

PAPER • OPEN ACCESS

## Marine Pollution of Ship Domestic Waste and Countermeasures

To cite this article: Rongjun Zhang 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **450** 012125

View the [article online](#) for updates and enhancements.

You may also like

- [Analysis of chemical parameters sourced from domestic waste in Lake Toba Region](#)  
Sri Indirawati and Amar Muntaha
- [Global burden of mortalities due to chronic exposure to ambient PM<sub>2.5</sub> from open combustion of domestic waste](#)  
John K Kodros, Christine Wiedinmyer, Bonne Ford et al.
- [Community Awareness on Domestic Waste Disposal Towards Its Impact to the Sustainability of Mangrove Forest in Kuala Selangor](#)  
N A Mazelan and F M Yusuff



**ECS**  
The  
Electrochemical  
Society  
Advancing solid state &  
electrochemical science & technology

**DISCOVER**  
how sustainability  
intersects with  
electrochemistry & solid  
state science research

# Marine Pollution of Ship Domestic Waste and Countermeasures

**Rongjun Zhang**

School of Jiangsu, Maritime Institute, Nanjing 211170, China

52582699@QQ.com

**Abstract.** Ocean is the natural environment for human survival and development. The exploitation and utilization of marine resources is one of the main methods to solve the pressures of the world's population, resources and environment. Moreover, the development of marine resources put forwards an important problem for mankind to prevent marine pollution, the various domestic waste produced by various ships in the ocean is one of the important sources of marine pollution. Therefore, preventing marine pollution caused by ship domestic waste, studying and formulating reasonable anti-pollution countermeasures, which has great practical significance for maintaining the sustainable development of the marine environment. For this reason, this paper analyzes the marine pollution caused by marine domestic waste, and proposes a waste recovery ship based on trimaran technology for recycling ship domestic waste.

**Keywords:** domestic waste; marine environment.

## 1. Introduction

With the continuous development of the marine cause, the number of ships sharply rise, while the pressure on the marine environment has intensified, resulting ocean and air pollution. With the gradual deterioration of the marine environment, the use and management of the marine environment has gradually been concerned by international society: therefore, it is necessary to strengthen the anti-pollution management of ships, attach importance to the protection of the marine environment, achieve sustainable development, and ensure the harmonious development of social ecology.

## 2. Pollution and Impact of Marine Domestic Waste on the Sea

Ship domestic waste is various foods, daily necessities and industrial supplies waste generated during the operation of the ship, mainly including plastic products, packaging materials, food waste, metal, glass, domestic sewage and oily sewage, etc., they are constantly produced in the actual operation of the ship, and make marine pollution more and more serious, moreover, with the continuous development of the economy, the ships' navigation density has increased, and the ship's domestic waste has gradually increased, resulting in the gradual seriousness of marine pollution. For ship domestic waste, if not handled properly, it has the following impacts on the marine environment: First, the domestic waste produced by the ship contains toxic substances; their entry into the water body will affect the water quality, resulting in the destruction of the living space of aquatic organisms. Second, the ship domestic waste has an impact on the self-purification capacity of the marine water body, resulting in deterioration



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

of the marine water quality. Third, the ship domestic waste is gradually deposited on the seabed, and cause the natural nutrient conditions of the plant to be affected, resulting in seabed pollution, and cause the extinction of aquatic organisms. Fourth, the organic matter in the ship domestic waste needs to consume dissolved oxygen in the water, which affects the self-purification ability of the water body; relevant information shows that the complete degradation of plastic waste discharged into the ocean by ships takes a long time. It can be seen from the above hazards that preventing the pollution of the marine environment by the ship domestic waste is very important for protecting the marine environment.

### **3. The Main Causes of Ship Waste**

#### *3.1. Seamen's subjective awareness is poor*

The seamen are the key to carry out marine cause. Many seamen are not fully aware of the dangers of ship waste to the marine environment. seamen' low subjective consciousness for marine environmental protection is one of the important factors leading to marine pollution, the seamen lives in the ship and improperly handles domestic waste and domestic sewage, resulting in environmental pollution. They often think that the rubbish they throw into the ocean is negligible in comparison with a vast expanse of water; moreover, they think that the ocean has self-purification capacity; it is a natural huge waste bin, under the guidance of this idea, they discarded all kinds of the waste generated during the actual operation of the ship into the ocean, waste are thrown into the ocean, cause serious pollution of the ocean. As an important part of the marine cause, enhancing the seamen's subjective awareness plays an important role in developing marine environmental protection awareness.

#### *3.2. Equipment factor*

Due to the economic interests, many ships with aging equipment are not updated and repaired in time, naturally, some ships have poor anti-pollution capacity, and the anti-fouling work on ships is seriously affected. Some port supervisors and environmental protection departments can only detect marine pollution in the offshore areas due to the backwardness of testing equipment; however, the pollution situation in the sea areas far from the port cannot be detected, resulting in an unsupervised state at sea, this make pollution at sea is more serious.

