The ultimate system for ballast water discharge analysis

FastBallast provides an ultra-sensitive solution for on board ballast water monitoring at the D2 regulatory limit. High sampling rates, made possible by incorporating Single Turnover Active Fluorometry (STAF), makes FastBallast better suited to analysing phytoplankton cells at the D2 threshold of ten cells/mL than more common (Multiple Turnover) PAM methods.

When analysing a sample, FastBallast first initiates a level 1 indicative test, which takes less than 2 minutes. If this generates a clear PASS or FAIL, testing is halted and the result is reported. If not, FastBallast automatically extends the test to level 2, which is completed in less than 10 minutes.

In contrast to other bulk sample fluorescence methods, the distribution-based FastBallast level 2 test does not require assumptions to be made about the amount of fluorescence per cell. The estimate of cell density generated is within the margin of error for microscope-based analysis up to concentrations of several hundred cells cells/mL.

With FastBallast's level 2 test, false negatives are extremely unlikely and false positives are virtually impossible. In contrast, estimates of cell density from alternative bulk sample tests can be orders of magnitude away from the true cell density.

Consequently, false positive results can only be minimised by setting the threshold for a PASS so low that false negatives become more likely, even at high cell densities.

To allow for potential changes to the regulations, FastBallast also incorporates four excitation wavelengths to provide greater flexibility for interrogating cyanobacteria.

Specifications

User interface	Panasonic ToughPad or Windows-based PC running FaBtest GUI
Sample volume	20 mL
Interrogated volume	0.5 mL
Excitation	Four channels (Royal Blue, Blue, Green and Red)
Sensitivity	<1 cell/mL
Dynamic range	0 – 4000 cells/mL
Time to result	<2 minutes for level 1 <10 minutes for level 2
Power	Internal rechargeable battery pack provides 8 h continuous operation
Connectivity	USB, Bluetooth or Ethernet
Dimensions	240 x 198 x 109 mm
Mass	5.0 kg
IP rating lid closed (open)	IP68 (IP65)
Service interval	Greater than two years

Flow-through accessory

Uniquely, FastBallast's STAF measurement technique works in flowing water. The portable, fully automated, FastBallast flow-through accessory provides continuous level 1 and discrete level 2 monitoring capability for validating the complete ballast water discharge or assessing treatment levels required at uptake.

Contact us today to see how we can help you

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In view of our continual developments, the designs and specifications of our products may vary from those described.

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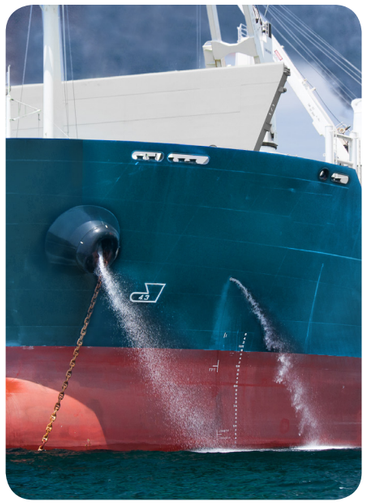
FastBallast

Portable Compliance Monitor

www.chelsea.co.uk

Portable system for on board compliance monitoring of treated ballast water to the IMO D2 (10 to 50 µm) standard



Users:

- Manufacturers of Ballast Water Treatment Systems (BWTS)
- Ship yards, operators and owners
- Port State Control and other compliance officers
- Service suppliers
- Analytical Laboratories
- Flow-through accessory kit includes pump and precision filtration

Chelsea Technologies Group Ltd

Product Information

Product Information

What can the FastBallast system do for you?

Advantages

- Provides rapid, on board compliance testing to the D2 limit (10 - 50 µm in the smallest dimension)
- Detection limit of < 1 cell/mL
- Size-independent measurement of cell density
- Sampling issues associated with analysing small static volumes at close to the D2 threshold are overcome by using a larger stirred volume of 20 mL
- Very low level of false negatives and negligible possibility of false positives
- Wide dynamic range provides a high tolerance of background fluorescence (from dead cells, CDOM and other sources)
- High level of turbidity rejection
- No consumables or sample preparation required
- Long service intervals (greater than two years)
- Flow-through accessory available for continuous discharge monitoring

Ballast Water Monitoring

It has long been accepted that ballast water functions as a vector for the transfer of harmful organisms. The IMO 'Ballast Water Management Convention, 2004' was established to tackle the problem of invasive species and is being adopted around the world.

