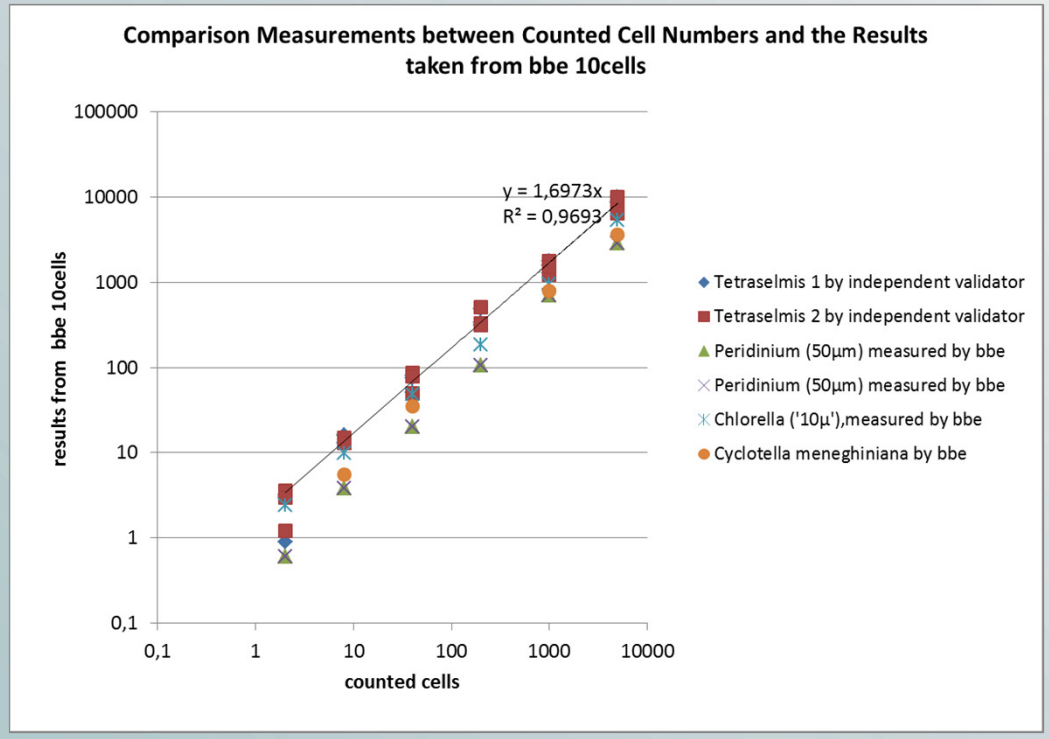
bbe l0cells

New Measuring Instrument for the Indicative Investigation of Ballast Water

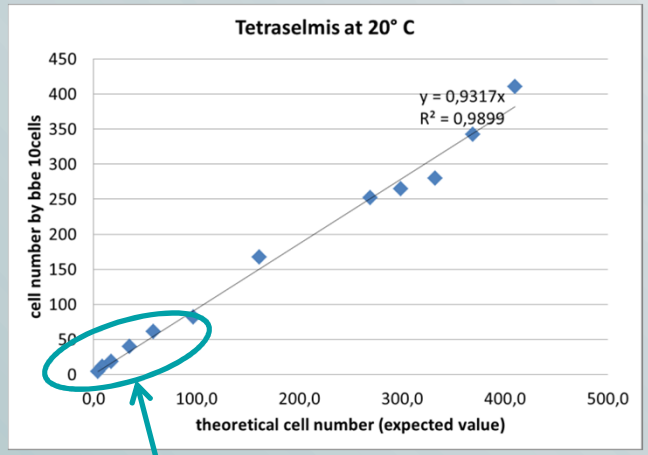
The Best First: the Advantages of bbe I0cells

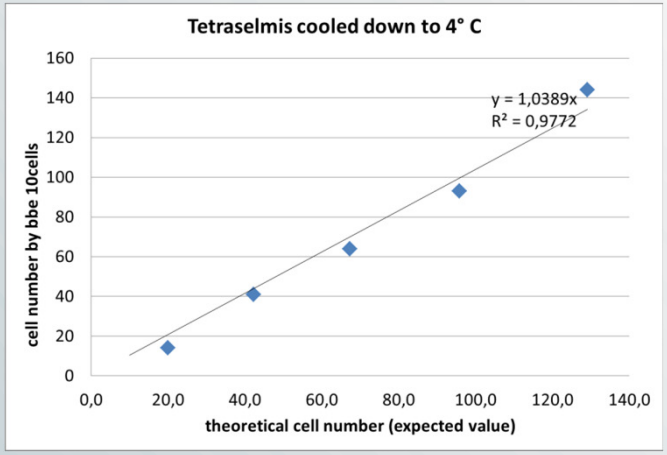
- Resolution: 1-2 cells/ml
- Very simple operation
- Measurement within approx.1 min
- Based on fluorescence ($f_{variable}$)
- No chemicals
- No ‘infection‘ by the sample-taker

