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Ballast Water Treatment Methods of International Vessels Docking in Loboc Port, Iloilo City, Philippines

Brian Gil S. Sarinas, Lorna D. Gellada, Daryl Ian D. Ardales, Klyntjoehn B. Chavez, Jan Jan C. Corbal, Jerson P. Maco and Peter Paul V. Ubal

John B. Lacson Foundation Maritime University - Arevalo, Iloilo City 5000, Philippines

Abstract: This study delved on the ballast water management methods among international vessels docking at Loboc Port, Iloilo City, Philippines and other factors that are considered during ballast operation. The respondents of this study were the seafarers from the 15 international vessels docking at Loboc Port. The findings of the study revealed that the international vessels docking at Loboc Port used the sequential method, flow-through method, chlorination method, hydrogen peroxide, UV (ultraviolet) irradiation and filtration method in ballasting. In order to prevent transfer of alien invasive species, government authorities such as MARINA (Maritime Industry Authority) and Philippine Coast Guard should strictly monitor and implement the ballast water management methods used by international vessels based on the guidelines set by the IMO (International Maritime Organization).

Key words: Ballast water, ballast water treatment, international vessels, IMO, Loboc Port.

1. Introduction

Ballast water is being used by vessels at sea about 120 years ago [1]. It is an indispensable tool because it reduces stress at the hull, improves propulsion and manoeuverability, compensates for the lost weight caused by water and fuel consumption, increases draught, improves trim, regulates stability [1-6] and maintains structural strength [7]. In addition, a vessel takes on ballast water as it passes under the bridge and discharges ballast water on the bottom of the waterway [7].

About 2 to 12 billion tonnes of ballast water are transported across the globe yearly and in effect, about 7,000 different species of organisms are transferred daily [8, 9]. These organisms are considered as non-native, nuisance and exotic species [4] and cause pollution to the area where the ballast water is discharged [2]. This is the reason why IMO (International Maritime Organization) considers the transfer of ballast water as one of the four major threats to world's ocean [1].

Corresponding author: Brian Gil S. Sarinas, Ph.D., research fields: biology and chemistry maritime-related fields. E-mail: bg_sarinas@yahoo.com.

Specifically, these aquatic invasive species survive in a particular aquatic environment, become invasive, outcompete the native species and even multiply like a pest [1, 6]. This marine pollution damages our marine diversity and has direct and indirect effects in our health [1, 10]. Other effects include economic damage to marine ecosystems [4, 5, 11, 12].

The International Maritime Organization, as the leading body of maritime issues, adopted the resolution A. 868 known as the guidelines for the Control and Management of Ships' Ballast Water in 1997. This resolution aimed to minimize the transfer of harmful aquatic species in ballast water [2]. Furthermore, IMO regulations on ballast water exchange in the mid-ocean must be at least 200 nautical miles from the shore and a depth of at least 200 m through the use of either sequential or flow-through methods [1, 2, 4].

IMO adopted another resolution A. 1000 known as the International Convention for the Control and Management of Ships' Ballast Water and Sediments [1] in 2004 for treatment of ballast water. In effect, the BWM (ballast water management) Convention

requires all ships to have a Ballast Water and Sediments Management Plan. All the plans are reflected in the Ballast Water Record Book [1]. In addition, as mandated by IMO, all ships performing BWE (ballast water exchange) must practice 95% volumetric exchange of ballast water [1].

Many authors conducted and reviewed the management practices in treating ballast water. The major treatment methods were filtration, separation unit, flow-through system, dilution method, sedimentation and floatation methods and BWE in open ocean while the physical removal of species included heat treatment, cooling treatment, UV (Ultraviolet) radiation, gamma radiation, ultra-sonics, microwave, rapid pressure changes, electrical, de-oxygenation and magnetic fields. The removal of species with the use of chemicals included chlorination, metal ions, ozone, hydrogen peroxide, coagulants, pH adjustment, altering salinities, antifouling paints on ballast tank coatings and organic biocides. However, they added that ballast water exchange through sequential exchange and flow-through exchange was considered as the best ballast water and sediment treatment or management in minimizing transfer of organisms [4].

