OPTICAL ABSORPTION OF CHROMOPHORIC DISSOLVED ORGANIC MATTER IN THE ESTUARY OF THE PO RIVER (NORTHERN ADRIATIC, ITALY)

D. Berto, V. Zangrando, F. Savelli, M. Giani *

Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare, Brondolo, 30015 Chioggia, Italy - *m.giani@icram.org

Abstract

Dissolved and particulate organic matter (DOC, POC), chlorophyll and salinity were analysed to evaluate the origin of chromophoric dissolved organic matter (CDOM) in an estuary of the Po. The absorption coefficient (aCDOM) at 280 and 355 nm were not positively correlated with temperature, salinity and DOC. The values of the slope coefficient of the exponential spectral, S, and the absorption coefficients $aCDOM_{280}$ and $aCDOM_{355}$ showed a marine origin of CDOM. To characterise the aCDOM the waters were extracted and the optical properties of extracts resulted comparable to those of the original waters.

Keywords: chromophoric dissolved organic matter, Po river, Northern Adriatic, optical absorption.

Chromophoric dissolved organic matter (CDOM) absorbs light strongly in UV, limiting the penetration of biologically damaging radiation into surface waters. In order to evaluate the variations and the origin of chromophoric dissolved organic matter in the estuary of Po river, analysis of dissolved and particulate organic matter (DOC, POC), chromophoric dissolved organic matter (CDOM), and chlorophyll and salinity were carried out (1). The sampling was performed in surface waters from February to May 2003 along an axis extending from the Po river towards the open sea.

Coastal DOC and POC values ranged from 70 to 263 µmol/L and from 66 to 580 µmol / L, respectively. DOC concentration increased from winter through spring (Fig. 1) mainly as a seasonal response to the increase of the phytoplankton production and thermohaline stratification. The aCDOM at 280 and 355 nm were not positively correlated with temperature and DOC, stressing the fact that the accumulation of DOC from winter to spring was mainly not chromophoric (Fig. 2).

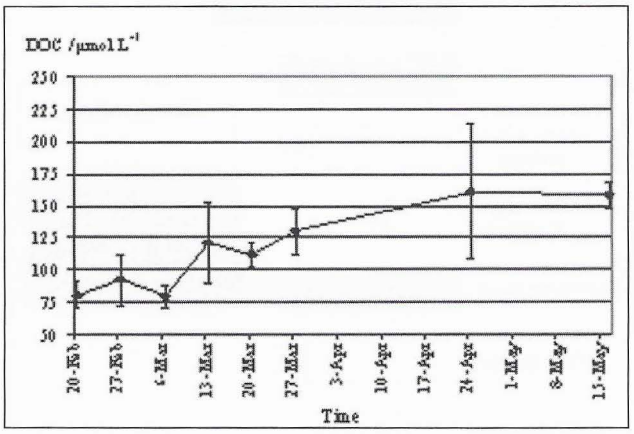

Fig. 1. Temporal variation of mean surface DOC concentration along the axis Po delta-seawards in winter–spring 2003. Error bars represent the standard deviation.

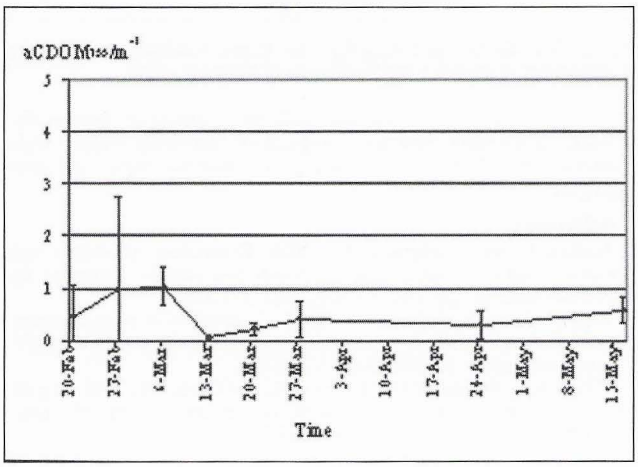

Fig. 2. Temporal variation of mean surface $aCDOM_{355}$ along the axis Po delta-seawards in winter–spring 2003.
Error bars represent the standard deviation.

High salinity in the coastal waters due to exceptionally low Po river discharge could explain the lack of linear correlation between chromophoric dissolved organic matter - and salinity as well as between DOC and salinity. Absorption coefficients at 280 nm, $aCDOM_{280}$, and 355 nm, $aCDOM_{355}$, ranged from 0.46 to 6.45 m^{-1} (average 1.79 m^{-1}) and from 0.05 to 2.38 m^{-1} (average 0.55 m^{-1}), respectively. The slope of absorption spectra, S, derived by exponential fitting, ranged from values typical of coastal waters influenced by rivers to offshore marine waters: 0.008 to 0.033 nm^{-1} (average 0.019 nm^{-1}).

High values of the exponential spectral slope coefficient, S, and low $aCDOM_{280}$ and $aCDOM_{355}$ values showed a low aromatic content and a marine origin of CDOM. To isolate and characterise the optical properties of humic and fulvic acids, seawaters samples were extracted through Amberlite XAD 2 resin column.

The optical properties of the extracted organic fractions were similar to those of the original water, as evidenced by the similar S values (2). The high values of S found in the extracts together with their solubility at pH 2 point out that this fraction is mainly constituted of fulvic acid.

References

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