

A facile technique for automatically counting odor-producing algae (*Pseudanabaena* sp.) in drinking water sources

Supplementary Information

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Table S1 Water quality of samples collected from Lake Y (May 24th, 2019 – September 20th, 2019).

Day	Temperature	chlorophyll a	TP	TN	PO ₄ -P	NO ₃ -N	NH ₄ -N	K	Geosmin	2-MIB	pH	Oxidation reduction potential	Electrical conductivity	Dissolved oxygen	Total organic carbon
Unit	°C	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ng/L	ng/L	—	mV	mS/m	mg/L	mg/L
0	22.8	3.7	0.033	0.396	0.002	0.095	0.018	0.87	0.0	0.0	7.4	240	9.8	7.5	1.40
7	20.0	5.3	0.047	0.535	0.004	0.193	0.037	0.95	0.9	1.3	7.4	204	9.3	7.6	1.54
14	24.2	7.7	0.029	0.354	0.000	0.081	0.012	0.98	1.4	11.3	7.5	217	9.7	7.9	1.53
21	22.8	2.0	0.050	0.200	0.000	0.022	0.000	0.92	2.1	32.8	7.8	214	10.0	8.3	1.97
28	22.7	8.8	0.027	0.393	0.000	0.051	0.013	0.95	1.8	136.5	7.4	174	9.5	7.3	1.64
33	23.2	5.9	0.025	0.335	0.000	0.011	0.022	0.94	1.5	306.1	7.8	213	10.3	8.4	1.64
42	20.4	4.3	0.031	0.628	0.005	0.236	0.053	0.86	0.7	10.4	7.1	236	8.6	6.3	1.56
49	21.4	7.3	0.025	0.484	0.003	0.209	0.018	0.89	0.5	3.3	7.3	221	8.7	7.3	1.60
56	20.5	3.6	0.032	0.738	0.002	0.384	0.010	0.79	0.9	1.9	7.0	239	7.6	7.6	1.47
63	23.0	12.0	0.035	0.641	0.001	0.209	0.019	0.75	0.7	4.6	6.9	214	9.2	6.1	1.47
70	24.0	14.8	0.030	0.434	0.001	0.144	0.033	0.87	0.8	4.4	7.1	219	8.2	7.1	1.43
77	24.8	10.1	0.031	0.469	0.004	0.126	0.046	0.90	1.3	10.2	7.5	221	8.3	7.3	1.65
84	25.6	7.7	0.017	0.387	0.001	0.125	0.048	0.92	1.4	10.4	7.3	198	8.5	6.6	1.46
91	25.5	4.2	0.078	0.854	0.006	0.295	0.030	0.86	1.8	11.1	7.3	194	8.2	6.8	2.05
98	21.2	0.5	0.045	0.843	0.017	0.412	0.032	0.75	2.2	3.5	7.0	225	5.8	8.2	1.40
105	22.5	5.0	0.022	0.683	0.006	0.360	0.013	0.82	1.3	1.1	7.1	219	6.9	7.3	1.15
112	22.5	12.2	0.016	0.484	0.002	0.224	0.036	1.00	1.6	1.1	7.4	211	7.7	8.8	1.23
119	22.0	7.9	0.016	0.343	0.002	0.144	0.089	1.33	1.6	0.6	7.5	209	8.4	7.7	1.10

