Sewage Effluent Phosphorus - a Major Risk to River Eutrophication

British scientists have examined sources of phosphorus in relation to eutrophication risk in lowland rivers. The results suggest that inputs from sewage/industrial effluents rather than agricultural sources of phosphorus may well provide the most significant risk for river eutrophication, even in rural areas with high agricultural phosphorus inputs.

The EU Water Framework Directive (WFD) requires widespread control of phosphorus (P) inputs to rivers in order to improve European river water quality and protect biodiversity. Phosphorus is a major problem for river water ecology, as P enrichment can promote excessive growth of aquatic plants (eutrophication), and undesirable changes in the structure and function of the ecosystem. The major sources of P entering rivers are sewage/industrial effluents (point sources) and agricultural runoff (diffuse sources).

British scientists have recently examined sources of P for 54 lowland river monitoring sites in the UK, in relation to eutrophication risk. They used boron as a tracer of sewage inputs to the rivers, as boron is chemically conservative and is primarily derived from detergents, discharged in sewage effluent. Traditionally, the relative importance of point and diffuse sources was assessed using annual P flux budgets, which was often dominated by inputs from storm runoff from intensively managed agricultural land. However, annual P fluxes are of questionable relevance for river eutrophication, since the undesirable symptoms of river eutrophication occur primarily at low flows during the plant growing season (spring and summer), when high water residence times, abundant light levels and high water temperatures promote rapid algal growth. The current study indicates that, at times of eutrophication risk, sewage effluent is the major source of high concentrations of dissolved, highly bioavailable phosphorus fractions in lowland rivers. At these times, agricultural runoff contributions are relatively low and river water P concentrations from point sources are generally high, as a result of reduced effluent dilution.

The major findings of the study were:

- Sewage/industrial effluents may well provide a greater risk of river eutrophication than diffuse sources from agricultural land, even in rural areas with high agricultural P losses.
- River sediments may help to mitigate the phosphorus inputs from point sources under stable low flows at times of eutrophication risk, by removing dissolved phosphorus from river water.
- Remediation of point source P inputs (effluent P-stripping) at large STWs discharging to major rivers (Urban Wastewater Treatment Directive) is effective in substantially reducing river water P concentrations. However, even after P-stripping, river P concentrations remain well above levels likely to bring about ecological improvement, as a result of the cumulative influence of many smaller STWs upstream (which may be too small to qualify for P-remediation under the Directive).

These findings provide new insights into the sources, timing and potential impacts of P in rivers, and therefore they could be of interest for targeting environmental management controls for P more efficiently under the context of the WFD requirements. The authors conclude that an important starting point for reducing river phosphorus concentrations to levels required for ecological improvement would be to obtain better control over point source P inputs, particularly small effluent discharges to ecologically sensitive rural tributaries.


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Theme(s): Waste, water, chemicals

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