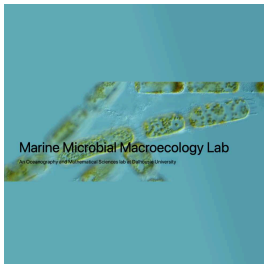
Mar 23, 2022 Version 10

Total RNA and DNA from Microalgae (24 samples per day) V.10



In 1 collection

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We use this protocol and it's working

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Abstract

Here we describe a protocol for extracting and quantifying bulk RNA and DNA from microalgae, which is adapted from Berdalet E. et al. (2005).

RNA and DNA are extracted from microalgae samples and then quantified by fluorochrome SYBR Green II.

The level of sensitivity of this method was set at ca. 40 ~300 ng RNA or 10 ~ 100 ng DNA (ml assay)$^{-1}$.

Citation

Berdalet E, Roldán C, Olivar MP, Lysnes K (2026)
. Quantifying RNA and DNA in planktonic organisms with SYBR Green II and nucleases. Part A. Optimisation of the assay.
Scientia Marina.

https://doi.org/10.3989/scimar.2005.69n11 LINK

Citation

Berdalet E, Roldán C, Olivar MP (2026)
. Quantifying RNA and DNA in planktonic organisms with SYBR Green II and nucleases. Part B. Quantification in natural samples.
Scientia Marina.

https://doi.org/10.3989/scimar.2005.69n117 LINK

Guidelines

Estimation of RNA/DNA in the collected microalgae samples:

Under replete condition, RNA and DNA is about 5.7% and 1% in total dry mass, while Chl-a is bout 1.1% in total dry mass. Therefore, RNA_ug/L = Chl-a_ug/L X (5.7/1.1), DNA_ug/L = Chl-a_ug/L X (1/1.1).

Common dilution from sample collected on the filter to assay is 1/40.

Materials

STEP MATERIALS

- Nuclease decontamination solution **IDT Catalog #**11-05-03-01
- Ribonuclease A from bovine pancreas **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**R6513-50MG
- DEOXYRIBONUCLEASE1 RNase and Protease Free **Bioshop Catalog #** DRB002.10
- Magnesium chloride solution **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**63069-100ML
- Calcium chloride solution **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**21115-100ML
- SYBR™ Green II RNA Gel Stain, 10,000X concentrate in DMSO **Thermo Fisher Catalog #**S7564
- Tris(hydroxymethyl)aminomethane hydrochloride 1M pH 8.0 RNase free **Fisher Scientific Catalog #**AAJ60080AK
- Deoxyribonucleic acid from calf thymus **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**D4522-1MG
- N-Lauroylsarosine sodium salt solution (20% RNase/DNase free) **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**L744-50mL
- EDTA buffer (0.5M DNase/RNase free) **Bioshop Catalog #**EDT333.100
- UltraPure™ DNase/RNase-Free Distilled Water **Thermofisher Catalog #**10977023
- E. coli Total RNA **Thermo Fisher Scientific Catalog #**AM7940

Protocol materials

- DEOXYRIBONUCLEASE1 RNase and Protease Free **Bioshop Catalog #** DRB002.10
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Safety warnings

No data is available addressing the mutagenicity or toxicity of SYBR® Green II Nucleic Acid Gel Stain. Because this reagent binds to nucleic acids, it should be treated as a potential mutagen and used with appropriate care. The DMSO stock solution should be handled with particular caution as DMSO is known to facilitate the entry of organic molecules into tissues. We strongly recommend using double gloves when handling the DMSO stock solution. As with all nucleic acid stains, solutions of SYBR Green II Nucleic Acid Gel Stain should be poured through activated charcoal before disposal or collected in waste container to be treated later. The charcoal must then be incinerated to destroy the dye.

Day 1: Freeze-dry samples

1 Freeze dry samples and blank filters. Freeze at -80 °C until processed.

Note

1. Freeze-drying should be as short as possible to reduce sample degradation.
2. The exact duration of freeze-drying depends on size of filter, quantity of sample and the size of container.