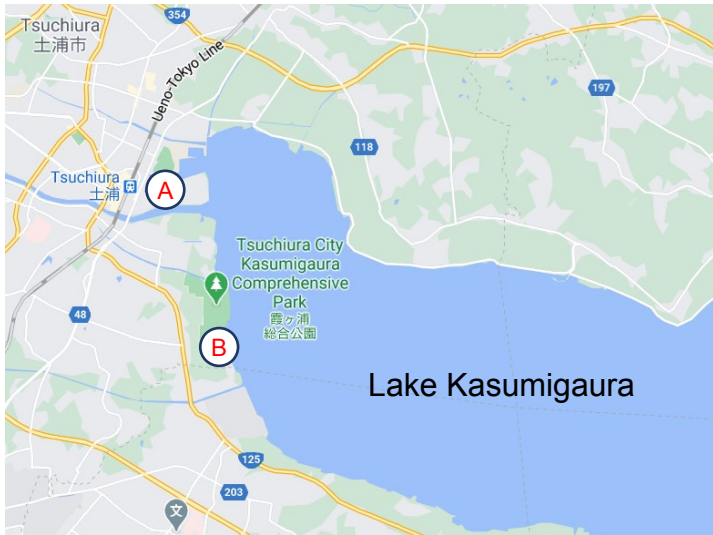


Fig. S1 Sampling points A and B of Lake K (created using Google Map).

Table S2 Water quality of samples collected from Lake K (29/9/2020 – 16/11/2020). “n.a.” represents data not available.

Date	Code	chlorophyll a (µg/L)	Temperature (°C)	Electrical conductivity (mS/m)
September 29 th , 2020	1-A	108	22.9	28.3
October 14 th , 2020	2-A	70	21.2	19.9
October 14 th , 2020	2-B	42	21	25.7
November 3 rd , 2020	3-A	148	17.2	23.7
November 3 rd , 2020	3-B	58	17.4	26.5
November 16 th , 2020	4-A	148	n.a.	n.a.
November 16 th , 2020	4-B	94	n.a.	n.a.

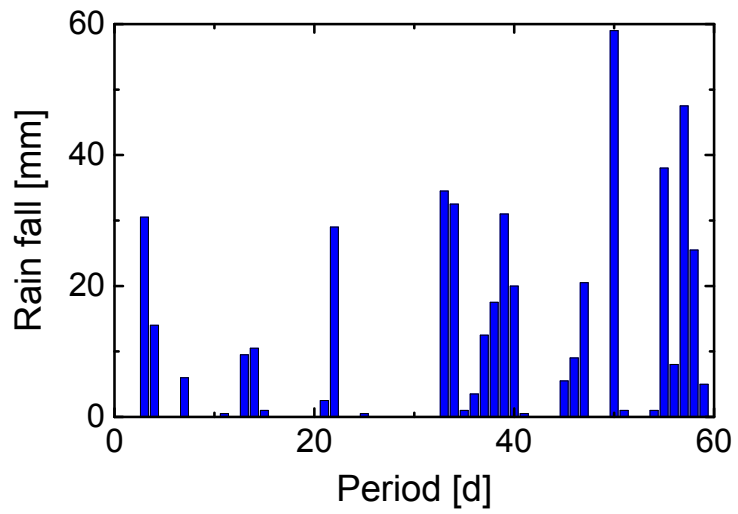


Fig. S2 Rainfall during the assessment of Lake Y.

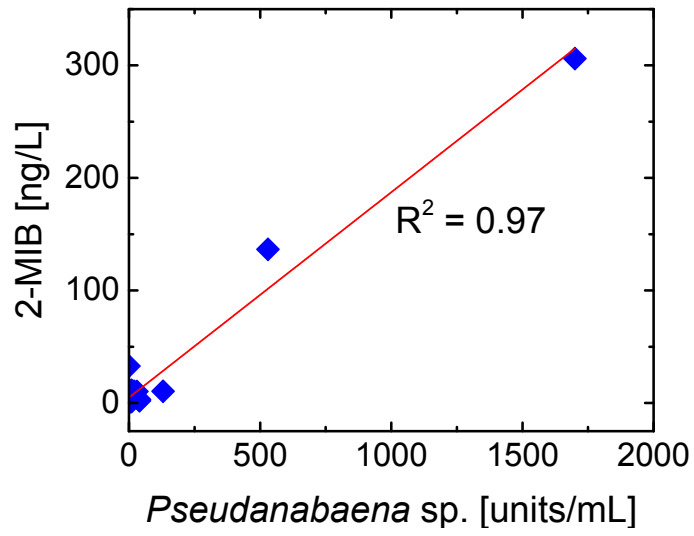


Fig. S3 Correlation between *Pseudanabaena* sp. and 2-MIB concentrations in Lake Y.

