Abstract

Only 2 per cent of the oil products found annually in the world ocean are contributed to bilge water. That percentage should be regarded considerably greater considering that available bilge water separators show a number of defects resulting in frequent failures. The percentage should be increased because those separators cannot actually treat surfactant chemical-polluted waters used to wash greased surfaces as well as sludge tank waters representing a tri-phase emulsion of extremely high contents of mechanical additives.

Therefore, there is a need to improve bilge water separators. We suggest a technical solution including the joint treatment of bilge and faecal water whereas the purification of both flows is done biologically. We believe that our solution does not only remove separator shortcomings, but enjoys a reliable structure, particularly easy to maintain.

Introduction

Global warming is more and more spoken openly of. However, the general public hardly believes that our home, the planet, is threatened by a serious catastrophe. Therefore, it is indispensable that a lot more Papers should refer the tackled issued to that phenomenon, explain the causes for it, point to measures, and develop technologies and equipments to overcome it.

It is widely known that the main cause is environmental pollution, and mostly, greenhouse gases. The world ocean pollution should not be neglected either. The main pollutants are the ships. Even the slightest oil layer on the sea surface prevents water from gas exchange. And the world ocean is indeed the planet lung.

The greatest percentages of oil products at sea are due to ship crashes, and then come wash water from tankers.

Bilge water is only reported by a 2%-share. That percentage should be regarded considerably greater considering that available bilge water separators are largely unreliable. Defects such as:

- Small settling capacity;
- Frequent failures of the measuring and discharge system gauging the gravity-separated oil layer out of the separator settling tank.

A failure means pollution of all three separator tanks by oil products. Then comes a thorough
wash and replacement of coalescence and filtration element – especially hard and expensive operation.

- The ceramic filter at the separator outlet is very easily blocked up. The filter itself is a misunderstanding. It is installed there to allow the measuring of pollutant concentration in outgoing water by means of special system. That system, too, is a misunderstanding, since it measures transparency rather than concentration. Therefore, even if water does not contain any oil products, but is non-transparent due to mechanical additives, the measuring system will switch off the separator. System sensors installed in a particularly moist environment display frequent defects.

- Separators are unable to treat water containing surfactant chemicals. Those are chemicals used to wash greased surfaces such floor plates, filters and separators, i.e., fuel and oil machine parts. Through wash water those chemicals are led into bilge.

- Separators are unable to treat the water contained in sludge tanks as they are characterized of high contents of mechanical additives - the ceramic filter is immediately blocked up.

Thus continuous, expensive and unattractive maintenance is expected. It should not be forgotten that bilge water separators matters only a little to ship’s survivability.

All these shortcomings make separators unusable, and force crews to find ways of pumping bilge water right out to sea, and very often, along with all oil products separated into the sludge tank, since no border can be drawn between the products and water.

Our assertions are based on an experience of over 30-years: observations and maintenance of separators operating on vessels of ship-owners of various countries.

Installation Description

What was said so far is a good reason for a radically new technical solution. Our objective is to avoid the shortcomings hereinabove said, and develop a bilge water separator of steady and reliable operation as well as make maintenance crew work easier.

We suggest a joint treatment of bilge, black and grey water. The theory of contaminated environment purification has it that two different pollutants are more efficiently removed when treated jointly. Oil and faecal water are just such pollutants. The suggested purification method is a biologically-based method. First, oil water is treated separately by means of prolonged settling and coalescence; then it goes to the disintegration tank of the biological part. Faecal water is sent directly to the same tank. Reliable measures are taken to keep the great quantities of oil products within the bilge tank, and prevent them from moving to the
coalescence tank. This runs counter to the available solution to see to the discharge of oil products out of installation, which requires the use of a system to measure and remove oil products. The suggested solution requires neither this system nor the one measuring the outgoing water transparency. The ceramic filter, too, is not needed. Measuring the outgoing water purity is done by observing the living condition of active biomass. Tinned bacteria availability on the market makes this solution easier.