Equipment

FreeZone® 2.5 L Benchtop Freeze Dryers	NAME
Labconco®	BRAND
700202000	SKU

Day 1: Prepare primary solutions

2 Turn on UV light in biosafety cabinet for 00:15:00 and clean working surface with decontamination solution.

Nuclease decontamination solution **IDT Catalog #**11-05-03-01

3 Prepare Tris buffer [M] 5 mM pH 8.0

3.1 Pour [M] 1 M pH 8.0 Tris into an RNase free 15 mL Falcon tube

Tris(hydroxymethyl)aminomethane hydrochloride 1M pH 8.0 RNase free **Fisher Scientific Catalog #**AAJ60080AK

Equipment

Falcon® Centrifuge Tubes	NAME
Polypropylene, Sterile, 15 mL	TYPE
Corning®	BRAND
352096	SKU

3.2 Directly add 2.5 mL [M] 1 M pH 8.0 Tris into 500 mL RNase free water in its original package.

UltraPure™ DNase/RNase-Free Distilled Water **Thermofisher Catalog #**10977023

Equipment

BT Barrier Pipet Tips	NAME
Pre-Sterile	TYPE
Neptune®	BRAND
BT1250, BT100, BT10	SKU

4 RNA primary standard solution ([M] 200 ug/ml)

4.1 In the original package, the E. Coli Total RNA is of 1 mg/mL, in which total RNA is 200 ug.

E. coli Total RNA **Thermo Fisher Scientific Catalog #**AM7940

Note

https://assets.thermofisher.com/TFS-Assets/LSG/manuals/sp_7940.pdf

4.2 Uncap the original package of E. Coli Total RNA and directly add 800 µL Tris buffer ([M] 5 mM , pH 8.0) .
Cap the package and vortex for a thorough mix.

4.3 Aliquot 30 uL by stepper with sterile tip to 600 uL RNase free microtubes. Keep frozen at -80 °C .

Equipment

Finnpipette Stepper Pipette	NAME
Thermo Scientific™	BRAND
4540000	SKU

Equipment

Finntip stepper pipette tips	NAME
500 ul (sterile)	TYPE
Thermo Scientific	BRAND
Thermo Scientific™ 9404173	SKU

Equipment

NAME	TYPE	BRAND	SKU
Microcentrifuge Tubes	1.7 mL/0.6 mL	Axygen Scientific	MCT-175-C/MCT-060-L-C

5 DNA primary standard solution (≈ [M] 500 ug/ml)

5.1 Uncap the original package of Deoxyribonucleic acid from calf thymus and add 2 mL Tris buffer ([M] 5 mM , pH 8.0).

Deoxyribonucleic acid from calf thymus **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**D4522-1MG

Note

https://www.sigmaaldrich.com/content/dam/sigma-aldrich/docs/Sigma/Product_Information_Sheet/d4522pis.pdf

5.2 Cap the package. Do not vortex or sonicate.

5.3 Keep the solution at 0 °C ~ 4 °C overnight to completely solubilize the DNA. Gentle reversion is recommended.

5.4 Aliquot 10 uL by stepper with sterile tip to 600 uL RNase free microtubes. Keep frozen at -80 °C .

Equipment

Finntip stepper pipette tips	NAME
500 ul (sterile)	TYPE
Thermo Scientific	BRAND
Thermo Scientific™ 9404173	SKU

5.5 Dilute 5 ul primary DNA standard solution with 95 ul Tris buffer ([M] 5 mM , pH 8.0) in a microtube (600 ul).
Measure DNA concentration by using µdrop plate (sample volume: 4 ul)
Use Tris buffer ([M] 5 mM , pH 8.0) as blank.

Equipment

µDrop™ Plates	NAME
Thermo Scientific	BRAND
N12391	SKU

Equipment

Varioskan LUX Multimode Microplate Reader	NAME
Thermo Fisher	BRAND
VL0L00D0	SKU

Note

The dilution is to avoid saturated observation at 260 nm.

5.6 DNA concentration (µg/ml) = (Abs_{260}-$Abs_{260\ (blank)}$)x 50 µg/ml x (10mm/0.5 mm) X DF
Where, DF=20.

Note

If the measured DNA concentration is not close to [M] 500 ug/ml , check reverse pipetting technique.

6 RNase primary stock solution ([M] 10 mg/ml)

6.1 Uncap the original package of Ribonuclease A from bovin pancreas and add 5 mL Tris buffer ([M] 5 mM , pH 8.0).
Cap the package and vortex for a thorough mix.

