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## Ballast water treatment system testing

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1. Ballast water treatment systems must solve the conundrum of disinfecting ballast water without causing harm to the crew, general public and the environment.
2. Even the most effective active substances to disinfect ballast water are useless when adequate neutralization methods and inline sensors for dosing control and residual discharge monitoring are not available.
3. The contribution of heterotrophic bacteria relative to dead organic material in challenging ballast water treatment systems during type approval testing should be further investigated.
4. The lack of regulating discharge of heterotrophic bacteria may lead to high bacterial growth in ballast water as a side-effect of treating  $\geq 50 \mu\text{m}$  and  $10\text{-}50 \mu\text{m}$  organisms.
5. It is an uphill battle to further improve automated image analysis software to better distinguish living and dead organisms in ballast water. Instead, the addition of motion tracking solves many limitations of camera-based ballast water compliance tools.
6. Measuring ATP levels of a wide variety of  $10\text{-}50 \mu\text{m}$  organisms in various stages of their growth cycle at concentrations between 5 and 50 cells  $\text{mL}^{-1}$  will improve pass/fail levels for ATP-based ballast water compliance tools.
7. Successful ballast water compliance tools are easy to use and yield quick results.
8. Without enforcement any regulation is powerless.
9. To truly appreciate someone, you must learn to accept the good as well as the bad.