#### *3.3. Marine environmental problems lack legal system constraints*

The system is the key factor to ensure the harmonious development of the society, in allusion to the actual pollution of the marine domestic waste to the ocean, in addition to the seamen's weak environmental protection awareness, there is still a problem of insufficient environmental protection system, lacking of system constraints become the key factor of marine environmental pollution. It is necessary to manage the marine environmental problem through the marine protection law, prove the quality of the marine environment, however, the former legal rules are too broad, there is no clear solution to the waste problem occurs during the operation process of ships, resulting in the generation of domestic waste, which makes the marine environment gradually bad.

#### *3.4. Supervision Problem of Marine Environment*

First, the "Marine Environmental Protection Law" clearly stipulates that the National Environmental Protection Agency as the unified management department of the national environmental protection work, implement guidance on national marine environmental protection work, conduct coordinated management and supervision. Second, the Ministry of Ecology Environment is mainly responsible for the supervision and management of the marine environment, organizes the detection and inspection of the marine environment, conducts actual assessments, and is responsible for marine environmental protection work. Third, the Maritime Safety Administration is mainly responsible for the pollution of the marine environment caused by non-military ship in the jurisdiction, and conducts actual investigation and handling of pollution accidents. Management of many departments causes unclear right and responsibility

## 4. Countermeasures of Ship Domestic Waste

### *4.1. Enhance the seamen's protection awareness for marine environment*

The government can popularize and publicize marine knowledge, enhance the seamen's protection awareness for marine environment, lead the seamen to participate in the management of marine environment, and achieve the effective implementation of marine environmental protection, therefore, the state should list marine education in compulsory education, make the whole people realize importance of the marine environmental protection, and make everyone participate in marine environmental management and protection, form a comprehensive education system; moreover, special education for the marine environment management of the seamen is carried out. On the one hand, the seamen establish a strong awareness to safeguard the rights and interests of the sea and protect the marine environment in the process of receiving universal education; on the other hand, in actual ship work, the professional knowledge helps to strengthen the awareness of protecting the marine environment, realize the effective control and treatment of waste in the actual navigation process of ships, and make important contributions to the marine environmental protection.

Shipping companies should strengthen publicity and education on pollution prevention regulations to help crews understand the significance of preventing pollution and protecting the marine environment. Specific education and training content includes: Provisions of MARPOL 73/78 Convention and its amendments (including the "Ship Waste Management Plan" and "Ship Waste Record Book" record requirements), domestic regulations on ship waste, equipment for handling ship waste on board and its applicable management, collection, sorting, compression, storage and incineration of domestic waste on board, the system of port receiving the ship waste and receiving facilities and insufficient, the regulations on violating the management and punishment of ship waste. In particular, the government must strengthen the supervision and management of ship managers. The waste must be classified and managed strictly according to the requirements, and the corresponding treatment must be carried out according to the regulations, and various records must be made. The management of the ship waste record book must be strengthened and make it become one of the important anti-pollution documents for ships.

### *4.2. Improve the legal system of the marine environmental protection*

At present, with the growth of China's marine cause, the marine environmental protection legal system based on marine environmental protection law has been gradually formed to provide legal support for the sustainable development of China's marine environmental protection. However, in the actual implementation of the law, There are still incomplete laws and regulations phenomenon, It causes the concrete implementation process to cannot have the restraint function: therefore, we must formulate a marine environmental protection mechanism suitable for current economic environment, further improve current law, and achieve comprehensive protection of the marine environment: moreover, we must refine the restraint mechanism, Strictly supervise the navigation operation of ships, to prevent marine domestic waste from causing harm to the marine environment.

### *4.3. Strengthen the supervision of marine environment*

At present, China's current management departments for the marine environment are in a decentralized and fragmented development situation, which cause the blank of the actual law enforcement of the marine environment and the occurrence of repeated law enforcement, which makes the actual supervision of the marine environment in China cannot be guaranteed. The establishment of a unified and multi-functional maritime supervision and law enforcement team is of great significance to protect the marine environment, protect the marine rights and interests and develop the sea resources. The multi-functional marine management teams should make full use of modern advanced technology, in the case of saving manpower, material resources and financial resources, realize the actual integration of resources, realize the actual utilization of resources, timely supervise the ship domestic waste in the operation process of the ship, and perform the important duties of maritime law enforcement.