Ribonuclease A from bovine pancreas **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**R6513-50MG

6.2 Aliquot 30 uL by stepper with sterile tip to 600 uL RNase free microtubes. Keep frozen at -20 °C .

Equipment

Finntip stepper pipette tips	NAME
500 ul (sterile)	TYPE
Thermo Scientific	BRAND
Thermo Scientific™ 9404173	SKU

Equipment

Finntip™ Stepper Pipette Tips	NAME
500 ul (Sterile)	TYPE
Thermo Scientific	BRAND
21-377-149	SKU

7 DNase primary stock solution ([M] 5 mg/ml = 10,000 U/mL)

7.1 Uncap the original package of Deoxyribonuclease1 and add 1 mL Tris buffer ([M] 5 mM , pH 8.0) .
Cap the package and vortex for a thorough mix.
DEOXYRIBONUCLEASE1 RNase and Protease Free **Bioshop Catalog #** DRB002.10

7.2 Aliquot 100 uL by stepper with sterile tip to 600 uL RNase free microtubes. Keep frozen at -20 °C .

Equipment

Finntip stepper pipette tips	NAME
1250 ul (sterile)	TYPE
Thermo Scientific	BRAND
Thermo Scientific™ 9404183	SKU

Day 2: Exact RNA and DNA

8 Turn on UV light in biosafety cabinet for 00:15:00 and clean working surface with decontamination solution.

9 Prepare falcon tubes and tube rack in biosafety cabinet

	A	B
	Volume of tube (mL)	**Contents in the tube**
	5	0.5 M EDTA
	5	20% sarcosine
	15 or 50	5 mM Tris
	15 or 50	1% STEB

Equipment

Falcon® Centrifuge Tubes	NAME
Polypropylene, Sterile, 15 mL	TYPE
Corning®	BRAND
352096	SKU

Equipment

Falcon® Centrifuge Tubes	NAME
Polypropylene, Sterile, 50 mL	TYPE
Corning®	BRAND
352070	SKU

10 Prepare STEB ([M] 1 %)

Note

Use the following formula to determine the total volume of 1% STEB required:
(# samples + # blank filters) X (500 ul) + (500 ul) = total volume of 1% STEB required

10.1 Pour sarcosine ([M] 20 %) into an RNase free 5 mL falcon tube.

N-Lauroylsarosine sodium salt solution (20% RNase/DNase free) **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**L744-50mL

10.2 Pour EDTA ([M] 0.5 M) into an RNase free 5 mL falcon tube.

EDTA buffer (0.5M DNase/RNase free) **Bioshop Catalog #**EDT333.100

10.3 Pour Tris buffer ([M] 5 mM , pH 8.0) into an RNase free 15 or 50 mL falcon tube.

> Note
>
> For large volume of Tris buffer usage, use sterile serological pipet

10.4 Mix 500 µL sarcosine ([M] 20 %) , 10 µL EDTA ([M] 0.5 M) and 9 mL + 490 µL Tris buffer ([M] 5 mM , pH 8.0) to obtain STEB ([M] 1 %).

11 Prepare ice bath

12 Remove freeze-dried samples from -80ºC freezer and place them On ice .

13 Add 500 µL Tris buffer ([M] 5 mM , pH 8.0) and 500 µL STEB ([M] 1 %) to the bead tube. Place tubes On ice .

> Equipment
>
> | LYSING TUBES | NAME |
> |---|---|
> | MATRIX D 2 mL/15 mL | TYPE |
> | MP BIOMEDICALS | BRAND |
> | 116913500/116933050 | SKU |

14 Rinse forceps by [M] 70 % volume ethanol and air dry.

Equipment

Filter forceps	NAME
blunt end, stainless steel	TYPE
Millipore	BRAND
XX6200006P	SKU

15 Transfer sample/blank filter into the bead tube by using clean forceps.

16 Vortex immediately then put back On ice . 20s

Equipment

VWR ANALOG VORTEX MIXER	NAME
VWR	BRAND
10153-838	SKU
With tube insert	SPECIFICATIONS

17 Disrupt samples on the bead mill at 6.5 m/s. 30s

Equipment

Fastprep-24 5G™ Sample Preparation Instrument	NAME
MP Biomedicals	BRAND
116005500	SKU

18 Keep tubes On ice . Check the label on each tube, restore the label if it fades. 1m 30s

19 Disrupt samples on the bead mill at 6.5 m/s. 30s

20 Keep tubes On ice . Check the label on each tube, restore the label if it fades. 1m 30s

21 Disrupt samples on the bead mill at 6.5 m/s 30s

22 Keep tubes On ice . Check the label on each tube, restore the label if it fades. 1m 30s

23 Disrupt samples on the bead mill at 6.5 m/s. 30s

24 Continuously shake homogenate in a multi-head vortex at the highest speed for 01:00:00 Room temperature 1h

Note

Votex mixer should be able to remain stable on the bench under this vortex speed.