Table S3 Algae population (units/mL) in Lake Y.

Day	0	7	14	21	28	33	42	49	56	63	70	77	84	91	98	105	112	119	
Cyanobacteria																			
<i>Anabaeana</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Anabaena affinis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Alphanocapsa</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Chroococcus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Pseudanabaena limnetica</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Pseudanabaena sp.</i>	0	10	10	0	530	1700	130	40	40	30	20	30	20	0	0	0	0	0	0
<i>Microcystis viridis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Microcystis aeruginosa</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others (unicellular cyanobacteria)	4800	4750	3750	8400	12300	19000	11600	12400	11600	12300	13100	12500	13500	13100	19500	14800	12700	13000	
Diatoms																			
<i>Cyclotella</i>	70	0	20	110	0	0	70	20	120	110	300	2570	150	80	0	80	360	170	
<i>Aulacoseira granulata</i>	0	0	0	0	0	0	0	10	0	20	30	20	0	0	0	0	20	0	
<i>Aulacoseira g var ang f spiralis</i>	0	0	0	0	0	0	0	10	0	0	0	10	0	0	0	0	10	0	
<i>Aulacoseira distans</i>	0	0	0	0	0	0	0	0	0	0	0	0	30	20	0	0	640	190	
<i>Attheya zachariasii</i>	0	0	0	0	0	0	0	0	0	0	0	0	220	60	0	0	0	0	
<i>Fragilaria crotonensis</i>	0	0	0	0	10	0	0	0	0	20	60	20	0	0	0	0	0	0	
<i>Synedra acus</i>	0	0	40	10	0	0	0	0	0	0	30	50	30	0	0	0	10	60	
<i>Navicula</i>	10	60	80	270	140	150	210	800	100	100	70	80	0	10	0	60	10	10	
<i>Nitzschia</i>	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Melosira varians</i>	0	0	0	10	0	0	0	0	0	0	0	20	0	0	0	0	0	0	
<i>Cymbella</i>	0	0	40	10	0	20	0	0	0	0	0	10	0	10	0	0	0	0	
Others	0	0	90	0	0	0	360	0	0	10	0	0	0	0	0	30	0	0	
Green algae																			
<i>Chlamydomonas</i>	10	60	110	20	30	0	30	50	80	180	70	50	90	110	0	30	30	50	
<i>Pleodorina</i>	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	
<i>Sphaerocystis schroeteri</i>	0	0	0	0	90	0	0	0	0	30	0	0	50	190	0	0	0	160	
<i>Oocystis</i>	0	70	40	0	30	20	0	0	0	10	0	0	0	170	0	0	0	0	
<i>Golenkinia radiata</i>	0	0	0	0	0	0	20	20	0	0	0	0	0	0	0	10	0	0	
<i>Micractinium pusillum</i>	0	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Staurastum</i>	0	0	0	10	0	0	0	0	0	0	10	0	0	0	0	0	0	0	
<i>Scenedesmus</i>	0	20	150	310	390	210	800	2090	440	100	40	70	20	0	0	0	40	0	
<i>Coelastrum cambricum</i>	0	0	20	30	0	0	0	40	0	0	0	0	0	0	0	0	30	0	
<i>Cosmarium</i>	0	0	10	0	0	0	0	0	0	20	0	0	0	20	10	0	0	0	
<i>Pediastrum duplex</i>	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	
<i>Crucigenia</i>	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Gleocystis</i>	0	30	0	480	0	10	0	0	0	0	0	0	120	20	0	0	0	0	
<i>Ankistrodesmus</i>	0	0	0	40	70	20	50	30	30	0	0	0	250	0	0	0	0	0	
<i>Eudorina</i>	0	0	10	10	0	0	10	0	0	50	190	390	310	0	0	0	10	30	
<i>Spondylosium</i>	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	
<i>Dictyosphaerium</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	10	
Others	30	70	760	210	1300	430	0	50	120	150	210	50	160	20	0	100	20	50	
Others																			
<i>Mallomonas akrokomos</i>	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Mallomonas caudata</i>	0	60	70	0	0	0	0	40	0	10	0	0	10	0	0	0	0	0	
<i>Mallomonas tonsurata</i>	0	0	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Botryococcus braunii</i>	0	0	0	0	30	0	0	0	0	10	0	0	0	0	0	0	0	0	
<i>Ceratium</i>	0	10	10	10	0	0	0	0	0	0	0	0	10	0	0	0	0	0	
<i>Trachelomonas</i>	60	170	120	40	20	0	40	30	20	30	10	10	0	60	10	20	0	10	

