Pollution of Marine Environment by Ship *(Muhammet Boran)*	"Cercetări Marine" Issue no. 47 Pages 244-248	2017

POLLUTION OF MARINE ENVIRONMENT BY SHIP

Muhammet Boran*

Karadeniz Technical University, Faculty of Marine Sciences, Trabzon/Turkey
E-mail: mboran@ktu.edu.tr

ABSTRACT

Many pollutants are released into the marine environment far upstream from coastlines. But there are various ways by which pollutants enters to the marine environment. Ships are one of the sources of these pollutants. There are two ways in which the seas are contaminated by ships. One of them is routine pollution the other are ship accidents that cause pollution in the seas. Routine contamination occurs when the wastewater such as bilge, ballast and sewage of vessels is discharged into the sea without resorting to international rules. Accidental pollution occurs by landing and collision of vessels carrying petroleum and other harmful cargo. The types of pollution that may originate from ships include oil, chemicals, garbage sewage, air pollution from the ship's engines and bunker fuel and the anti-fouling paint on a ship's hull. Marine pests in ship's ballast water or clinging to the ship's hull can also harm marine environments.

Key-Words: Ship-sourced pollution, bilge water, ballast water, sewage, garbage

AIMS AND BACKGROUND

The main source of marine pollution is terrestrial inputs and pollutants resulting from maritime activities. The impact of maritime activities on this pollution is about 20%. The role of vessels is considerable when the seas are polluted by maritime activities. Bilge water, sewage, tank washing waters from vessels as a result of an accident caused by a large number of leaks of hazardous substances and loading and unloading operations cause pollution of the seas.

There are usually two ways for ship generated pollution. One of them is routine contamination that occurs from discharging the wastewater produced by the vessels, such as bilge, ballast and domestic wastewater, while they are still operating, without applying national and international rules. Accidental pollution occurs by sinking, landing, collision, explosion and fire of vessels carrying harmful cargos or during the loading or unloading of dangerous liquid and solid loads.The accidents of ship's pollution, especially oil tankers and chemical ship's marine pollution incident is very serious. Pollution resulting from the accident of ships

causes catastrophic events for marine life. Magnitude of the pollution of both types of pollution varies depending on the displacement of the ship, its type, and the purpose of use and also the characteristics of the cargo. For example, the effect of a tanker, a passenger ship, a yacht and a cargo vessel on the sea may be different in terms of routine pollution (Samsunlu, 1995; Wang and Zang, 2012).

Ship interact with the marine environment in which they operate in many ways. The main focus of this document is to demonstrate the marine pollution caused by routine operations by ship.

EXPERIMENTAL

This manuscript reviews some studies on the pollution of marine environment by ship. The review summarizes ship-generated pollution.

RESULTS AND DISCUSSION

Vessel-source pollution is estimated to account for approximately 12 percent of all marine pollution, as compared to land-based and atmospheric sources (Tan and Jin, 1997). Pollution from ships can occur throughout in many ways such as oil spills and noxious liquid substances from ships, discharge of waste water from ships, noise pollution, exhaust emissions, damping of garbage and packaged harmful substances (White and Mollloy, 2001).

Pollution by Bilge Waters from Ships

The bilge water contain fuel, hydraulic oils, lubricant oils, volatile organic compounds, metals, detergents, degreasers and other chemicals derived from activities on board a ship. The amount of bilge water in a ship depends on the age, tonnage and maintenance of the ship. Cruise ships and passenger ferries produce more bilge water than other ships (US EPA, 2008). In a survey by Det Norske Veritas (DNV) the average production of bilge water was estimated to be 7500 L/day from passenger ships, 360 L/day from offshore ships, and 50 L/day from tankers and cargo vessels (Sjøfartsdirektoratet, 2009).