25 In the biosafety cabinet, transfer 150 uL of homogenate into RNase free 600 uL tube.

26 Freeze both aliquote (150 uL) and the rest of homogenate (in bead mill tube) at -80 °C until analyzed.

Day 3: Run the assay

27 Prepare ice bath.

28 Turn on UV light in biosafety cabinet for 00:15:00 and clean working surface with decontamination solution.

29 Prepare falcon tubes, microtubes and tube racks in biosafety cabinet
* Maximum number of samples (including blanks) per assay is 20.

	A	B	C
	Number of tubes	**Type of tubes**	**Contents**
	3	5 mL falcon tubes	1 M MgCl2, 1 M CaCl2, Sybr Green II working solution (SG-II WS)
	1	50 mL falcon tube	5 mM Tris buffer
	4	15 mL falcon tubes	0.05% STEB, Working solution A (WS-A), Working solution B (WS-B), Working solution (WS-C)
	5	1.7 mL RNase free tubes	RNase working solution, Secondary RNA standard solution, Secondary DNA standard solution, 900mM MgCl2, 900 mM CaCl2
	33	1.7 mL RNase free tubes	RNA standard solutions for RNA standard curves, DNA standard soutions for DNA standard curves
	N= total number of samples and blanks	1.7 mL RNase free tubes	Samples and blanks
	3XN	1.7 mL RNase free tubes	Diluted samples and blanks
	5	Microtube racks	Tubes of 1.7 mL

	A	B	C
	1	Tube racks	Falcon tubes

Equipment

Screw-Cap Centrifuge Tube	NAME
5 mL	TYPE
VWR	BRAND
10002-738	SKU

Day 3: Run the assay

30 Organize and label the tubes as shown below

Set 1:
In microtube rack, label 1.7 mL tubes for samples and blanks to be further diluted.

1	2	3	4	5	6	7	8	9	…	Blank

Set 2:
In microtube rack, label 1.7 mL tubes for RNA (marked in pink) and DNA (marked in blue) standard solutions to be used as standard curves.
Tubes A is for standard solutions treated with working solution A (WS-A)
Tubes B is for standard solutions treated with working solution B (WS-B)
Tubes C is for standard solutions treated with working solution C (WS-C)

Tubes A	R1A	R2A	R3A	R4A	R5A	R6A	D1A	D2A	D3A	D4A	D5A
Tubes B	R1B	R2B	R3B	R4B	R5B	R6B	D1B	D2B	D3B	D4B	D5B
Tubes C	R1C	R2C	R3C	R4C	R5C	R6C	D1C	D2C	D3C	D4C	D5C

Set 3:

In microtube rack, label 1.7 mL tubes for diluted samples and blanks.
Tubes A is for diluted samples and blanks treated with working solution A (WS-A)
Tubes B is for diluted samples and blanks treated with working solution B (WS-B)
Tubes C is for diluted samples and blanks treated with working solution C (WS-C)

Tubes A	1A	2A	3A	4A	5A	6A	7A	8A	9A	...	BlankA
Tubes B	1B	2B	3B	4B	5B	6B	7B	8B	9B	...	BlankB
Tubes C	1C	2C	3C	4C	5C	6C	7C	8C	9C	...	BlankC

31 Label tubes for reagents as following.

Follow the sheet, add Tris buffer ([M] 5 mM , pH 8.0) to the reagent tubes:

	A	B
	Reagent type	5 mM Tris (uL)
	0.05% STEB	9X1000 + 500
	RNA	990+495
	DNA	998
	RNase	380
	900 mM MgCl2	40
	900 mM CaCl2	40
	WS-A	5X1000 + 640

	A	B
	WS-B	5X1000 +640
	WS-C	5X1000 + 880
	SG-II WS	2X1000 + 500

32 Add 900 µL Tris buffer ([M] 5 mM , pH 8.0) to each tube in **Set 1**

Note

Depending on the dilution of extracted sample

33 Follow the sheet, add Tris buffer ([M] 5 mM , pH 8.0) to each tube in **Set 2**. The unit of volume is uL.

Tubes A	650	640	625	600	550	500	640	630	610	580	550
Tubes B	650	640	625	600	550	500	640	630	610	580	550
Tubes C	600	590	575	550	500	450	590	580	560	530	500

34 Follow the sheet, add Tris buffer ([M] 5 mM , pH 8.0) to each tube in **Set 3**. The unit of volume is uL.

Tubes A	650	650	650	650	650	650	650	650	650	...	650
Tubes B	650	650	650	650	650	650	650	650	650	...	650
Tubes C	600	600	600	600	600	600	600	600	600	...	600

35 Prepare STEB ([M] 0.05 %)

Add 500 µL STEB ([M] 1 %) to 0.05% STEB tube, and vortex.