Ballast water discharge must not contain more than 10 cells/mL of 10 - 50 µm in the smallest dimension. Because this size range is dominated by phytoplankton, active chlorophyll fluorometry is widely viewed as the most appropriate test technology.

The FastBallast active chlorophyll fluorometer provides on board, compliance-level testing, where most systems can only provide indicative results.

Step	Standard Procedure	FastBallast Procedure
1	Inspection of documents and BWMS	
2	Detailed inspection and check against plan	
3	On board indicative test	On board compliance test
4	Samples taken for shore-based compliance test	

Table 1: *FastBallast provides an* ***on board compliance-level test.***

Just Add Water

- Pour 20 mL of ballast water into the sample chamber using the measuring cup supplied
- Press 'Run Test' on the touch pad display
- A test takes between 2 and 10 minutes, depending on how close the sample is to the D2 threshold
- The test result comprises PASS/FAIL, confidence level and cell density (cells/mL)

Size Matters!

Standard Parameter	*Thalassiosira punctigera*	*Dunaliella salina*
Fv/Fm	0.111	0.940
Fv	0.254	0.263
Cells/mL		
Level 1	111 (FAIL)	94 (FAIL)
Level 2	8.8 (PASS)	360 (FAIL)
Microscope	7.0 (PASS)	427 (FAIL)

Table 2: *Data demonstrating FastBallast analysis is independent of cell size*

Table 2 illustrates how cells of different sizes and species can dramatically affect the results of an indicative test.

With *Thalassiosira punctigera* (a large diatom), the level 1 (indicative) test generates a false positive (a FAIL result that should have been a PASS). The level 2 (compliance) test correctly assesses the sample as a PASS.

With *Dunaliella salina* (a small chlorophyte), the level 1 test indicates a cell density below 25% of the microscope-based result. The level 2 test is much closer, at 85% of the microscope-based result.

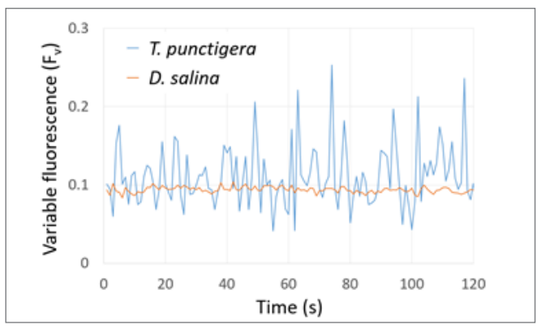


Figure 1: *Distribution based analysis*

Figure 1 shows selections from the distribution data (variable fluorescence, F_v) used to generate the level 2 test values in table 2. While both samples report the same F_v, the range of values for *T. punctigera*, as a proportion of the mean value, is clearly many times larger than for D. *salina*. This difference arises from the Poisson distribution within the sample and provides the basis of the size-independent distribution method used for level 2 testing by FastBallast.

FastBallast vs. Indicative Testing

Indicative test	Confident PASS	PASS could be 100x the D2 threshold	Confident FAIL
FastBallast level 1 test	Confident PASS	Go to level 2 test	Confident FAIL
FastBallast level 2 test	Confident PASS		Confident FAIL

Table 3: *FastBallast's measurement approach*

Indicative tests (level 1) performed with other fluorescence-based systems must assume the amount of *fluorescence per cell*, which can produce a large error as the fluorescence emitted from cells of different sizes and species varies enormously.

The FastBallast level 1 (indicative) test provides a quick indication (within 2 minutes) of whether a sample is grossly compliant or non-compliant. If the level 1 test produces a result between 4% and 4000% of the D2 threshold for a PASS/FAIL, it automatically triggers a level 2 (compliance) test. The FastBallast level 2 test is as accurate as shore based analysis and will always generate a high confidence result.