Particulate organic matter (POM) determination (POC/PON/POP)

Particulate organic carbon and nitrogen (POC and PON) using the mass spectrometric method

Olivier Grosso and Thierry Moutin, with the help of Lea Guyomarc'h for sampling on the N/O Thalassa

2400 mL samples were collected using Niskin bottles between 0 and 4000 m depth, and directly filtrated on pre-combusted () GF/F glass fiber filters. The filtration system (Fig. 1) allows to minimize contamination during filtration.

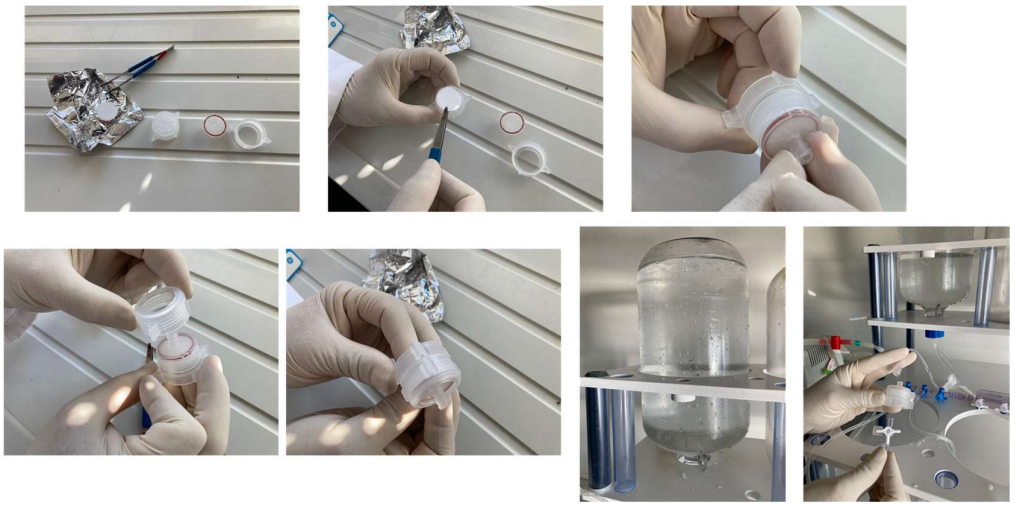

Fig. 1. Micro-bubbling sampling system to minimize contamination during filtration.

The pills containing the filters were immediately store at -18°C until the analyses in the laboratory.

In the laboratory, the samples were dried during 1h30 at 60°C. Then 150 µL of HCl 0.5 M were added on each filter during 15 min under the hood, and then dried again at 60°C. Because we were also interested to quantify the particulate inorganic carbon (PIC), a duplicate sampling was done at some depths to obtain samples that will not be acidified, in order to get the Total particulate carbon (TPC).

PIC = TPC – POC

The filters are then inserted in tin caps and compacted before introduction in the mass spectrometer. The standard curves, established for each series of 70 samples, are based on caffeine samples containing a known mass of carbon and nitrogen (Fig. 2). Two blanks were systematically operated for each CTD sampling. They were obtained by depositing GF/F filters on the filtration system and immediately stored them in pills at -18°C before analyses in the laboratory as for the samples.

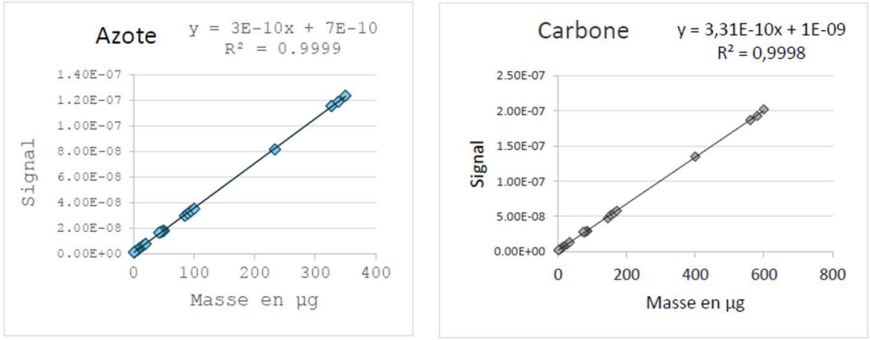

Fig. 2. Examples of standard curves obtained for an analysis's session.

The mean and standard deviation of all blanks measured were used to quantify the detection (DL) and quantification (QL) limits. Considering the difficulty for accurate POM measurements because of the heavy risk of contamination, we consider 3 ranges for the data (Low trust: Data < DL; Average trust: DL < Data < QL; High trust: Data > QL) and colored them in, red, black or green, respectively.

$$\text{Net DL} = 3*(\text{SD of the field blanks}) \text{ and Net QL} = 10*(\text{SD of the field blanks})$$

Remark: we began with another acidifying procedure (pure HCl in a desiccator), highly recommended, but our blanks were higher and we decided to change, which explain the different DL and QL reported with the data.

Particulate organic nitrogen and phosphorus (PON and POP) using the humid oxidation method

Olivier Crispi and Thierry Moutin, with the help of Lea Guyomarc'h for sampling on the N/O Thalassa

The same protocol as for POC and PON by mass spectrometry was used for sampling and filtration but with a lower volume of seawater (1200 mL). After filtration, the filters were stored at -18°C in plastic caps until analyses in the laboratory.