36 Add 250 µL STEB ([M] 0.05 %) to each tube in **Set 2** by reverse pipetting.

37 Place RNase and DNase primary stock solutions, RNA and DNA primary standard solutions and samples On ice .

38 Turn on refrigerated centrifuge and set the temperature to 4 °C .

Equipment	
CENTRIFUGE 5430 R	NAME
Eppendorf	BRAND
MP2231000510	SKU

39 Turn on shaker/incubator and set temperature to 37 °C .

Equipment	
SHAKING INCUBATOR	NAME
71L	TYPE
Corning® LSE™	BRAND
6753	SKU

40 Prepare [M] 900 mM $MgCl_2$

40.1 Pour [M] 1 M $MgCl_2$ solution into 5 mL RNase free Falcon tube

Magnesium chloride solution **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**63069-100ML

40.2 Transfer 360 µL [M] 1 M $MgCl_2$ solution into 900 mM $MgCl_2$ tube

41 Add 120 µL [M] 900 mM $MgCl_2$ to WS-A and WS-B

42 Prepare [M] 900 mM $CaCl_2$

42.1 Pour [M] 1 M $CaCl_2$ solution into 5 mL RNase free Falcon tube

Calcium chloride solution **Merck MilliporeSigma (Sigma-Aldrich) Catalog #**21115-100ML

42.2 Transfer 360 µL [M] 1 M $CaCl_2$ solution into 900 mM $CaCl_2$ tube

43 Add 120 µL [M] 900 mM $CaCl_2$ to WS-A and WS-B

44

Note

Lunch break!

45 Prepare RNase working solution [M] 0.5 mg/ml

Add 20 µL RNase primary stock solution ([M] 10 mg/ml) to RNase tube

46 Add 120 µL [M] 0.5 mg/ml RNase to WS-B and WS-C.

Keep WS-B and WS-C On ice .

47 Add 120 µL DNase primary stock solution ([M] 5 mg/ml) to WS-A.

Keep WS-A On ice .

Note

Two microtubes of aliquot (70 ul/tube)

48 Centrifuge extracted samples 10000 x g, 4°C, 00:04:00

49 Take one tube of

SYBR™ Green II RNA Gel Stain, 10,000X concentrate in DMSO **Thermo Fisher Catalog** #S7564

out of the freezer, keep it at Room temperature .

If open a new package, wrap 1.7 mL microtube with foil and aliquot 1000 ul to each tube, store at -20 °C .

50 Prepare RNA secondary standard solution [M] 2 ug/ml

Add 15 µL RNA primary standard solution to RNA standard tube and vortex.

Keep On ice .

51 Prepare DNA secondary standard solution [M] 1 ug/ml

Add 2 µL DNA primary standard solution to DNA standard tube and vortex.

Keep On ice .

52 Load 50 µL WS-A to Tubes A in **Set 2** and **Set 3**.

Note

From Step 51 to 54: Reverse pipetting
Decontaminate pipet between different WS.

53 Load 50 µL WS-A to Tubes C in **Set 2** and **Set 3**.

54 Load 50 µL WS-B to Tubes B in **Set 2** and **Set 3**.

55 Load 50 µL WS-C to Tubes C in **Set 2** and **Set 3**.

56 Add 100 µL centrifuged samples to its corresponding tubes in **Set 1**.
Vortex each tube.

57 From Set 1, transfer 250 µL of diluted samples to each corresponding tubes in **Set 3**.

Note

In order to avoid cross contamination from RNase or DNase, use one tip for each dispensing.
Pipette solution in the tube up and down for mixing.

58 Follow the sheet:
Add RNA secondary standard to tubes (marked in pink) in Set 2.
Add DNA secondary standard to tubes (marked in blue) in Set 2.
The unit of volume is uL.