#### *4.4. Strengthen effective supervision for port waste*

Every port country should strengthen the management and inspection of the ship domestic waste, ensure that the port is not polluted. It is important to check whether the waste collection containers are standardized, whether the waste is stored in strict categories, and check the operation condition of the ship incinerator, once any false report is found, it must be dealt with seriously and management efforts should be strengthened. Each port must be equipped with enough ship waste receiving facilities. This is required by MARPOL73 Convention and national law and regulations. The waste receiving department shall also provide the ships with waste bins and waste bags, so as to clean up the ship domestic waste in the port area at regular intervals.

#### *4.5. Strengthen the punishment for violations.*

Because the port waste disposal belongs to paid service, individual ships secretly discharge waste. In order to avoid this situation, the ship waste information tracking system established by the ministry of transport and relevant ports can be used. Severe punishment measures should be taken for ships with serious pollution caused by illegal operation, so as to stimulate the seamen's awareness of pollution prevention. Some typical cases can be reported through the news media to further expand the scope of education, so as to attract the attention of relevant departments.

#### *4.6. Establish reasonable charges*

At present, the charge of receiving ship domestic waste is too low and the operation is difficult. The reasonable charge should be adjusted by investigating and calculating the cost composition, so that the companies which treat ship domestic waste can be maintained without loss and with a little surplus, this method can stimulate the enthusiasm of port staff in dealing with ship domestic waste.

#### *4.7. Advanced ship anti-pollution equipment should be equipped.*

If the ship is equipped with advanced anti-pollution equipment, the ship itself will have a stronger ability to deal with waste. In this way, the workload of ship waste disposal in port can be reduced. The shipping companies can carry out relevant technical research to reduce waste production, if we can develop decomposable man-made materials to replace the existing plastic products, reform and make new ship equipment, study loading and unloading technology to reduce waste generation, recycling and reuse technology and system on board, avoid the generation of waste from the root to reduce the workload of waste disposal.

### **5. Waste Recovery Ship**

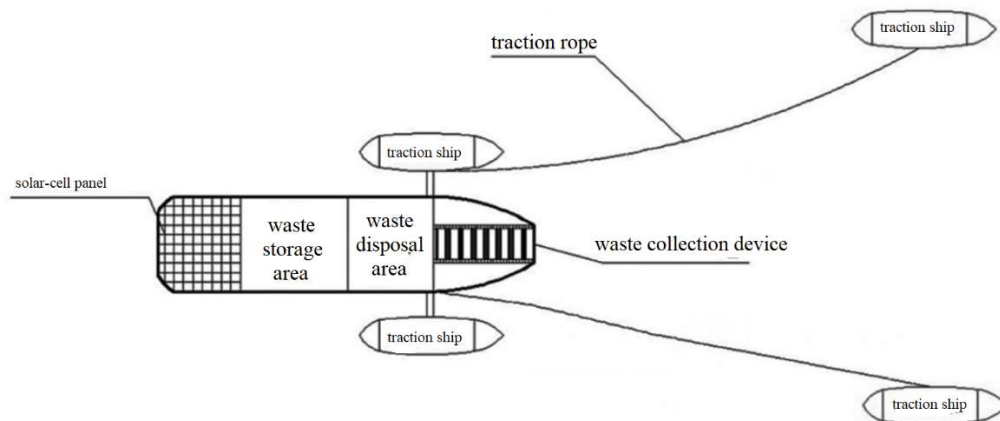
In allusion to the current shortcomings of marine waste collection and treatment, this paper designs and constructs a recovery ship that actively collects ship domestic waste.

#### *5.1. Design Concept*

Aiming at the current large amount of ship domestic waste floating on the sea, in order to alleviate the ecological crisis and ensure the safety of ship navigation and the personal safety of artificial collectors, this article designs a waste recovery ship based on trimaran technology, this ship is based on computer design theory, and ship design theory, the Internet of things and automatic control technology, and human-machine integrated waste identification technology maximize the efficiency of waste recovery ship, which can effectively remove and recycle ship domestic waste.

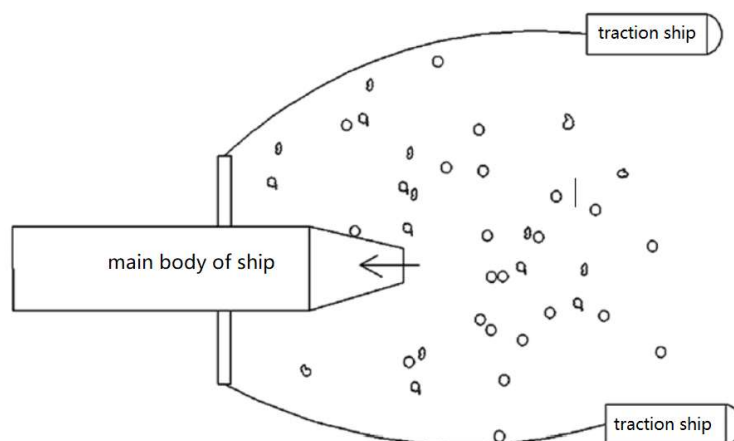
#### *5.2. Structure Design*

This waste recovery ship is mainly composed of main body of ship and a traction power ship on both sides, its structure is similar to a trimaran, as shown in Fig.1. The main body of ship is equipped with waste collection device, waste transmission mechanism, cutter, compressor, waste storage cabin, floating grid arrestor, retractor and other equipment, and solar panels are laid in the large open area of the main ship to solve the power problem of some equipment on board.



