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TECHNICAL INFORMATION

NO.2018-ETC-08

Subject : Application of Ballast Water Management Convention - Brine using in seagoing fishing vessels as refrigerant

1. International Convention for the Control and Management of ships' Ballast Water and Sediments, 2004 (hereinafter referred to as "BWM Convention") has been entered into force on 8th Sep. 2017, and ships that are subject to the BWM Convention shall install the Ballast Water Management System on board to be in compliance with Reg. D-2 (Ballast water performance standard) in accordance with Reg. B-3.

2. In recent IMO MEPC (Marine Environment Protection Committee) sessions, various issues with regard to application and/or implementation of the BWM Convention have been raised. Among the issues, the development of a unified interpretation of the brine used to freeze the catch in seagoing fishing vessels and guidelines for the case where the brine should be considered as ballast water in accordance with the definition of ballast water in Article 1 of the Convention was proposed at the MEPC 73rd session. For more details, please refer to the attachment with regard to the background of proposal and brine effects on aquatic organisms.

3. In conclusion, MEPC, at its 73 session, has made a decision that there was no need for developing guidance related to brine because brine used as a refrigerant is not considered as ballast water under the definition of the BWM Convention. Therefore, please be informed that BWM Convention shall not be applied to the seagoing fishing vessels using brine as a refrigerant, if a seagoing fishing vessel does not have ballast tanks or ballast tanks are void and/or permanent (refer to attachment).

#Attachment: Application of the Ballast Water Management Convention - Brine.

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Executive Vice President
Survey Division
Korean Register of Shipping

Distributions : Ship owners & Operators, Surveyors

#Attachment

Application of the Ballast Water Management Convention - Brine using in seagoing fishing vessel as refrigerant

Background

1. In accordance with Article 1 of the *International Convention for the Control and management of the Ships Ballast Water and Sediments, 2004* (hereafter "BWM Convention"), Ballast Water means the "Water" with its suspended matter taken on board a ship to control trim, list, draught, stability or stress of the ship.

2. In case of seagoing fishing vessels, brine made with salt and seawater (or fresh water) pumped up aboard contains suspended matter. When a fishing vessel using brine departures from its home port for a fishing ground, the brine must be considered to control draught and stability of the fishing vessel.

3. Seagoing fishing vessels prepare the brine (final salinity level: range from 211 PSU to 328 PSU) in the freezer hold. Brine chilled at - 17°C to - 20°C is used to freeze the catch. The catch can be maintained in the brine or the hold can be dried to maintain the catch in dry frozen state. In the case of contamination by debris, pieces of or blood of the catch during the freezing process, brine is discharged to high sea. Then seawater is taken on board form high sea to replace the discharging brine.

4. Given the fate of the brine and pattern of seagoing fishing vessels described in paragraph 2 and 3, the seagoing fishing vessels may be required from port State Control that brine discharging into territorial waters of other States should be managed by the fishing vessels using the brine in accordance with the BWM Convention.

5. Therefore, this technical information has been developed for reviewing effects of brine on aquatic organisms and for notifying recent decision of MEPC on this issue.

Effects on aquatic organisms in brine

6. Plants and animals have adapted to a wide range of aquatic environments, and have developed a range of physiological mechanisms and adaptations to maintain the necessary balance of water and dissolved ions in cells and tissues.

7. In terminology, osmosis is the spontaneous net movement of solvent molecules

through a selectively permeable membrane into a region of higher solute concentration, in the direction that tend to equalize the solute concentrations on the two sides (Fig. 1).

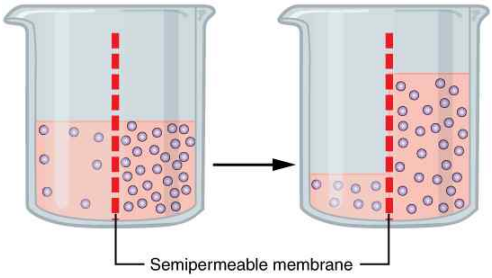

Fig. 1 The process of osmosis over a semi-permeable membrane. The blue dots represent particles driving the osmotic gradient (source: https://cnx.org/contents/FPtK1zmh@8.25:fEI3C8Ot@10/Preface).

8. In case of aquatic animal species, the ability to maintain or regulate the optimal internal osmotic concentration against external gradients determines the salinity tolerance of the species. Osmoregulators are organisms capable of maintaining homeostasis of water content in their bodies. They do this by regulating the osmotic pressure in order to keep their bodies from becoming too diluted or too concentrated of solutes or salt in the water. The concentration of ions in the body fluids of most freshwater animals is significantly lower than in their marine counterparts, but usually still well above that of their external medium. In fresh water, thus, body fluids of animals gain water by osmosis and ions in body fluids are lost by diffusion (Fig. 2). In contrast, animals in marine environments usually excrete only small amounts of concentrated urine and possess a range of mechanisms to exclude salt (Fig. 2).

