

SEASONAL VARIABILITY OF PARTICULATE AND DISSOLVED CARBOHYDRATES IN THE NORTHERN ADRIATIC

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Abstract

Particulate (PTCHO) and dissolved (DTCHO) carbohydrates were measured using the MBTH method along a transect in the central part of the northern Adriatic in order to determine their seasonal variability with a special emphasize on the relationship with phytoplankton dynamics. Distribution of PTCHO was well-correlated with chlorophyll *a*, showing maxima during spring and autumn phytoplankton blooms. In contrast, DTCHO showed maximum levels during summer stratification, indicating a significant accumulation of carbon-rich organic matter during that season.

Key words: organic matter, Adriatic Sea, phytoplankton, particulates

Introduction

During the last two decades episodes of hypertrophic formation of organic macroaggregates in the northern Adriatic seemed to occur at a much higher frequency than it was in the past (1). Since carbohydrates represent the major constituents of the northern Adriatic mucilage, study of their seasonal variability and the contribution to the overall carbon cycle in the basin is one of the important prerequisites for understanding this phenomenon. There have been recently several studies looking into the distribution of carbohydrates in the northern Adriatic (2, 3, 4), however, none of the studies provided a full insight into the seasonal variability of particulate and dissolved carbohydrates over the whole annual cycle.

Methods and Materials

Study area and sampling: Samples for the carbohydrate and pigment analyses were collected in the middle part of the northern Adriatic at several stations along the Po River mouth-Rovinj transect, which is generally accepted as representative of eutrophication gradients the northern Adriatic. Sampling was performed in the period from February 1998 to December 1998 from the research vessel *Vila Velebita* at 5-6 depths (0, 5, 10, 20, 30 m and near bottom) using 5 l Niskin bottles.

Determination of carbohydrates: Seawater samples (150 ml) were filtered on board onto 47 mm GF/F filters. The filtrate, containing dissolved CHO, was poisoned with HgCl₂ (final concentration 20 mg/l) and stored in the dark at 4°C until analysis. The filters, containing particulate CHO, were transported in liquid nitrogen and finally stored at -80°C until analysis. Dissolved and particulate carbohydrates were determined spectrophotometrically using the MBTH method, following the procedure by Johnson and Sieburth (5) and including an HCl hydrolysis step (100°C, 3.5 h, 1.7 mol/l HCl). Samples were analysed in duplicate and quantification was performed using glucose as a standard. All concentrations are expressed in glucose carbon equivalents, multiplying the weight glucose equivalents by 0.4, since glucose is 40% carbon by weight. Chlorophylls and carotenoids were determined using a reversed-phase HPLC method (6).

Results and discussion

The Northern Adriatic is a very dynamic system characterized by conspicuous spatial gradients of hydrographic properties and trophic conditions, especially in its western part, which is under the strong influence of freshwater discharges from the north Italian rivers. The distribution of carbohydrates is therefore very complex and shows rather pronounced temporal variability. Figure 1 illustrates the seasonal variability of PTCHO, DTCHO and chl *a* in the two characteristic layers of the station SJ 108, which is situated about 12 nautical miles from the Po River mouth. The concentration of PTCHO in the upper layer varied in the range from 23-276 µgC/l with maxima occurring in October and May/June. These two peaks coincided with maxima of the phytoplankton crop after typical spring and autumn freshets of the Po River. A smaller maximum of PTCHO in the bottom layer observed in mid summer can be interpreted as a consequence of phytobiomass thriving on regenerated nutrients. The distribution of DTCHO showed no correlation with chlorophyll *a*. In fact, the highest levels of DTCHO in the upper layer were observed during summer stratification (316-539 µgC/l) while the phytoplankton crop remained low. The reason for this observation is most probably an enhanced release of carbon-rich organic matter by summer phytoplankton in nitrogen-depleted conditions. This process seems to be effective only in the upper layer of the stratified water column, while the concentration of DTCHO in the bottom layer remains rather low (98-207 µgC/l) and relatively constant throughout the year.

References

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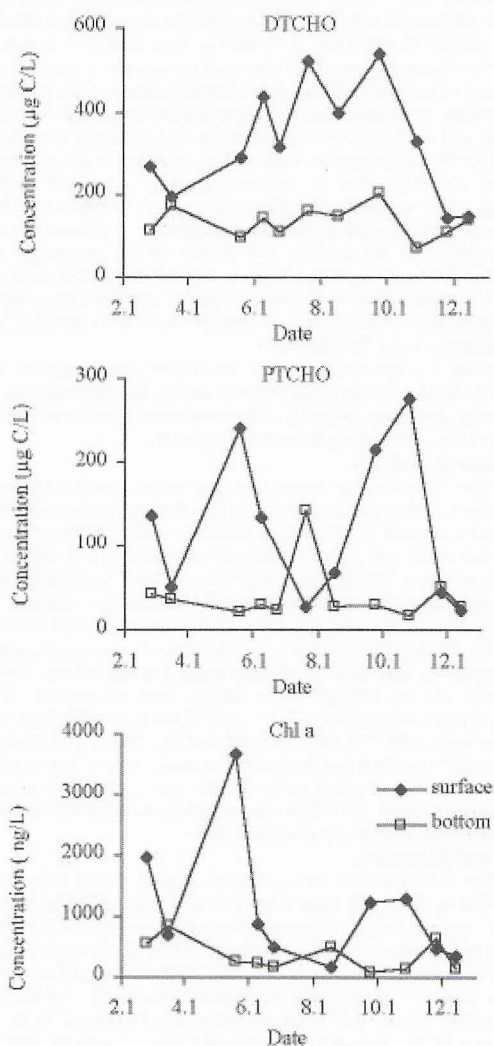


Fig. 1 Seasonal distribution of particulate and dissolved carbohydrates and chlorophyll *a* in the surface (0 m) and bottom (30 m) layer of the station SJ108.

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