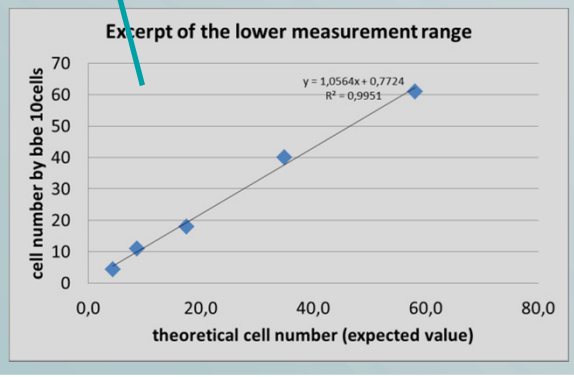
Results from Dilutions of Algae Species in the Range of 10µm - 50µm Cell Size



Hardly any Influence of the Temperature on bbe 10cells Measurements



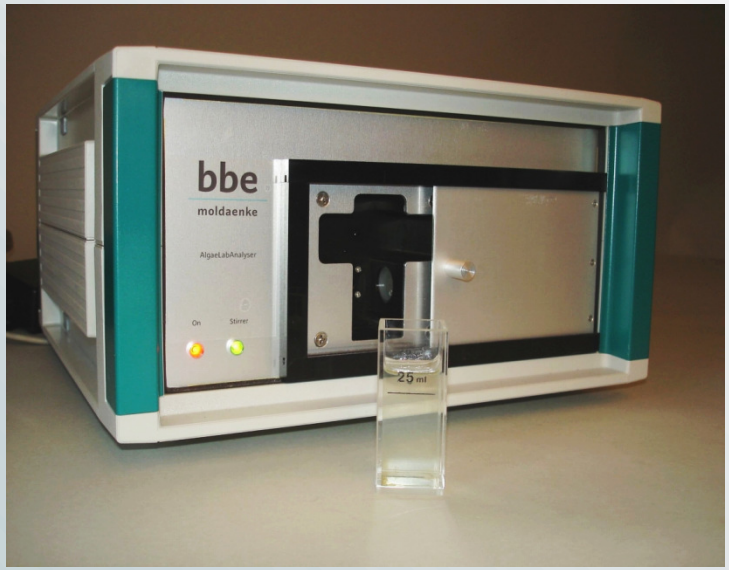


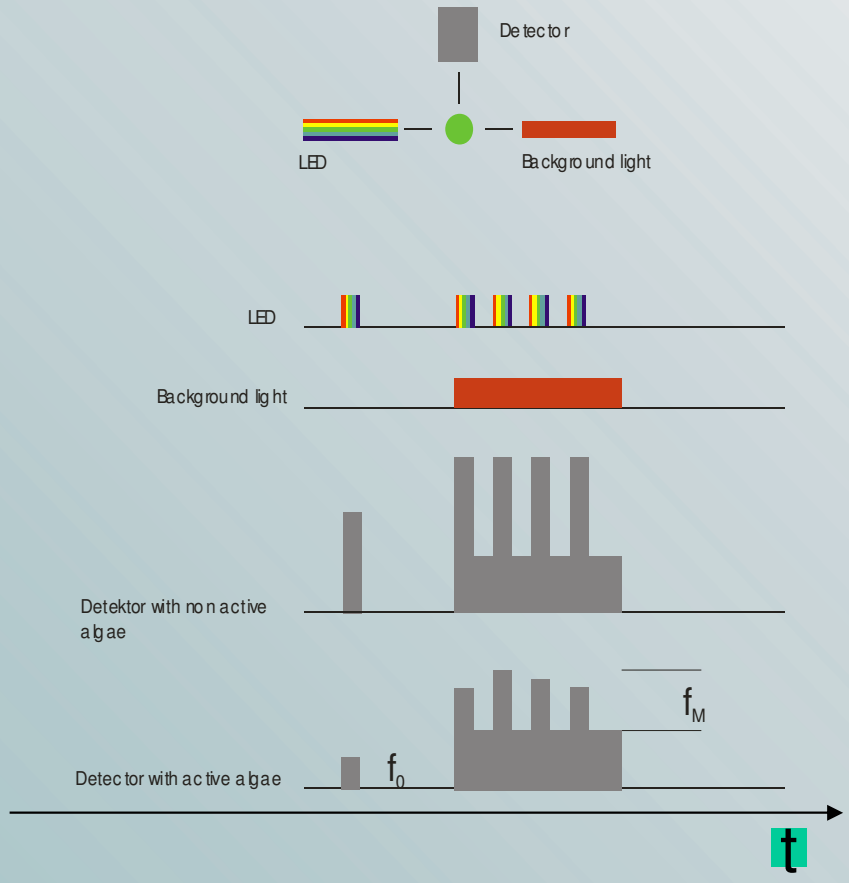


The deviation of the slopes is less than 10% at16°C temperature difference, and therefore within the deviation limits for repetitions at 20°C