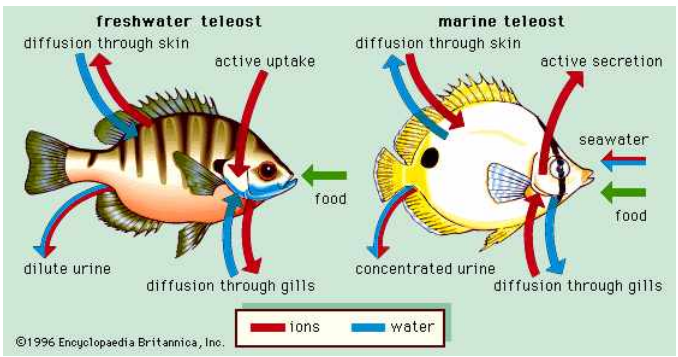

Fig. 2 Diffusion and gain water through osmosis in fresh water fish and marine fish (Source: Encyclopaedia Britannica, Inc).

9. Plant cells differ from animal cells in having a rigid cell wall, as well as a large vacuole which can develop high osmotic pressure because of the high concentrations of salts, sugars and other organic compounds stored in it. In a normally functioning plant cell, water diffuses into the vacuole causing it to distend and press against the cell wall (Fig. 3). Such a water-swelled condition is known as turgor. Turgor can be maintained only when the water potential of the solution is greater than that of the plant cells. If this

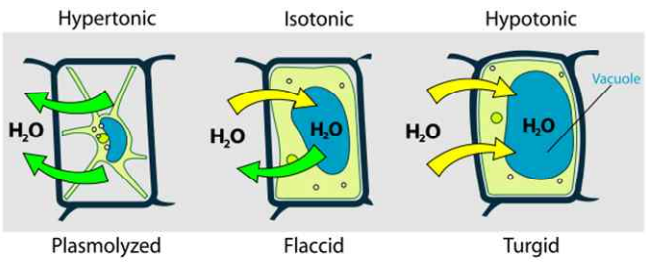

Fig. 3. The movement of water through osmosis in plant cell. Plant cells become plasmolyzed in a hypertonic solution, but tend to do best in a hypotonic environment. Water is stored in the central vacuole of the plant cell. (Source: https://www.ck12.org/biology/osmosis/lesson/Osmosis-BIO/)

plant cell were then placed into a high salinity solution, it would tend to lose water and the cell membrane would tent to shrink away from the cell wall. This non-turgid condition adversely affects the functioning of the plant and it will eventually die.

10. The ability of freshwater plants and animals to maintain homeostasis of water content in their bodies is extremely important in any consideration of their sensitivity to increases in salinity levels in their environment. In simplistic terms, high salinity is lethal to aquatic organisms because altering the salinity of the surrounding environment can induce changes in the activity rate, internal volume, volume regulation, respiration rate and oxygen requirements of aquatic organisms.

11. Fresh water or estuarine organisms remaining after ballast water exchange often experience high mortality, due to osmotic shock caused by high-salinity exposure. There are some laboratory experiments that have demonstrated that brine kills both freshwater and oceanic zooplankton over a shot time exposure (hours). Santagate et al (2009) estimated the lethal dosage of brine for 95% of the species in their experiments to be 110 ppt (95% confidence interval, 85-192 ppt) when the exposure time is 1 hr and 60 ppt (95% confidence interval, 48-98 ppt) when the exposure duration is 6 hrs or longer. In addition, a one-hour exposure to 115 ppt brine is a broadly effective treatment (99.9% mortality) regardless of treatment temperature, taxonomic group, or species' source habitat salinity.

Conclusion

12. As described in paragraph 3, brine used on fishing vessels as refrigerant has a high concentration of salt which is about 7 to 10 times higher than seawater. Its temperature is extremely low and considering temperature of seawater normally ranges from 0°C to 40°C, the theoretical temperature differential (Δt) ranges from 17°C to 60°C. Brine cause death of aquatic organisms due to toxic effect induce by osmotic stress stemming from the high level of salinity. Aquatic organisms living in ballasting operation cannot be survived at extremely low temperature and large Δt in the brine aboard fishing vessels.

13. In conclusion, it is not expected that brine used in seagoing fishing vessels introduces non-indigenous species into aquatic environment because the brine induce lethal effect on aquatic organisms through osmotic shock and cold shock.