Bilge waters are collected in a bilge well or bilge water tank located at the bottom of the gantry and must be thrown out of the vessel within a certain period of time. According to the International Convention for the Prevention of Pollution from Ships, (MARPOL 73/78) no water may be discharged into the sea if it contains ≥15 mg/L of oil (IMO, 1983). It is now recognized that introduction of such wastes into marine environment presents a significant environmental problem. In a study carried out by Fisher and Nault (2006) the bilge water taken 4 different ship classes were compared to municipal legislation governing disposal of wastewater via municipal sewer. The results indicate that hydrocarbon and zinc content exceeds municipal sewer disposal regulations in at least 50% of bilge spaces. Tiselius & Magnusson (2017) investigated the chemical composition and toxicity of treated

bilge water from seven passenger ferries in the Baltic Sea. They also found out that only one of the ships, had treated water with a total oil content exceeding the legal limit, 69.3 mg/L compared to regulations of a maximum of 15 mg/L. It is suggested that the effect of legally discharged bilge water (oil concentrations 15 mg/L) in the sea will depend on the volumes being released and the toxicity and degradation rate of the compounds in the released water.

Surfactants are also important compounds in bilge water and they affect significantly biological activity in the seawater. It is reported that if the amount of surfactants are more than 0.1 mg/L in the seawater it will be toxic for marine life. Additionally as a result of an increased dissolution of the crude oil by the dispersant making it more bioavailable for the exposed organisms (Tiselus and Magnusson, 2017).

Pollution by Ballast Water from Ships

The ballast water is called the water taken to the ship along with the hanging materials to control the gradient, slope, water draw, balance stress of the ship. However, it is necessary to take care while taking ballast water to prevent of contamination the marine environment from pathogens, heavy metal-containing sediments and other harmful substances. It is important to ensure that ballast water is not taken in very shallow water, nearby sewage outfalls, in turbulent currents, where dredging is or recently has been carried out, in darkness when organisms may rise up in the water column, in areas close to aquaculture. Care should be taken to ensure that the ballast is always taken and discharged from the same place and taken from places where the port state is to be appointed (Rolim *et al*., 2009).

The ballast water may contain a variety of harmful substances, including in certain cases oil contaminants, non-native marine animals and plants, and disease causing organisms. The introduction of non-native species from ships' ballast water, in addition to other sources, is a matter that is causing increasing concern and is a potentially serious, but highly unpredictable problem, in all coastal marine ecosystems. The result is the introduction of these species into a new environment. If the organisms survive, they can cause major ecological and economic damage to the ecosystem (Carlton, 1996). To prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens to the maximum extent practicable taking into account the nature of the ship ballast water should either be exchanged prior to discharge in accordance with regulation or otherwise managed in accordance with the requirements of the administration (Rolim *et al*., 2009).

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted in 2004 (entry into force September 2017) to introduce global regulations to control the transfer of potentially invasive species. Once the treaty enters into force, ballast water will need to be treated before it is released into a new location, so that any microorganisms or small marine species are killed off (IMO, 2004).

Pollution by Sewage from Ships

The main sources of human-produced sewage are land-based - such as municipal sewers or treatment plants. However, the discharge of sewage into the sea from ships also contributes to marine pollution. Waters such as kitchens, toilets, bathroom waters, etc. used by ship's personnel for their residence are containing high amounts of organic matter, nitrogen, phosphorus, coliform and suspended solids. The discharge of raw sewage into the sea can create a health hazard. Sewage can also lead to oxygen depletion and can be an obvious visual pollution in coastal areas - a major problem for countries with tourist industries. It also causes eutrophication in the coastal waters where the current is low (Samsunlu, 1995; IMO, 2004).

Pollution by Garbage from Ships

Garbage means all kinds of food wastes, domestic wastes and operational wastes, all plastics, cargo residues, incinerator ashes, cooking oil, fishing gear, and animal carcasses generated during the normal operation of the ship (Turkish Lloyd, 2014). The impact of Garbage Pollution in the marine environment is more than aesthetic. Other than spoiling coastlines, it causes severe harm to marine life by ensnaring or ingestion, amongst other things. Garbage from ships can be just as deadly to marine life as oil and chemicals (IMO, 1992).

