Y. de Lafontaine et al., Ecotoxicology and Enviromental Safety 71 (2008) 355-369 found a biocidal activity for peracetic acid in the Microtox® test that is more than a hundredfold higher than for hydrogen peroxide. A ballast water treatment using equilibrium peracetic acid of trade mark PERACLEAN® Ocean was approved by the IMO for ballast water treatment.

EP 1 671 932 describes a method for treating ballast water by adding from 10 to 500 ppm of hydrogen peroxide or hydrogen peroxide-forming compounds in combination with iron(II) ions, catalase or iodine. The method described in EP 1 671 932 is not approved by the IMO for ballast water treatment.

The inventors of the present invention have now found that the effectiveness of the ballast water treatment with equilibrium peracetic acid known from EP 1 006 084 may be further increased if catalase is added to the ballast water together with equilibrium peracetic acid. Advantages result most notably for ballast water at a low temperature and at low salinity of the ballast water. In addition, the addition of catalase together with equilibrium peracetic acid simplifies removal of unused peracetic acid before treated ballast water is discharged.

## Summary

In a first aspect, the disclosure therefore relates to a method for treating ballast water on a ship, characterized in that, on uptake of ballast water into the ship, equilibrium peracetic acid and catalase are added to the ballast water, wherein equilibrium peracetic acid is added in an amount from 5 to 50 mg/l peracetic acid and catalase is added in an amount which within 120 h breaks down the content of the hydrogen peroxide introduced with the equilibrium peracetic acid to less than 2 mg/l in the ballast water.

In a second aspect, the disclosure further relates to a device for treating ballast water of a ship, comprising at least one ballast water tank (1), a

conduit (2, 3, 4, 5, 6, 7, 8) for filling the ballast water tank and a conduit (8, 9, 3, 4, 10) for emptying the ballast water tank, characterized in that metering devices (15, 16) for equilibrium peracetic acid and catalase are connected to the conduit for filling the ballast water tank, and a metering device (17) for a reducing agent is connected to the conduit for emptying the ballast water tank, characterized in that the conduit for emptying the ballast water tank is provided with a measuring device (14) for salinity actuating the metering device (17) for a reducing agent.

Detailed Description

In the method according to the invention, equilibrium peracetic acid and catalase are added to the ballast water on uptake into the ship.

Equilibrium peracetic acid designates, according to the invention, a mixture which consists essentially of water, hydrogen peroxide, acetic acid and peracetic acid and in which these components are in a chemical equilibrium in accordance with equation (I).

(I) $CH_3COOH + H_2O_2 \leftrightarrows CH_3COOOH + H_2O$

Preferably, the equilibrium peracetic acid contains about 15% by weight peracetic acid, about 14% by weight hydrogen peroxide and about 27% by weight acetic acid. A suitable equilibrium peracetic acid having this composition is obtainable from Evonik Industries under the brand name PERACLEAN® Ocean.

The equilibrium peracetic acid preferably contains up to 5% by weight of a mineral acid, preferably polyphosphoric acid, in addition to water, hydrogen peroxide, acetic acid and peracetic acid. The addition of the mineral acid accelerates the establishment of the chemical equilibrium in accordance with equation (I). The equilibrium peracetic acid preferably additionally contains up to 1% by weight of a stabilizer complexing metal ions, wherein pyrophosphates and chelating phosphonic acids are particularly preferred.

The equilibrium peracetic acid is added to the ballast water in an amount from 5 to 50 mg of peracetic acid per

8. Device for treating ballast water of a ship, comprising at least one ballast water tank (1), a conduit (2, 3, 4, 5, 6, 7, 8) for filling the ballast water tank and a conduit (8, 9, 3, 4, 10) for emptying the ballast water tank, characterized in that metering devices (15, 16) for equilibrium peracetic acid and catalase are connected to the conduit for filling the ballast water tank, and a metering device (17) for a reducing agent is connected to the conduit for emptying the ballast water tank, characterized in that the conduit for emptying the ballast water tank is provided with a measuring device (14) for salinity actuating the metering device (17) for a reducing agent.

9. Device according to Claim 8, characterized in that the conduit for filling the ballast water tank is provided with a flow metering device (12) actuating the metering devices (15, 16) for equilibrium peracetic acid and catalase.

10. Device according to Claim 8 or 9, characterized in that the conduit for filling the ballast water tank is provided with a temperature measuring device (13) and/or a measuring device (14) for salinity actuating the metering device (16) for catalase.

11. Device according to any one of Claims 8 to 10, characterized in that the conduit for emptying the ballast water tank is provided with a flow metering device (12) and a sensor (24) for the peracetic acid content actuating the metering device (17) for a reducing agent.

12. Device according to Claim 11, characterized in that the sensor for the peracetic acid content is an amperometric sensor.

~~13. Device according to Claim 11 or 12, characterized in that the conduit for emptying the ballast water tank is provided with a measuring device (14) for salinity actuating the metering device (17) for a reducing agent.~~

~~14.~~13. Device according to any one of Claims 11 to ~~13~~12, characterized in that the conduit for emptying the ballast water tank is provided with a sensor (25) for the hydrogen peroxide content actuating the metering device (17) for a reducing agent.

~~15.~~14. Device according to any one of Claims 8 to ~~14~~13, characterized in that a separating device (28) for particles having a size in the range from 2 to 100 µm is arranged in the conduit for filling the ballast water tank upstream of the metering devices (15, 16) for equilibrium peracetic acid and catalase.