14. MEPC, at its 73 session, has made a decision that there was no need for developing guidance related to brine because brine used as a refrigerant is not considered as ballast water under the definition of the BWM Convention. However, In case of seagoing fishing vessels that have ballast tanks and/or any tank to control

draught and/or stability, the BWM Convention shall apply to the seagoing fishing vessels (Fig. 4a). If seagoing fishing vessels do not have ballast tanks or ballast tanks are void and/or permanently sealed, the BWM Convention shall not apply to the seagoing fishing vessels using brine as a refrigerant (Fig. 4b). Therefore, it shall be noted that the application of the BWM Convention to the seagoing fishing vessels requires prior review and discussions with Stability & Tonnage Team and Environment & Piping Team of the Society.

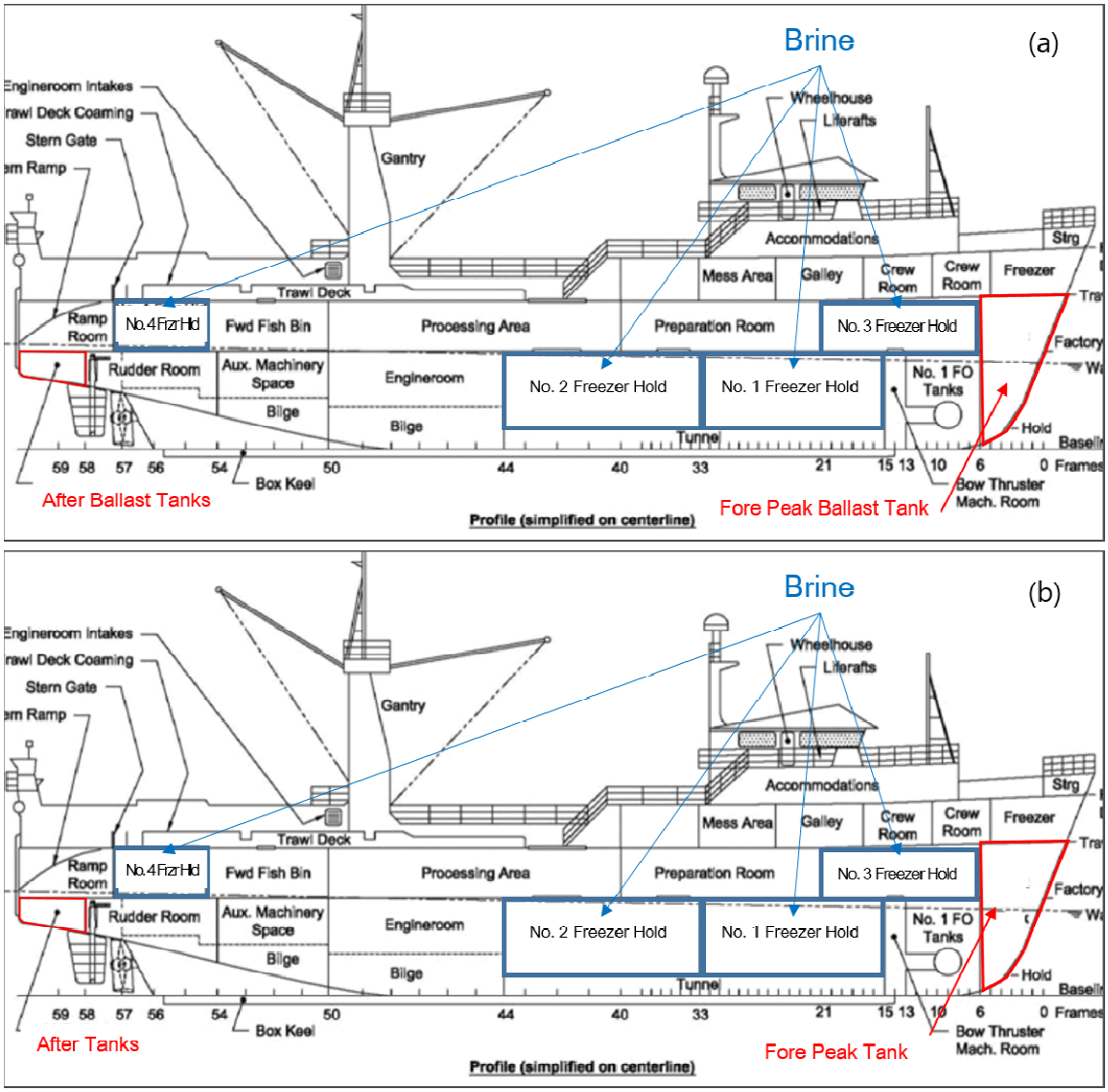

Fig. 4. Example for application of the BWM Convention to seagoing fishing vessel. (a) The BWM Convention shall apply to the seagoing fishing vessels. (b) If fore peak tank (FPT) and after peak tanks were void and/or permanent, the BWM Convention shall not apply to the seagoing fishing vessels. (Drawing source: http://factsanddetails.com/world/cat 53/sub340/item2196.html)

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