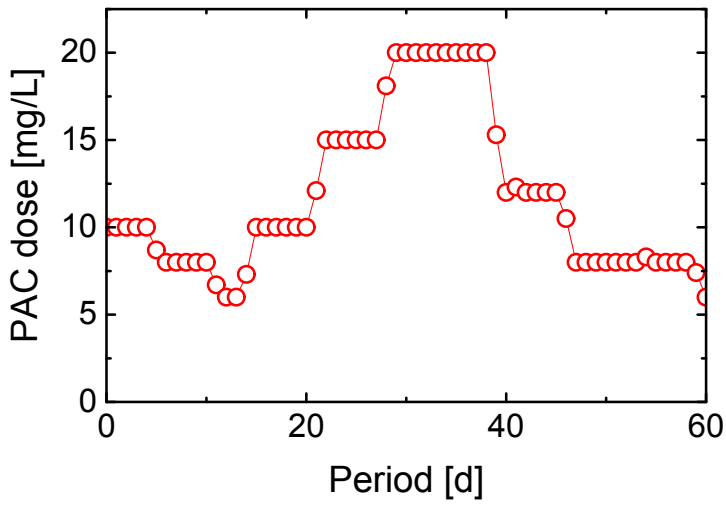


Fig. S4 Powdered activated carbon (PAC) doses at the drinking water treatment plant during the assessment of Lake Y.

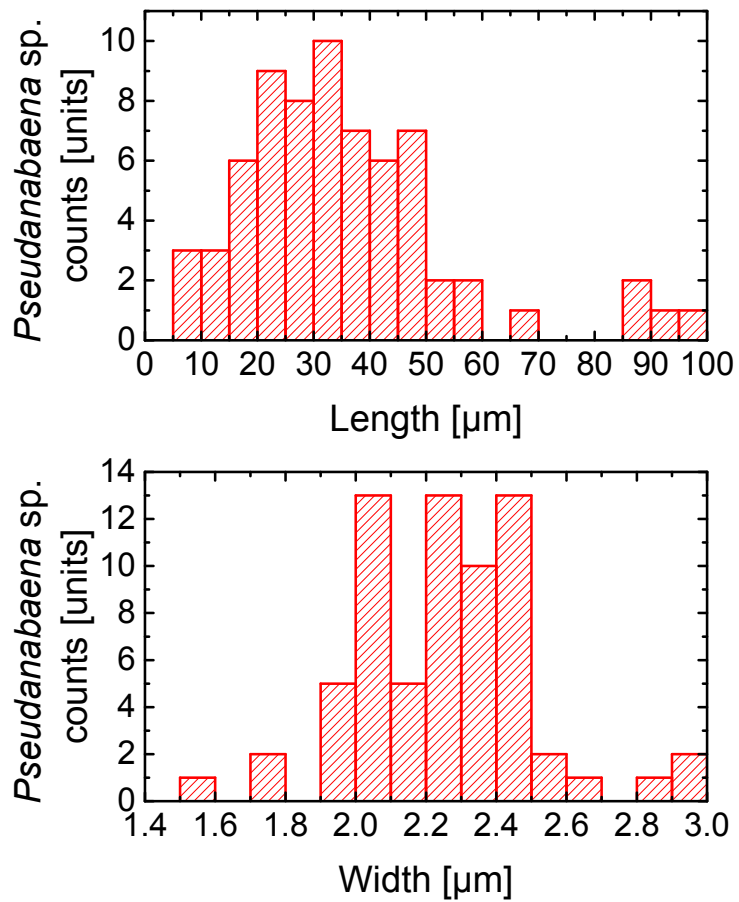


Fig S5 (a) Length and (b) width distribution of *Pseudanabaena* sp. in a pure culture sample that were captured in bright field ($n = 42$).

