

Management of food waste on cruise ships

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The aim of this paper is to determine the amount of food waste generated on cruise ships, and its method of disposal. Based on the obtained data, the impact of cruise tourism on the municipal waste management system on the mainland was assessed.

The latest estimates show that around 88 million tons of food waste is generated in the EU annually. Therefore, this is equal to 174 kg per person, respectively a total of 170 million tons of CO₂ per year, and in economic terms a total of 143 billion euros that end up as a waste. (EUFIC, 2021)

Tourism is extremely important in the Croatian economy, and therefore the impact of this sector on the environment is important because tourism activities directly affect the environment. There are three main reasons why tourism affects the environment. First, there is an increasing number of people who travel on vacation several times a year. Secondly, there is a need to take organizational and technical measures to accept them, which is especially related to the construction of new facilities, and thirdly, tourists during their travels and in their place of stay affect all elements of the environment.

Round trips are characterized by a large number of guests in one place who stop on land and make a daily visit to the specific place where they dock. Reducing the amount of waste that ends up in landfills on land from cruise ships is also one of the goals of all cruise companies. Sustainable excursion tours and consumption of food from sustainable sources are also imperative.

One of MARPOL's requirements is that the ship keeps records of the discharge of food waste into the sea and of the unloading of the same in the port. After the waste has been unloaded in the port, the port concessionaire for receiving waste is obliged to issue a receipt to the ship with the exact categories of received waste and the quantity expressed in cubic meters. (MARPOL, 2013)

The system for handling food waste on Valiant Lady is designed so that the residues stored in vacuum tanks are mostly dehydrated and stored in the biomass tank (thick mushy mixture). Up to 70% of water is removed. In this way, the volume is reduced, and thus the demand for storage space is also reduced.

On cruise ship the waste is collected and stored at lower temperatures in the so-called cold room and offloaded in the port following national and local regulations for food waste offloading. (Worldwide Marine Technology Limited, 2021) This indicates that it is necessary to plan in advance the handling of food waste. Food waste management system is given in Figure 1.

Food waste data was collected on the cruise ship Valiant Lady between December 22, 2021 and February 22, 2022 (63 days). Total of 13 feeding stations are used to transport leftover food and organic waste from food preparation rooms, restaurants, kitchens and dishwashing facilities. The basis of the transport system is vacuum technology, which is organized in two main lines, but with the possibility of turning from one to the other, so as to ensure continuity in the supply of the system (line A and line B). (Worldwide Marine Technology Limited, 2021)

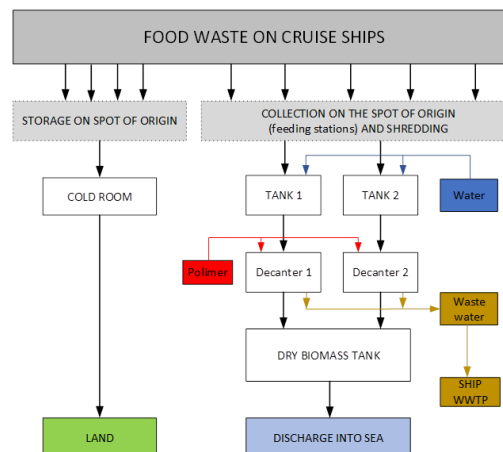


Figure 1. Food waste management system on cruise ship

According to the data collected in the period from December 22, 2021 to February 22, 2022, 58.47 m³ of dehydrated food residues (removed 70% of the added water) were produced on the cruise ship Valiant Lady, which were discharged into the sea when it was allowed. Also, 29.3 m³ of food residues were handed over to the authorized concessionaire in the port. The number of passengers and crew members in that period ranged from 350 to 1,310. In total, 87.77 m³ of food waste was generated. If the ship did not have an advanced system for processing food waste, the waste could not be dehydrated and the volume of food released into the sea would be 191.88m³. If the volume of food waste delivered to the port were added to that figure, the total volume of food waste would amount to 221.18m³.

According to a study by European Maritime Safety Agency, on passenger ships, 0.001 to 0.002 m³ of food waste is produced per person per day. The analysis of data from the ship Valiant Lady showed that, on average, 0.0019 m³ of food residues (after dehydration) were produced per person per day, which confirms the EMSA study. (European Maritime Safety Agency, 2016) According to literature data, food waste produced on ships in the ports of Quebec was 0.0061 m³/day/person (Vaneckhaute and Darveau, 2020), while 0.0047 m³/day/person was generated on the ship Lady Valiant, which is slightly less than the literature data presented (29 % less). Some authors report 0.97 kg/person per day (0.0026 m³/day/person). (Kotrikla et al., 2021)

Biowaste generated on cruises was calculated based on measured data on the ship Valiant Lady, gathered data of the number of passengers on cruises in the Republic of Croatia in 2019, and national report on municipal solid waste.

Table 1. Amount and total share of food waste produced by citizens, tourists on land and passengers on cruise ships

| | Amount of food waste (biowaste) (t) | share (%) |
|----------------------|-------------------------------------|-----------|
| Citizens | 478,972.80 | 84.25 |
| Tourists on mainland | 89,052 | 15.66 |
| Cruise ships | 481.01 | 0.08 |
| Total | 568,485.41 | 100 |

Based on the obtained results, it is evident that the share of biowaste (food waste) from tourism on land is about 15.66%, while the share of this type of waste from tourists (and staff) on cruises is only 0.08%.

Around the world there are various citizen associations that oppose the operation of cruise ships on the grounds that they pollute the air, sea, water, sensitive habitats, coastal communities and wild animals. It is unfortunately true that there have been incidents when cruise ships have illegally discharged untreated waste water and oily water into the territorial waters of some countries or food residues mixed with plastic, either intentionally or due to ignorance. The companies were fined and placed under increased maritime inspectors in all ports for international traffic.

Today, cruise ship companies transparently display all data about their operations and impact on the environment. Also, in recent years, the cruise ship industry has been making progress in building more environmentally friendly and eco-friendly ships, implementing the latest technological advances and designs that reduce the emission of harmful gases. The goal of most companies is to reach zero emissions by 2050.

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