Tubes A	0	10	25	50	100	150	10	20	40	70	100
Tubes B	0	10	25	50	100	150	10	20	40	70	100
Tubes C	0	10	25	50	100	150	10	20	40	70	100

59 Vortex each tube for 00:00:02 and place all tubes into the shaker/incubator at 37 °C, continuously shaking at 200 RPM for 00:20:00. 20m

Note

Incubation time is critical. Temperature might be disturbed by door open/close. Don't start the timer until temperature returns to 37°C.

Read fluorescence

60 Prepare SYBR Green II working solution (SG-II WS)

60.1 Each 96-well microplate requires 1 mL of SG-II WS.

Note

For 24 samples:
2.5 mL Tris
17.5 uL SG-II WS

60.2 Centrifuge one tube of SG-II concentrate at Room temperature 5m
13000 rpm, 00:05:00 to deposit DMSO.

60.3 Wrap SG-II WS tube with foil, transfer [M] 17.5 ul ***supernatant*** of SYBR Green II 10,000X concentrate to SG-II WS tube in biosafety cabinet.

Note

Any step involving SYBR Green II should be operated in dark room or at least dim light.

60.4 Adhere black film on the top of a microplate lid.

Equipment

Black Vinyl Films for Fluorescence and Photoprotection NAME

VWR BRAND

89087-692 SKU

Equipment

Microplate Lids	NAME
Polystyrene	TYPE
Greiner Bio-One	BRAND
07000288	SKU

60.5 Load 10 µL SG-II WS to each well in the microplate with 0.5 mL tip of stepper, and cover the plate with the black-film lid.

Equipment

Finntip™ Stepper Pipette Tips	NAME
500 uL	TYPE
Thermo Scientific™	BRAND
9404170	SKU

Equipment

NAME	TYPE	BRAND	SKU
96-Well Black Microplates	Polystyrene	Greiner Bio-One	655076

Note

Wipe or dab the liquid drop on the outside of the tip, avoid wiping the tip open before dispensing the liquid.

61 After incubation, vortex each tube for 00:00:02 and then place into the fridge to stop the reaction.

62 Allow samples to reach Room temperature for 00:02:00 before loading the microplate.

Note

Since fluorescence decreases with increasing temperature, with percentage changes depending on the fluorophore (Bashford, 1987), the SG-II WS must be kept dark at RT (22°C) and the samples must be equilibrated at RT (c. 2 min).

63 Label the microplate.

64 Organize tubes in 96-well microtube rack in the same order as how microplates are loaded.

65 Load 190 µL working sample to the microplate by reverse pipetting. 45m

Blank must be included in each plate.
Pink area: RNA standard solutions for RNA standard curves
Blue area: DNA standard solutions for DNA standard curves
Yellow area: Samples and blanks

	1	2	3	4	5	6	7	8	9	10	11	12
A	R1A	R2A	R3A	R4A	R5A	R6A	1A	1A	1B	1B	1C	1C
B	R1B	R2B	R3B	R4B	R5B	R6B	2A	2A	2B	2B	2C	2C
C	R1C	R2C	R3C	R4C	R5C	R6C	3A	3A	3B	3B	3C	3C
D	D1A	D2A	D3A	D4A	D5A		4A	4A	4B	4B	4C	4C
E	D1B	D2B	D3B	D4B	D5B		5A	5A	5B	5B	5C	5C
F	D1C	D2C	D3C	D4C	D5C		6A	6A	6B	6B	6C	6C
G	9A	9A	9B	9B	9C	9C	7A	7A	7B	7B	7C	7C
H	Blank A	Blank A	Blank B	Blank B	Blank C	Blank C	8A	8A	8B	8B	8C	8C

	1	2	3	4	5	6	7	8	9	10	11	12
A	Blank A	Blank A	Blank B	Blank B	Blank C	Blank C	17A	17A	17B	17B	17C	17C
B	10A	10A	10B	10B	10C	10C	18A	18A	18B	18B	18C	18C
C	11A	11A	11B	11B	11C	11C	19A	19A	19B	19B	19C	19C
D	12A	12A	12B	12B	12C	12C	20A	20A	20B	20B	20C	20C
E	13A	13A	13B	13B	13C	13C	21A	21A	21B	21B	21C	21C
F	14A	14A	14B	14B	14C	1C	22A	22A	22B	22B	22C	22C
G	15A	15A	15B	15B	15C	15C	23A	23A	23B	23B	23C	23C
H	16A	16A	16B	16B	16C	16C	24A	24A	24B	24B	24C	24C

Note

Wipe or dab the liquid drop on the outside of the tip, avoid wiping the tip open before dispensing the liquid.