Meanwhile, the physical disinfection methods include ballast water exchange, physical filtration, hydrocloning, UV radiation de-oxygenation, ultrasonics/cavitation, electric pulse, and heat treatment as well as chemical disinfection methods such as chlorination, chlorine-di-oxide, ozonation, peroxyacetic acid, paracetic acid plus hydrogen peroxide, and Vitamin K (K3-Menadione) [11].

On the other hand, a study using a stochastic simulation of different strategies for controlling ballast water contamination revealed that minimizing the visit of a ship is more effective than eliminating key ports that are major sources of global ballast water contamination [13]. Sodium chloride (NaCl) brine at 230‰ is emergency ballast water management option [14]. While natural seawater at slightly elevated pH and containing 1 ppm of H_2O_2 can be lethal to wide species of plankton [15].

There is no current method or technology that can completely eradicate aquatic invasive species or remove all organisms from ballast water [2, 4, 16]. However, a filtration system in combination with heat treatment is the best option to treat ballast water [11].

This study was conceptualized because there is a dearth of studies concerning the enumeration of ballast water management methods and other concerns during ballast operation among international vessels docking at Loboc Port, Iloilo City. This study can be an eye opener to all concerned government authorities leading to the prevention or transfer of unwanted and invasive species in the Philippine ports.

2. Methods

2.1 Respondents

The respondents of the study were the seafarers from 15 international vessels docking at Loboc Port, Iloilo City. Respondents included two masters, 12 chief officers and one second officer, in-charge of the ballast operation.

2.2 Data Collection

The study was conducted at Loboc Port, Iloilo City, Philippines. Before the actual administration of the survey questionnaire, letters of permission to conduct the study was sent by the researchers to the managers of the Philippine Ports Authority, Bureau of Customs, Company Representative, ship agents and master of the vessel. With the approval of the permits of the request, the survey questionnaire was personally administered by the researchers and, the data were collected after the questionnaire were answered.

2.3 Data Analysis

The number of international vessels docking at Loboc Port, Iloilo City was identified and tallied. The data for the open-ended questions determine the other factors they considered during ballast operation.

Table 1 Ballast water management methods of international vessels docking at Loboc Port, Iloilo City, Philippines.

Methods	Number of vessels utilizing
Sequential method	15
Flow-through method	12
Chlorination method	2
Filtration method	2
Hydrogen peroxide	1
UV radiation	1

3. Results and Discussion

Table 1 shows that 15 international vessels docking at Loboc Port, Iloilo City for the period of December 2013 to February 2014 used the sequential method in exchanging ballast water. Out of 15 international vessels, 12 of these vessels also used both flow-through method and sequential method.

Two international vessels used both chlorination method and sequential method; another two international vessels used both filtration method and sequential method. At the same time, one out of 15 international vessels used both hydrogen peroxide and sequential method and also one out of 15 international vessels used both UV irradiation and sequential method in treating ballast water, respectively.

On the other hand, the respondents were further asked how many miles did they perform ballast exchange from the shore. They unanimously conveyed that they followed the IMO regulation on ballast water discharge of 200 nautical miles from land at depth of 200 m which is the standard bases.

Secondly, in terms of pumping-in water in each tank, at least 300% of total tank capacity or at least 95% of tank capacity follows the flow-through and sequential methods, respectively.

Finally, the depth of water, stability of ship, stress, shearing force and bending moment were the factors they considered during ballast water exchange.

4. Conclusions

International vessels docking at Loboc Port, Iloilo City, Philippines manage very well their ballast water by using various treatment methods particularly sequential method as a majority, followed by flow-through method and other treatment methods. Furthermore, these international vessels follow the International Convention for the Control and Management of Ships' Ballast Water and Sediments set by IMO in 2004 because these vessels discharge the ballast water that is 200 nautical miles from land at depth of 200 m and pump in ballast water for at least 300% of total tank capacity or at least 95% of tank capacity.

It is recommended that we should follow up the studies or further conducted on ballast water management practices among vessels docking at Loboc Port, Iloilo City, Philippines to secure safety of ballasting in the Philippine waters. Likewise, this study may be useful to the Philippine government agencies like MARINA (Maritime Industry Authority), Coast Guard, lawmakers, maritime institutions and other stakeholders to further strengthen and/or strictly implement the ballast water management methods of all vessels in compliance with international standards set by IMO.

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