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Alkaline Phosphatase Activity : an overlooked player on the phosphate behavior in macrotidal estuaries

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The non-conservative behavior of phosphate within the estuarine salinity gradient is essentially assigned to physico-chemical processes, such as desorption at low salinity and to benthic exchanges. Microbial phosphatase activity (APA), generally related to phosphate deficiency, is seldom studied in phosphate rich estuarine waters. In order to address the impact of microbial activity (bacterial abundance, production BSP, APA) on phosphate behavior, we studied these activities on a seasonal basis within the salinity gradient of two macrotidal estuaries presenting different levels of suspended solids. Whatever the season the Charente estuary is characterized by high levels of Suspended Particulate Matter (SPM > 1g.L-1), particularly in the Maximum Turbidity Zone (MTZ) located at the 5-10 psu. In this area characterized by high BSP and APA there is a significant increase of PO4 levels especially during summer. In the Aulne estuary the particle load is significantly lower (1/10) but high BSP and APA are equally recorded. In the highly turbid waters of the Charente estuary, active phytoplankton is virtually absent as pheopigments constitute up to 80% of the total pigments, particularly in the MTZ, therefore APA may essentially have a bacterial origin. In the Aulne estuary attached bacteria are dominant, both in numbers and production, and their distribution along the haline gradient perfectly follows those of APA and phosphate levels. These observations, associated with the very close relationships observed between APA, SPM and BSP, suggest that APA derive mainly from bacterial (attached) origin and operate at the expense of particulate phosphorus and hence contribute to PO4 regeneration, especially in spring and summer. Finally, as APA increased as PO4, whereas the reverse is observed in both fresh and marine waters, an original scheme for APA regulation, related to the large dominance of attached bacteria can be described for the estuarine waters.