66 Shake black film covered microplate at Room temperature for 00:10:00 10m

Note

(1) The fluorescence of the RNA-bound SG-II is highly stable during the 0 - 180 min period
(2) The fluorescence of the DNA-bound SG-II varies during the first 10 min and remains stable during the 10-60 min period, but tended to decrease afterwards.
(3) In summary, readings are performed within the 10-60 min period following the SG-II addition;
meanwhile the samples are kept dark at RT (22°C).

67 Setup microplate reader:
Plate: Greiner F bottom chimney well PP 96 well;
Shake: Continuous 5s at 600 rpm
Endpoint reading: Ex 490 nm/Em 520 nm;

Equipment

Varioskan LUX Multimode Microplate Reader	NAME
Thermo Fisher	BRAND
VL0L00D0	SKU

68 Read fluorescence and export data to excel sheet.

Calculate

69 RNA standard curve

69.1 Concentrations of RNA standards in the microplate

Standard	2 ug/mL (uL)	Tris+WS (uL)	0.05% STEB (uL)	SG II WS (uL)	Final (ng/mL)
R1	0	700	250	50	0
R2	10	690	250	50	20
R3	25	675	250	50	50
R4	50	650	250	50	100
R5	100	600	250	50	200
R6	150	550	250	50	300

69.2 Slope of fluorescence in Tube A vs concentration of RNA standard gives $m_{RNA+DNase}$ (≈0.03)
Slope of fluorescence in Tube B vs concentration of RNA standard gives $m_{RNA+RNase}$

69.3 Calculate ρ

$$\rho = \frac{m_{RNA+RNase}}{m_{RNA+DNase}}$$

70 Total RNA of the samples

$$ug\ Total\ RNA\ (ml\ assay)^{-1} = 0.001 \times \frac{(RFU_A - RFU_{A_{Blank}}) - (RFU_C - RFU_{C_{Blank}})}{(1-\rho)} / m_{RNA+DNase}$$

Where,
RFU_A and RFU_C are the fluorescence in Tube A and Tube C of the same sample.
RFU_{ABlank} and RFU_{CBlank} are the fluorescence in Tube A and Tube $_C$ of the blank.

71 DNA standard curve

71.1 Concentrations of DNA standards in the microplate

Standard	1 ug/mL (uL)	Tris+WS (uL)	0.05% STEB (uL)	SG II WS (uL)	Final (ng/mL)
D1	10	690	250	50	10
D2	20	680	250	50	20
D3	40	660	250	50	40
D4	70	630	250	50	70
D5	100	580	250	50	100

71.2 Slope of fluorescence in Tube A vs concentration of DNA standard gives $m_{DNA+DNase}$
Slope of fluorescence in Tube B vs concentration of DNA standard gives $m_{DNA+RNase}$ (≈0.12)

71.3 Calculate δ

$$\delta = \frac{m_{DNA+DNase}}{m_{DNA+RNase}}$$

72 Total DNA of the samples

$$ug\ Total\ DNA\ (ml\ assay)^{-1} = 0.001 \times \frac{(RFU_B - RFU_{B_{Blank}}) - (RFU_C - RFU_{C_{Blank}})}{(1-\delta)} / m_{DNA+RNase}$$

Where,
RFU_B and RFU_C are the fluorescence in Tube B and Tube C of the same sample
RFU_{BBlank} and RFU_{CBlank} are the fluorescence in Tube B and Tube $_C$ of the blank.

73 Dilution factor=40
If,

- Sample is extracted by 1 mL extraction reagent
- In Set 1, sample is diluted to 1/10
- In Set 3, diluted by Tris and all working solutions to 250/950
- In microplate, diluted by SG-II WS to 190/200

Citations

Berdalet E, Roldán C, Olivar MP, Lysnes K. Quantifying RNA and DNA in planktonic organisms with SYBR Green II and nucleases. Part A. Optimisation of the assay
https://doi.org/10.3989/scimar.2005.69n11

Berdalet E, Roldán C, Olivar MP. Quantifying RNA and DNA in planktonic organisms with SYBR Green II and nucleases. Part B. Quantification in natural samples
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