Efficacy of a Hypochlorite Generator and Filtration Treatment System in Preventing the Introduction of Non-indigenous Aquatic Species Found in Ballast Water

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Keywords: ballast water, chlorination, microbiology

Oceanic shipping transports and discharges an enormous volume of ballast water between ports across the globe. When discharged, organisms contained in ballast water have the potential to become established as invasive species. Ballast water treatment may be the best method for adequately controlling ballast water organisms. A filtration and sodium hypochlorite (bleach) generation system was tested for its effectiveness in removing and inactivating bacteria, zooplankton, and phytoplankton found in Puget Sound. Sodium hypochlorite was electrolysically generated, by passing an electric current through a stream of seawater in an electrolytic cell. The system also included a 50 micrometer filter designed to remove organisms and particulates larger than 50 micrometers in size. Experiments were conducted in 280 L mesocosms, which were filled with treated water, stocked with ambient zooplankton, and covered to simulate ballast tank conditions. Samples were periodically taken from 5 hours to 10 days and were analyzed for chemical, physical, and biological parameters. Preliminary results from experiments conducted in 2004 showed greater than 99% reduction of organisms in treatments using a combination of chlorination at or above 3.0 mg Cl₂/L and filtration in samples collected 5-hours after treatment. Bacteria in treated samples remained at very low concentrations after 10 days. Chlorophyll a levels were at or below the detection limit (0.02 micrograms/L) starting at 5 h. Very few zooplankton survived after 5 h of treatment and none survived after 24 h. Based on our initial results, the treatment system appeared to be very effective at eliminating potential aquatic invasive organisms.