PAM AlgaeLabAnalayser

- Measuremment of the chlorophyll concentration by chlorophyll fluorescence
- Algae class differentitation
- Weak relation to cell numbers
- Genty





Theoretically: active algae = f(chl) x Genty

Principle of the Genty-Measurement to Detect the Activity of the Algae

$$Genty = 100 * \frac{fm - fo}{fm} [\%]$$

Non-Active Algae – fluorescence response independent from the background light, the same proportion of the excitation energy decays in form of fluorescence

Active Algae - energy distributed in chemical reaction, thermal loss and fluorescence

UV Treatment: How much Energy is Needed

9mJ/cm²
200 J/Liter = 100%
Resolution 0,1µg/l
=50cells Tetras.
=400cells Talassio

Day 1 treatment	Chlorophyll ALA			
Sample/ Replica	Tetraselmis suicica	Microcystis aeroguinosa	Thalassiosira sp./ Peridinium sp	Gesamt
	µg/L	µg/L	µg/L	µg/L
0% Dosis				
1. Replica	1,54	0,23	2,30	4,07
2. Replica	1,67	0,21	2,38	4,26
3. Replica	1,75	0,23	2,47	4,45
50% Dosis				
1. Replica	1,99	0,25	1,74	3,98
2. Replica	2,16	0,22	1,61	3,99
3. Replica	2,22	0,32	1,70	4,24
100% Dosis				
1. Replica	2,05	0,23	1,09	3,37
2. Replica	2,25	0,30	1,50	4,05
3. Replica	2,19	0,27	1,57	4,03
150% Dosis				
1. Replica	1,48	0,00	0,82	2,30
2. Replica	1,84	0,00	1,21	3,05
3. Replica	1,84	0,00	1,39	3,23
200% Dosis				
1. Replica	1,58	0,00	0,94	2,52
2. Replica	1,63	0,00	0,99	2,62
3. Replica	1,40	0,00	0,82	2,22
400% Dosis				
1. Replica	0,77	0,00	0,44	1,21
2. Replica	0,91	0,00	0,35	1,26
3. Replica	0,85	0,00	0,57	1,42

Day 5 darkness	Chlorophyll ALA			
Sample/ Replica	Tetraselmis suicica	Microcystis aeroguinosa	Thalassiosira sp./ Peridinium sp	Gesamt
	µg/L	µg/L	µg/L	µg/L
0% Dosis				
1. Replica	0,66	0,09	1,36	2,11
2. Replica	1,6	0,25	1,98	3,84
3. Replica	1,69	0,23	2,04	3,97
50% Dosis				
1. Replica	1,03	0,28	1,25	2,55
2. Replica	0,66	0,15	0,97	1,78
3. Replica	1,24	0,29	1,22	2,75
100% Dosis				
1. Replica	1,1	0,16	1,11	2,37
2. Replica	1,14	0,26	1,24	2,64
3. Replica	1,16	0,24	1,18	2,58
150% Dosis				
1. Replica	0,88	0,08	0,96	1,92
2. Replica	1,05	0,16	1,04	2,25
3. Replica	1,13	0,22	1,19	2,54
200% Dosis				
1. Replica	0,77	0,13	0,89	1,78
2. Replica	0,79	0,14	0,84	1,77
3. Replica	0,68	0,25	0,66	1,59
400% Dosis				
1. Replica	0,35	0,00	0,32	0,67
2. Replica	0,56	0,00	0,12	0,68
3. Replica	0,25	0,00	0,21	0,46

Day 20 growth				
Sample/ Replica	Tetraselmis suicica	Microcystis aeroguinosa	Thalassiosira sp./ Peridinium sp	Gesamt
	µg/L	µg/L	µg/L	µg/L
0% Dosis				
1. Replica	46,72	2,66	0	49,39
2. Replica	31,06	3,28	0	34,35
3. Replica	33,92	3,27	0	37,19
50% Dosis				
1. Replica	1,51	0,03	0	1,55
2. Replica	1,66	0,04	0	1,7
3. Replica	0,07	0,01	0	0,08
100% Dosis				
1. Replica	0,07	0	0	0,07
2. Replica	0	0	0	0
3. Replica	0,02	0,01	0	0,02
150% Dosis				
1. Replica	0	0	0	0
2. Replica	0,25	0	0	0,25
3. Replica	1,21	0,01	0	1,23
200% Dosis				
1. Replica	0	0	0	0
2. Replica	0	0	0	0
3. Replica	0,1	0,03	0	0,13
400% Dosis				
1. Replica	0,00	0,00	0,00	0,00
2. Replica	0,00	0,00	0,00	0,00
3. Replica	0,00	0,00	0,00	0,00

