Ballast water management and their system processing

M. Diasamidze
A. Shotadze

Batumi State Maritime Academy, Batumi, Georgia

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Department of Exact and
Natural Sciences, Professor,
Batumi State Maritime
Academy, Batumi, Georgia

m.diasamidze@bsma.edu.ge

a.Shotadze@bsma.edu.ge

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Ballast water provides stability and maneuverability to a ship. Large ships can carry millions of gallons of ballast water. Ballast water discharged by ships can have a negative impact on the marine environment. There are thousands of marine species that may be carried in ships' ballast water; In order to reduce the risk of new introductions of exotic species, the UN International Maritime Organization (IMO) has adopted the International Convention for the Control and Management of Ship's Ballast Water and Sediments in 2004. This Convention aims 'to continue the development of safer and more effective Ballast Water Management options that will result in continued prevention, minimization and ultimate elimination of the transfer of harmful aquatic organisms and pathogens'. To prevent possible invasions, organisms should not be discharged from ballast tanks. This can be achieved by treating the ballast water, for instance by killing organisms that are travelling in the ballast water.

Keywords: Ballast; marine ecosystem; cleaning.

Introduction

Ballast is the waters that fill the special voids on ships for ensure the stability and maneuverability of the vessel during an empty sea crossing. Large vessels can carry millions of gallons of ballast water. Ballast water inside the vessel can be viewed as an aquarium on a vessel full of microscopic life forms, since small organisms living in sea water are pumped into the ballast tanks along with water, including coastal sediments and all organisms associated with them. In this way, many aquatic organisms drift with Ballast waters.

Materials and Methods

The ballast water is taken in the coastal waters of the ports and transported by ships to the next port of call, where the ballast can be discharged along with all the surviving organisms. This is the way the transfer of organisms to the ports of discharge, into a habitat alien to these organisms. These invaders are also called exotic species. Populations of rare species can grow very quickly in the absence of natural predators. And in this case they are called "invasive." Transportation of alien organisms on ships with ballast water is not only an environmental problem, but also a safety problem of navigation, fishing and fish farming, agriculture, and, in general, an economic problem. The

introduction of alien species of animals and plants into natural communities as a result of human activity is a kind of "biological pollution". Damage caused by alien marine organisms to the new habitat, due to the disturbance of the natural balance of the ecosystem, often threatens with the complete extinction of any native species of flora and fauna. Science is still unknown quite effective and harmless ways to restore the balance of the ecosystem. Representing a great threat to the marine ecosystem, these aquatic species have led to an increase in biological invasion at an alarming rate. In contrast to the discharge of oily water, ballast discharge, as a rule, is not noticeable visually, it is difficult to detect it without the use of special studies, however the consequences may be more catastrophic. According to rough estimates, about 3-5 billion tons of ballast water is transported around the world every year by ships. One cubic meter of ballast water can contain up to 50,000 samples of zooplankton or 10 million phytoplankton cells, so without exaggeration we can say that thousands of different marine species can be transported in ship's ballast tanks. This includes bacteria and other microbes, small invertebrates and eggs, cysts and larvae of various species, most fish species, although not all of them survive in ballast tanks, as they are a hostile environment with constant disturbances, lack of food and light. Precipitation in ballast tanks is closely related to ballast water. Turbid or shallow water often

contains solids. When they enter the ballast tank, they gradually settle to the bottom as “sediments” and are the basis for the development of various marine organisms. “Thus, ballast water is considered as one of the main vectors for the transfer of potentially invasive alien species, responsible for transferring from 7 to 10 thousand different

species of marine microbes, plants and animals around the world every day.” Every nine weeks somewhere in the world, marine species invade (infest) a new environment.

The following species have moved with ballast water around the world and created damage to the environment:

North American
comb Jelly

Zebra Mussel

Asian Kelp

European

North pacific Seastar
Green Crab

Round Goby

Toxic Algae

Mitten Crab

Caducean Water Flea

Cholera

International Convention on Control and Handling shipboard ballast water and sediments

In 1973, the IMO adopted a resolution on “studies of the effects of ballast water discharge containing bacteria of epidemic diseases” “Research into the effect of discharge of bacteria containing epidemic diseases”. In 1991, non-binding rules were adopted under the title “Guidelines for the Prevention of the Admission of Unwanted Organisms and Pathogens to Shipboard Ballast Water and Precipitation”. In 1997, the IMO Assembly adopted resolution A.868 (20), which revised the directives previously created. And on February 16, 2004, seven years later, the IMO Assembly revised resolution A.868 (20) and adopted it as a convention (International Convention for the Control and Management of Ships' Ballast Water and Sediments).