Table S4 Algae population (units/mL) in Lake K.

Date	1-A	2-A	2-B	3-A	3-B	4-A	4-B
Cyanobacteria							
<i>Anabaeana</i>	0	0	0	0	0	0	0
<i>Anabaena affinis</i>	0	0	0	0	0	0	0
<i>Aphanocapsa</i>	3298	1242	471	2655	1927	4197	4112
<i>Merismopedia</i>	1028	1542	642	1713	4754	3683	4925
<i>Microcystis</i>	0	0	0	0	0	0	514
<i>Pseudanabaena</i> sp.	2827	771	728	385	899	300	557
<i>Pseudanabaena limnetica</i>	728	43	43	43	214	171	171
<i>Others (unicellular or unidentified cyanobacteria)</i>	25184	14904	19316	39275	57092	33965	67414
Diatoms							
<i>Cyclotella</i>	5696	2655	2570	2570	4069	5268	5354
<i>Aulacoseira granulata</i>	814	385	214	86	86	43	43
<i>A. granulata</i> var. <i>angustissima</i> f. <i>spiralis</i>	257	128	43	43	86	86	171
<i>Aulacoseira italica</i>	1842	600	514	343	43	514	600
<i>Synedra</i>	171	0	0	43	43	0	171
<i>Navicula</i>	557	43	257	171	685	171	171
<i>Nitzschia</i>	985	428	385	857	1499	1799	1328
<i>Others</i>	985	1028	1371	1542	1927	4026	3212
Green algae							
<i>Scenedesmus</i>	171	300	343	985	1199	985	1028
<i>Ankistrodesmus</i>	86	514	128	771	1242	1071	642
<i>Dictyosphaerium</i>	0	385	43	128	128	247	128
<i>Shroederia</i>	0	0	43	43	43	0	43
<i>Staurastum</i>	0	428	43	0	0	43	0
<i>Pediastrum</i>	0	86	0	0	0	0	43
<i>Others</i>	26340	10023	13577	8180	18546	12463	12892

