

PRODUCTION OF TRANSPARENT EXOPOLYMER PARTICLES (TEP) IN THE NORTHERN ADRIATIC SEA DURING 2000

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Abstract

The distribution, seasonal changes and properties of transparent exopolymer particles (TEP) were studied in two areas of the northern Adriatic with different degrees of eutrophication. Preliminary results suggested that TEP formation occurs mainly in the more eutrophic western part of the northern Adriatic while horizontal advection probably represents the principal mechanism of TEP accumulation in the more oligotrophic eastern part.

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

Introduction

The transparent exopolymer particles (TEP) play an important role in the formation of marine snow (1) and probably also in the mucilage events (2) that have occurred frequently in the Adriatic since 1989 and were particularly intense in the northern part (3). It was hypothesized that mucilage events can develop when the concentration of microaggregates with enhanced stickiness properties (including TEP) rise above a «critical» level (4). To verify those assumptions, the distributions, seasonal changes, and properties of TEP were studied in two areas of the northern Adriatic with different eutrophication degree.

Materials and methods

Samples were collected from March to December 2000 at stations SJ101, 12 Nm off the Po River delta, Italy (44° 59,9' N; 12° 49,8' E), and SJ107, 13 Nm off Rovinj, western Istrian coast, Croatia, (45° 2,8' N; 13° 19,0' E). The total TEP concentrations (xanthan equivalent) were measured by the alcian-blue spectrophotometric method (5). The particle abundances and total areas were determined with a light microscope on filters stained with alcian blue (1). Salinity was measured by a high precision laboratory salinometer, temperature with reversing thermometers, and the phytoplankton abundance was determined by the Uthermöl method from samples preserved with neutralized lugol. The results were compared using the Spearman's rank correlation test.

Results and discussion

The occurrence of TEP was extremely variable and, surprisingly, the mean values for the period March-December 2000 did not differ substantially between the investigated stations (Tab. 1), although the influence of nutrient rich freshwaters were much more marked at station SJ101. Increases in TEP concentration at this station during the spring and summer were due to phytoplankton blooms in surface layers with significantly lowered salinity (Fig. 1). In contrast, a much higher freshwater input during October did not induce a corresponding phytoplankton (and TEP) production, probably due to light limitation in turbid waters. Remarkably, at station SJ107 extremely high TEP concentrations (up to 2500 µg xanthan.equiv.L⁻¹) were measured in June in surface layers with low phytoplankton abundance, although their salinity was significantly reduced.

Table 1. Concentrations, abundances and total surface areas of TEP at stations SJ101 and SJ107.

	SJ107				SJ101			
	n	Mean	C.V.	Range	n	Mean	C.V.	Range
Concentration 'xanthan equiv. µg.L ⁻¹)	55	309	127	4-2498	50	322	111	9-2000
Abundance (N*10 ⁶ L ⁻¹)	54	5.3	77	0.9-28	50	9.1	70	0.8-30
Total surface area (mm ² L ⁻¹)	54	717	98	78-3774	50	985	114	72-6255

Moreover, all TEP parameter values (total concentration, abundance, and surface area) were inversely correlated with salinities at both stations (statistical significance at least at p<0.05), but different results were obtained when comparisons with temperatures and diatoms' abundances were made. While significant positive correlations (p<0.01) were found at station SJ101, no evident relationships were noted at station SJ107.

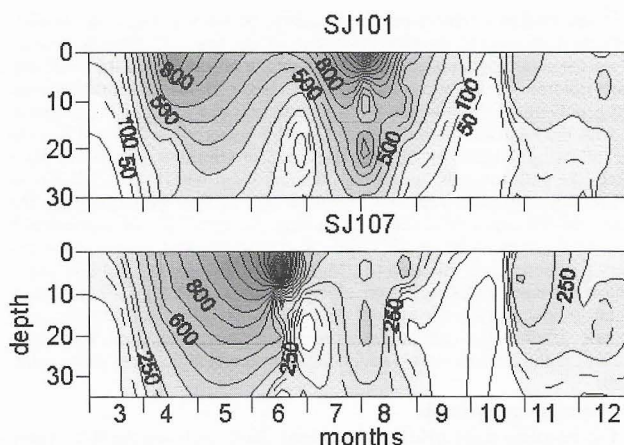


Figure 1. Temporal distribution of TEP (µg.L⁻¹xanthan equiv.) at stations SJ101 and SJ107.

These results suggest that TEP production occurs mainly in the more eutrophic western part of the northern Adriatic. Horizontal advection would represent the principal mechanism of TEP accumulation in the more oligotrophic eastern areas, assuming that their residence times are longer than for their producers (phytoplankton).

Finally, unexpectedly weak correlations were observed when the total TEP concentrations were compared with the abundance and total surface area values. This may be related to contamination of samples by gel substances that can also react with the alcian blue. In fact, a mucilage event occurred in June and July 2000, with formation of aggregates up to several meters in length in the upper water column (CMR, unpub. data).

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