied as a test. The properties* of spilt oil were as follows: specific gravity of 0.959 at 20℃ kinematic viscosity of 137.5 cSt at 50℃ and 10,000～15,000cSt at 10～8℃ (estimated), and pour point of -17℃. It was confirmed that the dispersants for highly viscous oil were very effective when spilt oil contained little water. However since oil slick gradually absorbed water to change to oil mass(mousse like oil) which had 70% of water content and 10℃ of pour point, the dispersants were no longer effective. The reasons are considered as follows: fine water particles in the oil mass prevented the dispersants from penetrating and sprayed dispersants can not directly get to the oil mass because their specific gravity become closer to that of seawater, which covers the surface of oil. From now on, I hope these problems will be solved and efforts for improving performance will be made.

To response spilt oil off the coast quickly, it is necessary to spray dispersants to oil slick from aircraft. To accomplish this, the dispersants are required to change oil slick to fine particles and disperse them into seawater without agitating. This characteristic is called "Self-mixing." For this purpose, the dispersants contain the amphiphilic solvents that are mixable with water and oil. However, due to high toxicity of the solvent for marine organisms, the dispersants are more toxic for them than conventional type ones. Since the amount necessary to be effective is less than one fifth of that of conventional type ones, it is possible to approve the use of the dispersants for sprayring from aircraft as long as the usage is limited in the offshore, even though those are more toxic than conventional type ones. In Japan, development of much lower toxic dispersants for aerial spraying is under way.

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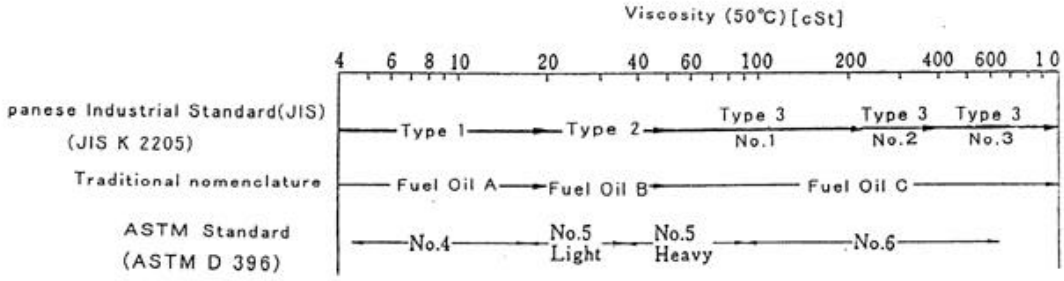
* Note by the translator : There are several figures for the properties of the spilt oil by different sources. However, official figure has not been issued as of July 1, 1997.

(Reference)



① Comparison of specifications for fuel oil

		Viscosity (50℃) cSt	Pour Point ℃
Type 1		20 max	5 max
Type 2		50 max	10 max
Type 3	No. 1	250 max	-
	No. 2	400 max	-
	No. 3	400～1000	-

② JIS Specification for fuel oil