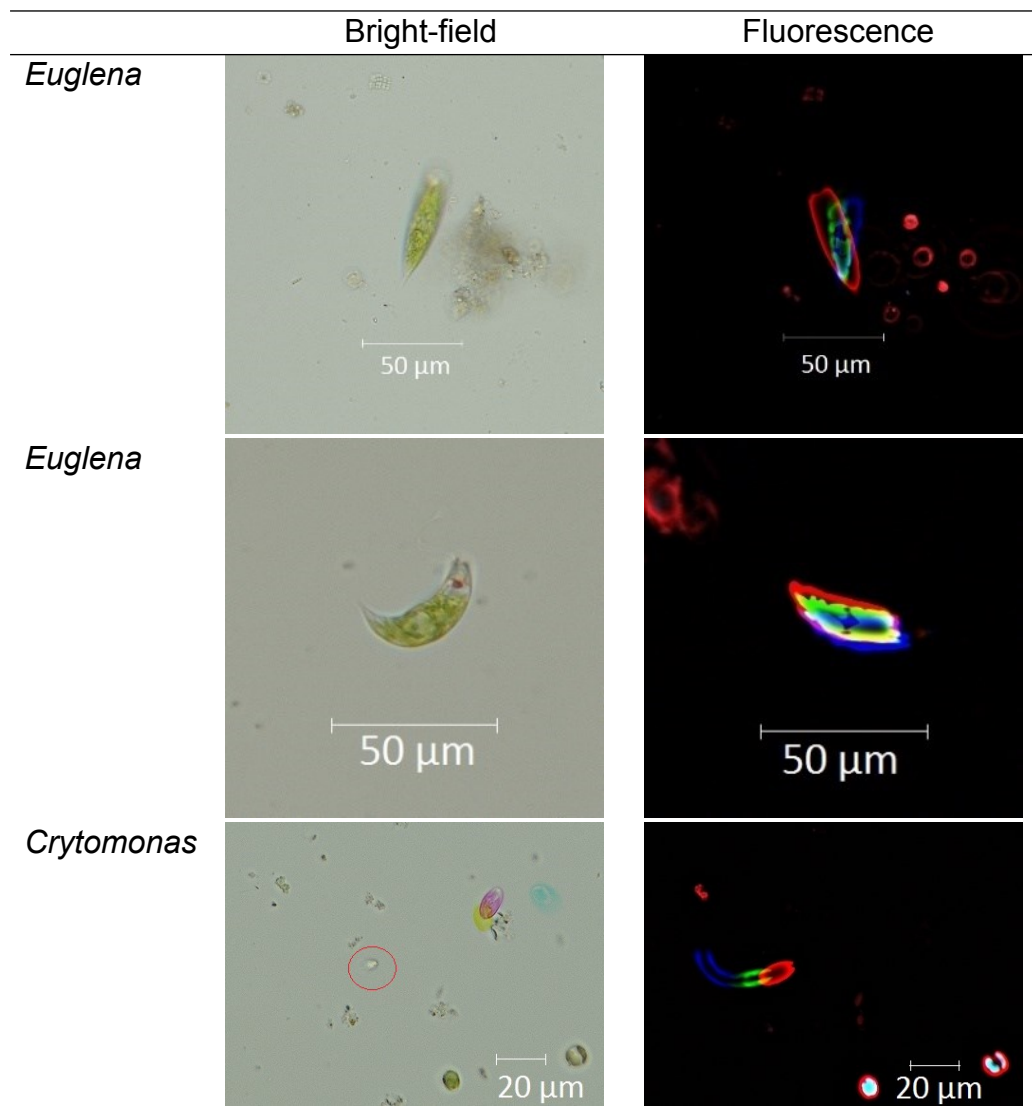


Fig S6 Microscopic images of *Euglena* and *Cryptomonas* in bright-field observation and the path of light created by moving plankton in fluorescence observation. They were not counted in bright-field observation.

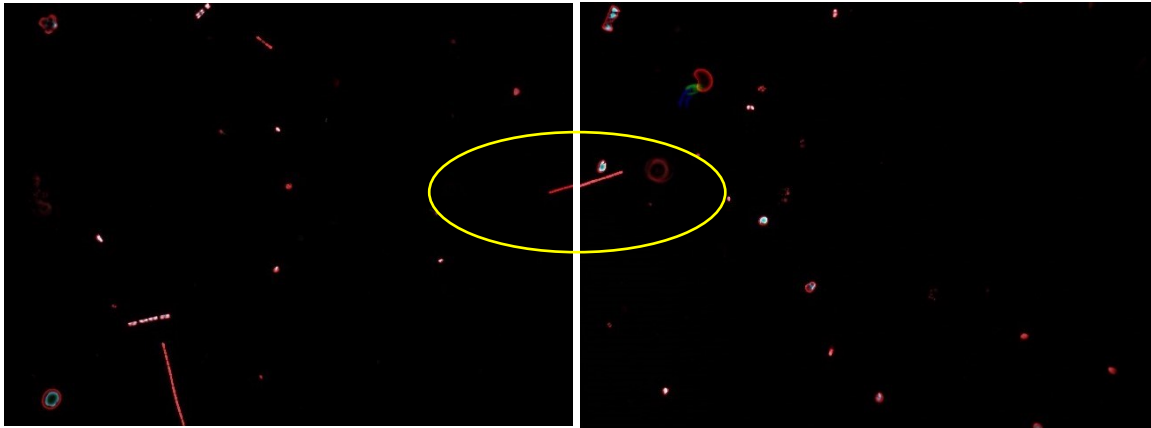


Fig S7 A filament of *Pseudanabaena* sp. on two consecutive microscopic images in fluorescence observation: the single *Pseudanabaena* sp. was counted as two units with the developed auto-counting technique.