According to IMO, as of the end of February 2012, 33 states (out of 30 required) adopted the Convention, the percentage of world freight traffic was 26,46%. In January 2015, Georgia ratified the Convention on the Control of Ship's Ballast Water. The total number of countries that have joined the Convention in 2015 reached 44, which is 32.57% of world tonnage. But for the document to enter into force, it is necessary that 35% of all global shipping ratify Ballast Water Convention. The world community has taken another step closer to addressing the grave threats to the ocean's environment — the spread of invasive organisms through the ballast water of merchant ships systems. Ballast replacement on the high seas is used as a temporary measure in effect during the transitional period. For the first time, the Convention obliges to improve, minimize and finally eliminate the danger to the environment, human health, property and resources associated with the transfer of harmful aquatic and pathogenic organisms. This is supposed to be done by controlling the quality of ship's

ballast water and controlling it, applying for this purpose mechanical, physical, chemical and biological processes individually or in combination.

Ballast water treatment

To date, ballast water treatment is one of the most pressing scientific and technical challenges facing humanity. The term ballast water quality management, according to the Convention, is understood as the various ways to remove, deactivate or avoid taking on board a ship of harmful and pathogenic organisms. A widely used method up to the present time consistent with the Convention was the replacement of ballast at a distance of 200 nautical miles from the nearest shore, in places with a water depth of more than 200 meters. Replacement was to be made with an efficiency of at least 95% by volume of ballast water on the vessel. Ballast water treatment is a serious task that worries not only shipowners, but also environmentalists around the world. Every year in the world at least 5 billion tons of ballast water is used, the internal compartments of cargo ships are not at all highly sterile, and along with the ballast waters rust, oil, mechanical impurities and other pollutants enter the ocean. When toxic organisms, diseases and pathogens are introduced with ballast water, as a result, they cause illness and even death. Many environmentalists directly associate the discharge of unclean ballast water and outbreaks of various diseases among people, such as cholera.

A widely used ballast replacement at a distance of 200 nautical miles from the nearest coast, in places with water depths of over 200 meters with efficiency, at least 95% by volume of ballast water on a vessel is ineffective, because even with a three-time ballast change in tanks, stagnant zones are formed and full change of water does not occur. In this regard, it can be concluded that only methods of

processing ballast on board a vessel, despite the possible additional waste. The convention encourages new methods of water ballast control, the requirements for new methods are: they must be safe, they must be environmentally acceptable, they must work. There are several methods - some of them:

1. Mechanical cleaning methods, such filtration and separation;
2. Physical purification methods, such as sterilization with ozone, ultraviolet light, electric current and heat treatment;
3. Chemical purification methods such as adding biocides to ballast water in order to kill microorganisms;
4. Various combinations of the above, the So-called method of aging ballast water.

Studies have shown that if ballast water remains in a ballast tank for a year or more, more than 95% of aquatic life and pathogens die. However, this is not an approved method. Physical (non-reagent), chemical (reagent), biological and combined methods can be attributed to the methods of ensuring the environmental safety of water on board the ship. Each method of water purification has its advantages and disadvantages, includes many options for technology. In order to ensure that their vessels comply with the rules and regulations established by IMO with respect to ballast water management, several operators have begun implementing ballast water treatment systems on their vessels. The main types of ballast water treatment technologies available on the market are: Filtration systems (physical); Chemical disinfection (oxidizing and non-oxidizing biocides); Ultra-violet cleaning; Deoxygenated cleaning; Heat (heat treatment); Acoustic (cavitation treatment); Electric impulse / pulsed plasma systems; Cleaning with a magnetic field. Most of the ballast water treatment system uses 2-3 disinfection methods, together, are divided into different stages. The choice of cleaning system is used in combination depending on various factors, such as the type of vessel, the available space on the vessel, and cost constraints.

Conclusion

With a large variety of options for selecting ballast water treatment systems, it is still difficult to identify one that would be promising for preventing biological pollution of water bodies, minimizing damage to ecosystems and definitely suitable for handling shipboard ballast water. "It should be noted that there are significant costs required for the installation and operation of a ballast water management system - about 1-2 million dollars/ship, depending on the size and type, plus operating costs." Costs of society in the fight against alien aquatic organisms can reach billions of dollars. "It is also inevitable that the development of new technologies necessary to comply with regulatory requirements takes time, forcing many ship-owners to refrain from using them on board newly built vessels" (IMO Secretary General Koji Sekimizu). Nevertheless, IMO urges IMO member countries to "cooperate and take effective measures that would ease the burden of shipping for implementing the necessary ballast water management technologies under the Convention on Ballast Water Management".

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