**Method of Operation**

The ship’s bilge pump drives bilge water into the bilge tank. The bilge tank is of the required height, and is used as settling tank. Low capacity Pump 3 sucks in the settled water from here, and pumps it to the Coalescence Tanks 1 and 2 filled of polystyrene granules. From Tank 2 through Inlet 23 water is driven into Disintegration Tank 17. Tank 1 and 2 bottoms house a wash water volume where Serpentines 8 are located. Outboard fresh water under pressure is fed through Valves 7 into tank bottoms. Wash water is passed through the granules, and via top Valves 7 is driven to the bilge tank. This hot water washing of already heated granules prolongs their life, and extends the period of time between two washes and granule refilling. Valves 10 and 12 serve to continuously drive the separated oil products to the bilge tank. Due to the long settling in the bilge tank the products are in a small quantity, and of low relative weight. Level Gauge 15, Vacuum Gauge 14, and Pressure Gauge 13 serve to prevent large quantities of oil products from getting into Tanks 1 and 2, and there is no longer a need of subsequent general wash or refilling.

The installation can very efficiently operate even without tank 2.

**The biological part of the Installation, like any Sewage Treatment Plant, consists of Disintegration Tank 17, Settling Tank 18, and Chlorination Tank 19. Case 24 filled with coke is mounted above the one Air Disperser 22 in Tank 17. Coke helps bacteria survive the stress resulting from the high concentration of oil product and the available surfactant chemicals as well as the acid preparations for sanitation uses. This is the essence of our patent.**

Both Air Compressors 2 can be replaced by one high pressure fan. A biological part prototype has been tested using two types of fuel – heavy and light, and two types of surfactant chemicals used to wash greased surfaces, produce of Gamlen and Ameroid. The tests have been carried out with pollutant concentrations of 15, 50, 100, 150 and 250 ppm. The pollutant is 50% fuel and 50% chemical. As no faecal flow was available during the test ammonium phosphate was added.

The Table below shows the results and treatment times.
All final pollutant concentration results are below 0,2 ppm at the expense of prolonged time. High concentrations such as those used for fuels and particularly, for chemicals, cannot be obtained, under natural conditions, at the biotank inlet following a preliminary treatment of oil water. Chemicals are usually used with a concentration less than 5%. Actually, both chemicals and their surfactants are hard to disintegrate biologically.

Normally, bacteria grouped in colonies float freely in the disintegration tank driven by the air coming in through dispersers. During the high concentration test – of over 100 ppm – coke was stuck with bacteria.

The abdominal tract flora and fauna are suitable strain bacteria. A collection of bacteria disintegrating oil products offered in tinned condition on the market can also be used.

The above Installation has been reported to the IMO Central Office. Having announced their positive attitude, the Central Office referred us to Chapter EQUIVALENTS, MARPOL. Bulgarian Maritime Association expressed a wish that an Installation model should be tested onboard a ship and the results of natural tests be reported to the Central Office. Unfortunately, due to administrative hindrances, and changes in Bulgarian State Shipowner administration, no tests have been carried out.

**Installation Advantages**

As compared to the available separators the suggested installation has the following advantages:

1. Opportunity for successful treatment of surfactant chemical-polluted bilge water to be used to wash greased surfaces.
2. Opportunity for successful treatment of sludge tank released water.
3. Long and steady operation with guaranteed purification of bilge water and the mechanical additives therein from oil products.
4. Biomass of secured vitality, and protected from high percentage of oil products and chemicals, acids inclusive.
5. Simple and effective maintenance.

**Conclusion**
The above advantages are a proof that the suggested installation must be implemented. This will facilitate considerably the crew work, will prevent the crew from illegal actions, will make the purification process reliable, and will contribute essentially to a cleaner world ocean.

As measures are taken to reduce great pollutants from ships, such as ballast and wash water, so should the pollution from the smallest source, bilge water, be reduced. Bilge water is small in quantity, but is daily disposed.

The technology significance is increased by the fact that the technology can also be applied to shore and floating treatment plants.

References