

Large-scale plant to test new treatment technology for ships' ballast water

DHI's new gigantic plant in Hundested harbour in Denmark is to give green light for the Danish Desmi Ocean Guard ballast water treatment system.

DHI is close to completing the construction of its new test plant in Hundested, which will soon be used to test a new method of removing non-native organisms from ships' ballast water.

The main features of the system developed by the Danish company Desmi Ocean Guard are a low pressure filter, ozone and UV irradiation.

The technology has been developed to gain a piece of pie when the ratification of a UN convention on ballast water treatment latest in 2016 will give rise to a new billion dollar market. Once the convention is ratified, all of the world's 100,000 commercial ships will be required to have treatment systems onboard ensuring that ballast water does not spread so-called 'non-native marine species' in foreign ecosystems.

This initiative will incur costs of at least 11 billion USD for the shipping industry to invest in new treatment systems – money that Desmi Ocean Guard (DOG) expects to get a share of. The company will therefore launch the tests to obtain approval for the new treatment system in April and thereby take an important step closer towards the market.

The plant in Hundested will feature a 7,5m tall tank, which can contain up to 750 cubic metres of water to run through the treatment plant. "Moreover the plant has a number of collecting tanks, in which the treated water can be tested", says the head of DHI's centre for environment and toxicology, Torben Hansen.

The new test plant will come at a high cost, but DHI expects to carry out tests for other customers as well once Desmi Ocean Guard has concluded its test runs this summer.

Environmentally friendly treatment

The major asset of Desmi Ocean Guard's system is that it is environmentally friendly and energy efficient.

"The main component of our treatment system is physical, and we are therefore able to avoid the use of chemicals. The advantage of this is that you do not need to worry about something going wrong during treatment so that the vessel could pollute the ocean when discharging ballast water", says Mark Kalhoj, project manager in DOG.

Nevertheless, the system operates with added ozone, which triggers a chemical process (oxidation), but according to Mr Kalhoj there is no risk of the ozone polluting the ocean when the ship discharges ballast water.

Firstly, the used amounts of ozone are rather low since it is the secondary disinfectant. Secondly, ozone, or O₃, is extremely reactive and will always attempt to get rid of one of its O-molecules in order to be able to transform into oxygen. Should there, despite this process, be any ozone remains in the water, these will be converted into hydroxyl radicals when exposed to UV rays. Hydroxyl radicals have a life span of a few nanoseconds.

Once all test results have been gathered in autumn, the data needs to be analysed. According to Mark Kalhoj, DOG will then submit their application for final approval of the system by the end of the year.

1. **Filtering.** A rotating pressureless filter removes larger particles from the water and only lets organisms smaller than ten micrometres penetrate.
 2. **Oxidation.** Ozone (O₃) is similar to atmospheric oxygen, but has an additional O-molecule, which makes the matter chemically unstable. Ozone tends to reject its additional molecule by reacting both with organic as well as inorganic material: this is called oxidation. Excessive ozone will be transformed into oxygen and hydroxyl radicals under UV-treatment.
 3. **UV-treatment.** The water is exposed to strong ultraviolet light killing all microbes, bacteria etc. The advantage of this method is that organisms are unable to become resistant to the light, contrary to chemicals.
- Seawater inflow
 - Treated water led into the ballast tanks
 - UV lamps are imbedded in larger glass tubes with an air layer in between. In this layer, ozone is formed to be used in the ozone reactor.

The Desmi Ocean Guard system can be installed on various ship types, and the illustration is therefore universal. The sea water is led from the intake in the sea chest through a filter, subsequently it undergoes ozone treatment and then UV irradiation before it reaches the ballast water tanks.

- Bacteria, microbes and other organic material
- Ballast water tank
- UV irradiation
- Addition of ozone
- Sea chest
- Filter
- Pump