

## Phytoplankton pigment and yellow substance absorption data series for cruise Pelagia PE125

### Principal Investigator and Data Originator

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### Content of data series

Parameter	Unit	Parameter code	Number of stations	Comments
<b>Phytoplankton pigment:</b>				
mean absorption coefficient for 400-750 nm	per m	PIGAATX1	13 CTD	none
mean absorption coefficient for 400-600 nm	per m	PIGAABX1	13 CTD	none
mean absorption coefficient for 600-750 nm	per m	PIGAARX1	13 CTD	none
light wavelength for blue absorption maximum	nm	AMWLBPX1	13 CTD	none
light wavelength for red absorption maximum	nm	AMWLPRX1	13 CTD	none
blue light pigment absorption maximum	per m	PIGAMBX1	13 CTD	none
red light pigment absorption maximum	per m	PIGAMRX1	13 CTD	none
<b>Yellow substance:</b>				
light absorption by seawater between 200 and 700 nm.	per m	SWLAnnnA (*)	6 CTD	none

(\*) where nnn is light wavelength from 200 to 700 nm every 1 nm.

### Originator's protocol

#### **Methodology for phytoplankton pigment absorption data:**

Water samples were collected from 3 to 4 depths using the CTD-rosette water sampler at stations close to PROVCESS main site (Site A) in the northern North Sea. Phytoplankton absorption spectra "in vivo" were measured using a spectrophotometer equipped with an integrating sphere. The water samples were filtered through GF/F filters and frozen in liquid nitrogen before spectrophotometric reading. The measurements of spectra and further calculations (including beta-factor) were performed following the methodology given by Tassan and Ferrari (1995) i.e. taking into account the portion of light reflected on filter surface. The spectra of phytoplankton pigment absorption were obtained as the difference between the spectrum of total particulate matter settled on filter and the same sample spectrum after bleaching with 2% Ca(ClO)<sub>2</sub>.

#### **Methodology for yellow substance absorption data:**

Water samples were collected from ca. 5 and 60 metres with the CTD-rosette water sampler at stations close to PROVCESS main site (Site A) in the northern North Sea. Samples collected for the determination of yellow substance absorption were processed according to the procedure recommended for use in coastal waters by Reuter et al. (1986). The first filtration was performed on standard GF/F filters to remove most of the suspended solids and plankton cells. Collected filtered water was then filtered again through 0.2 µm pore Sartorius cellulose membrane filters to remove the fine size particles. The first two portions of 250 ml filtered water were discarded and the third filtered sample was collected in 200 ml brown glass bottles and stored in dark cool conditions (ca. 4 deg. C). 400 µl of 0.5 M HgCl<sub>2</sub> was then added to prevent bacterial growth and degradation of yellow substance. The samples were analysed on board the ship no later than three days after their collection.

Measurements of sample transparency were performed with a double beam UNICAM UV-VIS

spectrophotometer in 5-cm quartz cell in the spectral range 300-700 nm using fresh MQ-water as reference. The transparency in absorbency units  $A(\lambda)$  was transformed into absorption coefficient ( $a_{ys}$ ) which obeys Lambert-Berr law with the use of the following relation:

$$a_{ys}(\lambda) = \ln(10) * A(\lambda) / l \quad [m^{-1}]$$

where  $l$  is the cell length in metres ( $l = 0.05$  m).

The accuracy of the measurements was estimated from the reproducibility of a blank sample, with both optical cells filled with double distilled water. No major difference was found in observed spectra in absorbance units below 0.001, which corresponds to the detection level for the absorption coefficient of  $0.046 \text{ m}^{-1}$  for 5 cm cell. The spectrum of the base line was preserved in a file in absorbency units. The effect of the residual scattering present in the samples was removed by subtracting the scattering component from the spectrum. The values of absorbency in the spectral range 650-700 nm, where the linear model was not fulfilled, were averaged. The mean value was then subtracted from the whole spectrum.

The yellow substance absorption spectrum slope coefficients can be calculated by applying least-square methods for estimation of linear parameters of the spectrum in the semi-logarithmic scale in the spectral range of 300 - 600 nm. This spectral range should be chosen because yellow substance has a shoulder around  $275 \text{ nm} \pm 15 \text{ nm}$  and that could influence estimation of the slope coefficient. Very high sensitivity of the measured spectra to high signal to noise ratio for wavelengths longer than 600 nm have been noticed. In the selected spectral range, the absorption of light by yellow substance measured on the samples collected during the cruise was below detection limit and no further calculation were made.

### **BODC processing**

For two samples (CTD47, 5 m and 30 m) duplicate measurements of phytoplankton pigment light absorption were averaged before being loaded in the database. The coefficient of variations relative to the mean ( $SD*100/\text{mean}$ ) for each of the absorption coefficients reported varied between 14 and 22% for the 5 m sample and between 1 and 4 % for the 30 m sample. The difference between absorption maximum wavelengths varied between 1 and 4 nm.

The rest of the data were loaded into a database under the ORACLE Relational Database Management System without modification.

### **Comments on data quality**

None to report.

### **References**

Tassan S, Ferrari GM (1995) An alternative approach to absorption measurements of aquatic particles retained on filters. *Limnol. Oceanogr.* 40(8):1358-1368.

Reuter R, Albers W, Brandt K, Diebel-Langohr D, Doerffer R, Dörre F, Hengstermann T (1986) Ground truth techniques and procedures for Gelbstoff measurements. In 'The influence of yellow substances on remote sensing of sea water constituents from space', Rep. ESA Contract RFQ 3-5060/84/NL/MD, GKSS Res. Centr., Geesthacht, Germany.