Effects on UV-treated Ballast Water

Day 1	Chlorophyll ALA	Aktivität ALA	**10cells**
Sample/ Replica	Total Chl	PAM Aktiv.	10cells
	µg/L	%	cells/ml
0% Dosis			
1. Replica	4,07	51,81	1466
2. Replica	4,26	52,01	1796
3. Replica	4,45	53,7	2098
50% Dosis			
1. Replica	3,98	28,37	525
2. Replica	3,99	33,96	537
3. Replica	4,24	26,16	401
100% Dosis			
1. Replica	3,37	31,05	236
2. Replica	4,05	28,21	427
3. Replica	4,03	31,17	484

Day 1	Chlorophyll ALA	Aktivität ALA	**10cells**
Sample/ Replica	Total Chl	PAM Aktiv.	10cells
	µg/L	%	cells/ml
150% Dosis			
1. Replica	2,30	17,13	183
2. Replica	3,05	23,89	294
3. Replica	3,23	24,59	537
200% Dosis			
1. Replica	2,52	21,13	208
2. Replica	2,62	14,14	198
3. Replica	2,22	13,33	143
400% Dosis			
1. Replica	1,21	8,11	34
2. Replica	1,26	6,41	25
3. Replica	1,42	10,56	37

Effects on UV-treated Ballast Water

Day 5 darkness	Chlorophyll ALA	Aktivität ALA	**10cells**
Sample/ Replica	Total Chl	PAM Aktiv.	10cells
	µg/L	%	cells/ml
0% Dosis			
1. Replica	2,11	52,48	710
2. Replica	3,84	45,13	568
3. Replica	3,97	43,89	759
50% Dosis			
1. Replica	2,55	27,89	96
2. Replica	1,78	41,23	36
3. Replica	2,75	24,94	105
100% Dosis			
1. Replica	2,37	31,14	36
2. Replica	2,64	28,52	75
3. Replica	2,58	35,06	200

Day 5	Chlorophyll ALA	Aktivität ALA	**10cells**
Sample/ Replica	Total Chl	PAM Aktiv.	10cells
	µg/L	%	cells/ml
150% Dosis			
1. Replica	1,92	33,1	18
2. Replica	2,25	44,48	62
3. Replica	2,54	46,6	82
200% Dosis			
1. Replica	1,78	29,15	14
2. Replica	1,77	27,31	25
3. Replica	1,59	44,09	42
400% Dosis			
1. Replica	0,67	6,12	7
2. Replica	0,68	4,25	5
3. Replica	0,46	7,58	9

Effects on UV-treated Ballast Water

Day 20 under light	Chlorophyll ALA	Aktivität ALA	**10cells**
Sample/ Replica	Total Chl	PAM Aktiv.	10cells
	µg/L	%	cells/ml
0% Dosis			
1. Replica	49,39	18,32	2201
2. Replica	34,35	13,03	1960
3. Replica	37,19	16,97	1752
50% Dosis			
1. Replica	1,55	6,43	54
2. Replica	1,7	2,96	51
3. Replica	0,08	--	4
100% Dosis			
1. Replica	0,07	--	2
2. Replica	0	--	1
3. Replica	0,02	--	2

Day 20	Chlorophyll ALA	Aktivität ALA	**10cells**
Sample/ Replica	Total Chl	PAM Aktivität	10cells
	µg/L	%	cells/ml
150% Dosis			
1. Replica	0	--	1
2. Replica	0,25	6,72	0
3. Replica	1,23	32,03	18
200% Dosis			
1. Replica	0	--	0
2. Replica	0	--	0
3. Replica	0,13	0	6
400% Dosis			
1. Replica	0,00	--	0
2. Replica	0,00	--	1
3. Replica	0,00	--	0

Advantages and Disadvantages of Indirect Methods of Algae Counting in the Range of 10-50µm – Personal Opinion

	10cells	PAM	ATP	FDA
Cell counting	-	-	-	-
Resolution	++	-	o	o
Time needed	++	++	o	?
Costs	o	o	o	o
Use of chemicals	++	++	o	-
Simple measurement, no. of steps needed	++	++	-	-
Transportable	++	++	++	++
Affected by temperature	++	++	-	-

We have found an extremely suitable method to be able to measure ballast water concentrations (algae) in the range of 10µm-50µm upto far below 10 cells/ml.

This idea has now been implemented by the new I0cells instrument.

Many thanks for your attention!