

**ALKALINE PHOSPHATASE ACTIVITY AND NUTRIENT REGENERATION
IN THE VENICE LAGOON**

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SUMMARY

Alkaline phosphatase activity and nutrients were determined in the most polluted part of the Venice Lagoon. The results clearly indicate the important role of APA in the nutrient regeneration processes, occurring mainly at the sediment surface. Nutrient release from the sediments appears to be at least as important as external contributions in establishing the concentrations of the lagoon waters nutrients.

RESUME

Nous avons déterminé l'activité de la phosphatase alcaline (APA) et la concentration des sels nutritifs dans l'eau, l'eau interstitielle et le sédiment d'une zone polluée de la lagune de Venise en octobre et novembre 1982, en conditions de biomasse phytoplanctonique minimale. Les résultats indiquent clairement que l'APA joue un rôle essentiel dans le processus de régénération des sels nutritifs, lesquels se déroulent principalement à la surface du sédiment. La libération du phosphate et de l'ammoniaque par le sédiment semble influencer la concentration des sels nutritifs dans l'eau lagunaire avec une intensité comparable à celle des apports externes par les eaux résiduelles.

INTRODUCTION

The rapid development of various human activities during the last few decades (Cossu et al., 1984a) has caused eutrophication in the Venice Lagoon, a 550 km² shallow (avg. 1 m depth) marine embayment of the northwestern Adriatic Sea.

A study was carried out in order to evaluate the relative importance of the processes involving alkaline phosphatase in the complex mechanism of the nutrient regeneration in the most polluted part of the Venice Lagoon.

MATERIALS AND METHODS

Water and sediments were sampled during three cruises (October/November 1982) at 6 stations in the area located between the industrial zones of Porto Marghera and the Venice historical center, under conditions of minimum phytoplankton standing crop. Standard oceanographic parameters and nutrients were determined according to Strickland and Parsons (1972) with minor modifications. The interstitial waters were

extracted by centrifugation at 1600 g for 30 min. Alkaline phosphatase activity was assayed using 4-nitrophenyl phosphate as the substrate. After 24 hours incubation at 25 °C the absorbance of the developed 4-nitrophenol was determined at 410 nm. Before incubation the sediment samples were suspended in buffered substrate solutions and sonicated for 10 min. The sediment phosphorus compounds were determined after shaking the samples with 1 mol.l⁻¹ HCl, and extractable nutrients after shaking with artificial seawater.

RESULTS

Linear regression analysis has been used to study the relationships between the potential alkaline phosphatase activity (APA) and nutrient concentration values. Direct relationships were found between APA and reactive phosphorus (RP) concentrations below 4 µmol.l⁻¹ in lagoon and interstitial waters. Above this limit, the relationships follow rectangular hyperbolic patterns, indicating RP inhibition on APA. Significantly, similar relationships were also observed between APA and ammonia concentrations, but not with nitrite and nitrate. Moreover, the sediment APA was significantly correlated with RP and ammonia concentrations both in lagoon and interstitial waters.

When the interstitial nutrient concentrations were higher than the corresponding lagoon water values, positive relationships exist for RP and ammonia. Significant nutrient release was observed in laboratory experiments with large undisturbed cores collected in the studied area (Cossu, et al., 1984b).

Finally, the concentrations of all main nutrients (except nitrite) were well correlated with salinity.

DISCUSSION

The described results show that in the most polluted area of the Venice Lagoon the nutrient concentrations and distributions are competitively controlled by dispersion of wastewaters into the lagoon waters and by regeneration processes, mainly occurring in the surface sediments.

Potential alkaline phosphatase activity is a parameter quite suitable for evaluating the degree of nutrient regeneration. The analysis is fast, accurate and economical. It should be routinely included in ecological studies of eutrophic aquatic environments.

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