Sediment in the ship's ballast water tank: A forgotten problem

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On 8. September 2017. the International Maritime Organization's (IMO) International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) Convention has entered into force. It deals with one of the greatest threats to coastal and marine environments around the world: aquatic invasive alien species (IAS). Although the control of IAS through treatment of ballast water is appropriately dealt in the Convention and its implementation, the problems generated by sediments are not treated in such a manner. For example, Convention's Guideline G1, which addresses sediments does not set out definite treatment procedures or discharge standards, asking only that the applied procedure should avoid unwanted side effects. As a result, ship operators have devised their own method: they dump it at sea, at least 200 miles offshore and in at least 200m of water.

Among others, we have pointed to the problem of sediments, meaning matter settled out of ballast water within ship, some time ago [1]. Regulation B-5 Sediment Management for Ships states that all ships shall remove and dispose of sediments from spaces designed to carry ballast water in accordance with the provisions of the ship's Ballast Water management plan. New ships should be designed and constructed with a view to minimize the uptake and undesirable entrapment of sediments, facilitate removal of sediments, and provide safe access to allow for sediment removal and sampling, taking into account guidelines developed by IMO.

In addition, under Article 5 of BWM Convention Sediment Reception Facilities, Parties undertake to insure that ports and terminals where cleaning or repair of ballast tanks occurs have adequate facilities for the reception of sediments.

Recently, we have witnessed the increased interest in ballast tank sediments. There is a number of published technical and scientific papers, discussions and commentaries. For example, Maglic et al. [2] reported elemental analysis of ballast water sediments. Their results indicate that the sediments samples mostly consisted of compounds that originated from the deterioration of tank plates, tank coating residues and ballast operations such as clay, slit, sand and organic materials. No significant heavy metals or highly toxic elements were found. Baiely et al [3] studied the ballast sediment of transoceanic vessels operating on the North American Great Lakes to determine if ballast sediments could serve as a vector of nonindigenous species. The accumulation of sediments derives from the obstruction of the scallops in the tanks' structures, and by the non-direction of sediments towards the BW suction bell. To minimize this problem, paper by Pereira [4] proposes modifications in the de-ballasting systems of ships that can be implemented in either existing ships or incorporated in new construction.

Most of the ballast tank sediment (~90%) is made of particles ≤50 μm with about 60% of particles ≤20 μm. This poses a problem to the filtration of large volumes of ballast water which might contain particulate matter up to 1% volume [5].

Several systems for the treatment of ballast waters use a combination of two or three techniques, filtration being usually the first and/or the last step. Presence of sediments in ballast waters imposes the limits on applicability of these methods. For example, systems with UV irradiation cannot eliminate all organisms present in ballast waters because of inability to deliver a stable lethal dose to ballast waters of variable quality. The presence of sediments drastically reduces the effectiveness of UV irradiation because the sediment particles protect small organisms from exposure to irradiation.

We advocate the use of radiation treatment by using electron accelerator, preferably in an on-shore installation or as a mobile, additive sea container sized units with integral power, separated for water and sediment treatment.

References: [1] V.Valkovic and J.Obhodas. (2015) 9th International SedNet Conference 23-26 Sept. Cracow Polland,*;* [2] Maglic et al. (2016). Marine Pollution Bulletin **103** : (1-2) ; [3] S.A.Bailey et al. (2007). *Aquatic Ecosystem Health and Management* **10**:93-100; [4] N.Pereira (2013) *Naval Engineers Journal* **125-2(2)** : 127-134 ; [5] S. Gollasch (2017). *https://www.ballastwatermanagement.co.uk/news/view,sediments-the-forgotten-aspect-of-ballast-treatment_46837.htm*