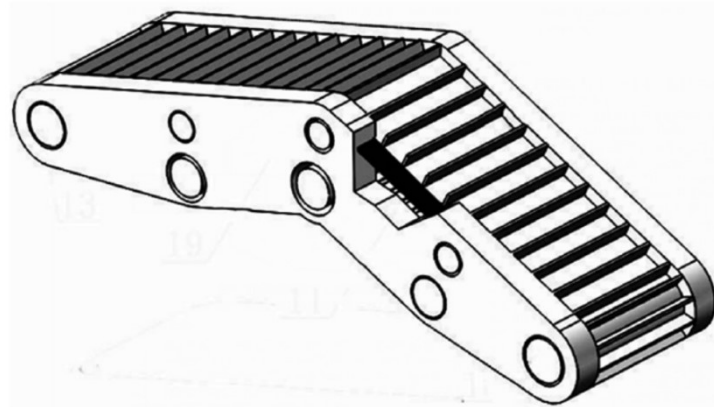
**Fig.1** Structure of a waste recovery ship

The main body of ship and the traction ship on both sides are connected by a movable mechanical arm, in which the mechanical arm drives the floating fence. The waste recovery ship is powered by a traction power ship; the main body of ship is dragged to the working sea area for waste cleaning and recycling. Firstly, through image recognition system, the waste recovery ship confirms target waste and then the work begins, at this time, the traction ship and the main body of ship is separated, and two traction power ships drag the floating fence to carry out waste containment. The work flow of this ship is shown in Fig.2. After the waste collection is completed, the main body of ship retracts the mechanical arm, and two traction ship drive the floating fence to gather the waste on the waste collection device for waste collection, after the collection, the waste will enter the waste disposal area, at this time, the traction ship and the main body of ship are combined to continue to search for the target waste.



**Fig.2** Working process diagram of the waste recovery ship

When the waste is surrounded by the waste collection device, the waste collection device starts to work. In the working process, first, the side of the conveyor belt of the waste collection device is immersed in seawater for the recovery of waste, and then the conveyor belt rotates. The conveyor belt in the working process is shown in Fig.3. In this process, through the image recognition system, different types of garbage are returned to the garbage disposal area. According to the waste type, different types of waste are returned to the waste disposal area, respectively. This device is heavy because the upper conveyor belt is mainly responsible for transporting waste, this waste recovery ship can handle and recycle waste well.



**Fig.3** Track device of waste recovery ship

## 6. Conclusion

To sum up, in the actual management of marine domestic waste, we should pay attention to the promotion of marine protection awareness, effectively control the generation of domestic waste, we should establish corresponding systems, realize the legal system to restrict the generation of marine pollution, and effectively control and manage the marine environment. Moreover, all marine departments should work together, coordinate and complement each other to achieve effective and powerful supervision, ensure the effective control of the ship domestic waste and realize the sustainable development of the marine environment. From the perspective of ship domestic waste treatment, this paper calls for people's understanding of the protection of the marine environment. In a word, the protection of the marine environment needs the conscious maintenance of the seamen and the supervision and inspection of the departments at all levels. We hope that everyone take action to prevent marine pollution and reduce it to the lowest level, so ensure that the ocean is cleaner and the environment is more beautiful, thus creating a good natural environment for the development of marine cause.

## References

- [1] Mao da. A Historical Account of Marine Waste Pollution and Its Remedies[J]. Journal of Yunan Normal University (Philosophy and Social Sciences Edition), 2010, 42(6), 56-66..
- [2] Wang Yongtang, Qian Zhilin. Preventing Pollution Due to Vessels of Ideas and Skills Check[J]. Public Communication of Science & Technology, 2011, (8), 141-142.
- [3] Chen Fujin. Marine Pollution Prevention and Control Measures[J]. Guangdong Science&Technology, 2011, 20(14): 145-146.
- [4] Cheng Chuanliang, Yan Xuntang. Ships to Sea Pollution and Government Measure[J]. China Water Transport, 2006, 6(7), 12-13.
- [5] Bai Yang. On the Existing Problems in China's Ship-source Marine Pollution Prevention and Control Law and Their Perfection, Journal of Tianjin Administrative Institute of Political Science & Law, 2009, 25(3), 74-77.