Dynamics of P interactions with suspended and bed-sediments

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Transport of P by the R Swale is dominated by P associated with particulate material The research reported here covered part of the work on nutrient transported by the river Swale and in particular the interaction of soluble reactive P (SRP) with suspended and river bed-sediments.

The net interaction of SRP with sediments may be conveniently described using the "Equilibrium Phosphate Concentration" (EPC) parameter. This is obtained from sorption isotherm measurements designed to cover a wide range of concentration encompassing the EPC of the sediment. The isotherm is plotted in such a way that the gradient gives the distribution coefficient or adsorption affinity of the sediment, and the native P, i.e. phosphorus sorbed to the sediment whilst in the river, from the axis intercept. It is important that the solution conditions during the isotherm determination mimic those of the river at the time of sampling, e.g. EPC often increases with lowering of the solution redox potential and may be sensitive to the counter-ions present. When the SRP concentration in the overlying water is greater than the EPC of the sediment, a net transfer of SRP from the water to the sediment is expected whilst, for the converse, a net release of SRP is predicted. The magnitude of the difference between the SRP concentration in the overlying water and sediment EPC enables the flux to be estimated (House *et al.*, 1995). The method has been used to examine the variability in EPC (as well as total P, Ca and Fe) of sediments collected from 1 km sections of the R. Swale between Catterick and Leckby Grange (a 56 km stretch). All the sediments produced relatively low EPC values (<2 μmol dm^{-3}) with no discernible trend downstream inspite of the increase in SRP concentration in the river water caused by inflows from major tributaries such as Bedale Beck and the R. Wiske. The mineralogy of the bed and suspended sediments were found to be similar but with different particle-sizes- i.e. as expected the suspended material contained much higher concentrations of silt and clay.

The interactions with bed-sediments was investigated in detail using sediment trays installed in the river at Leckby Grange for 6 weeks and then transported with a minimum of disturbance to the IFE fluvarium at Wareham. The release of SRP (and also total dissolve P) to a solution re-circulated over the bed-sediment at a constant velocity and at the temperature of river water, initially containing no SRP, was measured over 48 hours. Subsequently, the overlying solution was augmented with SRP and the kinetics of net-uptake of SRP from the overlying water was measured. In both studies, the final concentration of SRP in the overlying water approached the EPC of the bed-sediment. Within limitations, the EPC method is appropriate for assessing the P status of sediments and assessing the conditions in the overlying water when there will be a net uptake or release of SRP.

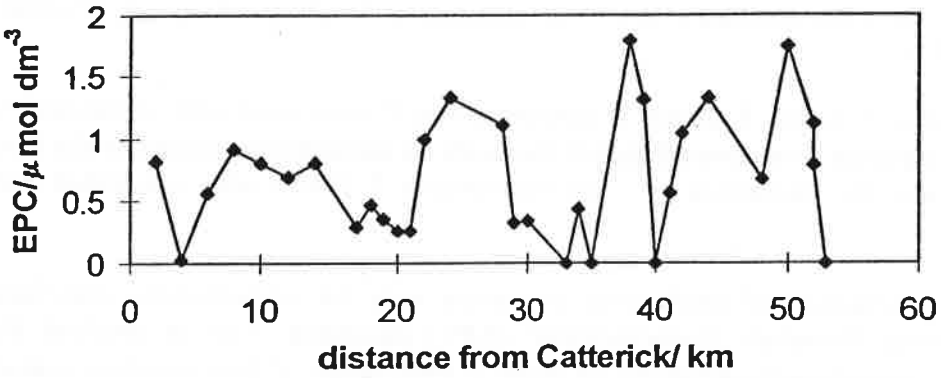

Figure describing the changes in the equilibrium phosphate concentration, EPC, measured in the surface bed-sediments (< 5 cm depth and sieved to 2 mm) along a section of the river Swale between Catterick and Leckby Grange (near Thornton Manor, the lower LOIS CORE monitoring site on the R. Swale). Samples were taken in June 1996.

Reference

House, W.A., Denison, F.H., Smith, J. and Armitage, P.D. (1995) An investigation of the effects of water velocity on inorganic phosphorus influx to a sediment. *Environ. Poll.*, **89**, 263-271.

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