The humid oxidation procedure is described in details in Pujo-Pay and Raimbault (1994).

Data below DL were deleted.

Reference:

Pujo-Pay, M., Raimbault, P., 1994. Improvement of the wet-oxidation procedure for the simultaneous determination of particulate organic nitrogen and phosphorus collected on filters. Mar. Ecol. Prog. Ser. 105, 203– 207.

PON determination comparison

The spectrometric method allows to measure the POC and the PON, and the oxidation procedure the PON and the POP. Therefore, there are two different methods, using other principles and techniques, allowing to measure the PON. Fig. 3. presented the PON (MS) vs the PON (HO) which allows to be relatively confident on the measurements.

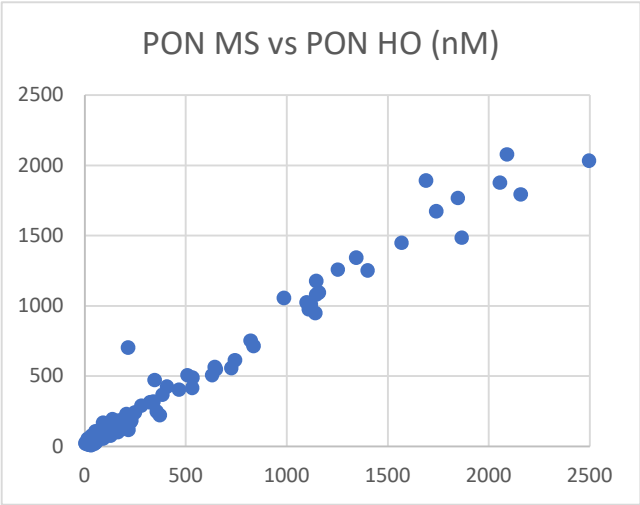

Fig. 3. PON using mass spectrometry against PON using humid oxidation (nM) (PP data)

Presentation of the table of data in the Allinone_file:

R/V Pourquoi Pas?

BY	POC MS	nM	Particulate organic carbon (POC) measured by mass spectrometry	Mass spectrometry	O. Grosso & T. Moutin
BZ	IC POC k=2	nM	Standard deviation	Mass spectrometry	O. Grosso & T. Moutin
CA	DL	nM	Detection limit	Mass spectrometry	O. Grosso & T. Moutin
CB	QL	nM	Quantification limit	Mass spectrometry	O. Grosso & T. Moutin
CC	Test		Test comparing data with DL and QL	Mass spectrometry	O. Grosso & T. Moutin
CD	PIC	nM	Particulate inorganic carbon in nanomole per liter	Mass spectrometry	O. Grosso & T. Moutin
CE	PON MS	nM	Particulate organic nitrogen (PON) measured by mass spectrometry	Mass spectrometry	O. Grosso & T. Moutin
CF	IC PON k=2	nM	Standard deviation	Mass spectrometry	O. Grosso & T. Moutin
CG	DL	nM	Detection limit	Mass spectrometry	O. Grosso & T. Moutin
CH	QL	nM	Quantification limit	Mass spectrometry	O. Grosso & T. Moutin
CI	Test		Test comparing data with DL and QL	Mass spectrometry	O. Grosso & T. Moutin
CJ	POC/PON		POC on PON ratio	Mass spectrometry	O. Grosso & T. Moutin
CK	PIC/POC		PIC on POC ratio	Mass spectrometry	O. Grosso & T. Moutin
CL	PON HO	nM	Particulate organic nitrogen (PON) measured by humid oxidation	Humid oxidation	O. Cispi & T. Moutin
CM	POP HO	nM	Particulate organic phosphorus (POP) measured by humid oxidation	Humid oxidation	O. Cispi & T. Moutin

R/V Thalassa

BB	POC MS	nM	Particulate organic carbon (POC) measured by mass spectrometry	Mass spectrometry	O. Grosso & T. Moutin
BC	IC POC k=2	nM	Standard deviation	Mass spectrometry	O. Grosso & T. Moutin
BD	DL	nM	Detection limit	Mass spectrometry	O. Grosso & T. Moutin
BE	QL	nM	Quantification limit	Mass spectrometry	O. Grosso & T. Moutin
BF	Test		Test comparing data with DL and QL	Mass spectrometry	O. Grosso & T. Moutin
BG	PON MS	nM	Particulate organic nitrogen (PON) measured by mass spectrometry	Mass spectrometry	O. Grosso & T. Moutin
BH	IC PON k=2	nM	Standard deviation	Mass spectrometry	O. Grosso & T. Moutin
BI	DL	nM	Detection limit	Mass spectrometry	O. Grosso & T. Moutin
BJ	QL	nM	Quantification limit	Mass spectrometry	O. Grosso & T. Moutin
BK	Test		Test comparing data with DL and QL	Mass spectrometry	O. Grosso & T. Moutin
BL	POC/PON		POC on PON ratio	Mass spectrometry	O. Grosso & T. Moutin
BM	PON HO	nM	Particulate organic nitrogen (PON) measured by humid oxidation	Humid oxidation	O. Cispi & T. Moutin
BN	POP HO	nM	Particulate organic phosphorus (POP) measured by humid oxidation	Humid oxidation	O. Cispi & T. Moutin