According to revised MARPOL Annex V shipboard generated garbage is to be grouped into the following categories: plastics, food wastes, domestic wastes, cooking oil, incinerator ashes, operational wastes, cargo residues, animal carcasses, fishing gear. Procedures for collecting garbage generated on board should be based on the consideration of what is permitted and what is not permitted to be discharged into the sea while route, and whether a particular garbage type can be discharged to port facilities for recycling or reuse. To reduce or avoid the need for sorting after collection, the categories of distinctively marked garbage receptacles must be provided to receive garbage as it is generated (Turkish Lloyd, 2014; Kairis, 2012).

CONCLUSIONS

Most of marine pollution is simply by accident. But the routine operations of ships, without applying international rules have significant effects on the pollution of the marine environment. Discharge of bilge water, sewage and ballast water, damping of garbage, oil spills and discharge from engine room, discharge from cargo residues can cause pollution in seas and exhaust from engine, incineration of garbage, freon and halon gases pollute the atmosphere

REFERENCES

Carlton, J.T., (1996), Biological invasions and cryptogenic species. Ecology. **77**:1653-1655;

Fisher, G., Nault, P., (2006), Bilge water characterization of CF ships. Defence Research and Development, Technical Memorandum, Canada, 21 p;

Greer, C.D., Hodson, P.V., Li, Z., King, T., Lee, K., (2012), Toxicity of crude oil chemically dispersed in a wave tank to embryos of Atlantic Herring (*Clupea harengus*). Environ.Toxicol. Chem. **31**(6):1324-1333;

IMO, (1983), International convention for the prevention of pollution from ships (MARPOL);

IMO, (1992), Prevention of pollution by garbage from ships. Retrieved from: http://www.imo.org/en/OurWork/Environment/PollutionPrevention/Garbage/Pages/Default.aspx. 14 August, 2017;

IMO, (2004), International convention for the control and management of ships' ballast water and sediments (BWM);

Kairis, S., (2012), Ships' garbage management under revised MARPOL Annex V. Retrieved from**:** https://officerofthewatch.com/2012/11/07/ships-garbage management-under-revised-marpol-annex-v/. 17 August, 2017;

Rolim, M.H.F.S., Librando, G., Leppakoski, E., (2009). The international law on ballast water: Preventing biopollution, Publications on Ocean Development, ISBN-13: 978-9004166523;

Samsunlu, A., (1995), Marine pollution and control, ITU Faculty of Naval Architecture and Marine Science, İstanbul, Turkey;

Sjøfartsdirektoratet, (2009), Study on discharge factors for legal operational discharges to sea from vessels in Norwegian waters. Det Norske Veritas, Report no: 209/0284;

Tan, A., Jin, K., (1997), The Regulation of vessel-source marine pollution: reconciling the maritime and coastal state interests. Singapore Journal of International & Comparative Law, **1**: 355-381;

Tiselius, P., Magnusson K., (2017), Toxicity of treated bilge water: The need for revised regulatory control. Marine Pollution Bulletin, **114 (2)**: 860-866;

Turkish Lloyd, (2014), Garbage management plan. Retrieved from: www.turkloydu. org/pdf-files/.../garbage-65duzeltme.docx. 12 August 2017;

US EPA, (2008), Cruise ship discharge assessment report (assessment report). Report no. 842-R-07-005;

Wang, X., Zhang, J., (2012), Ship pollution situation and control measures**.** 2nd International Conference on Consumer Electronics, Communications and Networks (CECNet), 21-23, Yichang, China: 2842-2845;

White, L., Molloy, F., (2001). Ships and the marine environment. Maritime Cyprus. The International Tanker Owners Pollution Federation Limited: 1-7.