

August 2007 Information

Phosphates: a good environmental solution for detergents

Safe and natural

Phosphates are irreplaceable for human health and all living organisms, essential in bones, teeth, genes, proteins, biological cycling of energy, photosynthesis ... The phosphate used in detergents (STPP) is safe, indeed it is authorised forⁱ, and widely used in, human food preparations. The only concern about phosphates is “eutrophication”: because phosphates are a key nutrient for plants, too much phosphate in water can lead to excessive growth of plants and algae (“phytoplankton”).

Eutrophication

Eutrophication, although reversible and based on natural effects (plant nutrients, plant development), is a real and major environmental problem. However, eutrophication is a very complex phenomenon, related not only to nutrients (both phosphates = P and nitrates = N), but depending also on river flows (changes in river morphology), climate, health of zooplankton (which graze algae), fish populations, water quality In some cases, increased plant growth can be absorbed by the food chain (resulting in increased fish catches), but in many surface waters, algal blooms can have considerable detrimental impacts on leisure or tourism, use of water, drinking water extraction, fish and other organisms (oxygen depletion).

However, do detergent phosphates cause eutrophication problems ?

Sources of phosphates

Sources of phosphates and nitrates to surface waters include agriculture (fertilisers, animal manures, run-off), animal wastes, human sewage, food wastes, urban run-off, vegetable matter, industry and detergents. Increasingly, agriculture is the main sourceⁱⁱ of phosphates (as well as of nitrates), and where inadequately treated sewage does continue to be a significant source of P, detergents are a minority contributor (where phosphates are used in all detergents, they only represent less than one third of P in sewage, most of which come from human excrements and food wastes). Detergent phosphates have thus been estimated to contribute only 3-7% of total phosphate inputs to surface watersⁱⁱⁱ.

Will the relatively small contribution to total phosphates coming from detergents significantly modify ecosystem balance ?

Sewage treatment

If existing EU sewage treatment legislation were implemented, then the environmental impact of detergent phosphates would clearly be nil. EU Waste Water Treatment Directive 1991/271^{iv} effectively required, by 1998, phosphate and nitrogen removal from sewage, wherever receiving waters are potentially susceptible to eutrophication. In reality, Directive 1991/271 has not yet been fully applied by many member states (and Accession countries have negotiated 10-15 years for implementation).

Where nutrient removal is installed it can broadly be considered that detergent phosphates are removed from sewage. Phosphate levels in sewage works discharges are defined by works operating parameters (sewage works policy, process configuration and/or discharge consent) and are not a function of influent phosphate concentration. Increased input phosphate loads do not therefore increase phosphate inputs to surface waters. The impacts on operating costs and sludge production of increased phosphate inputs will be lower than those resulting from P-free detergents (sludge generated by insoluble and non-biodegradable additives used in P-free detergents – see below).

The contribution from detergent phosphates to surface waters should, if existing EU sewage treatment legislation were implemented, be nil:

- Wherever receiving waters are potentially susceptible to eutrophication, EU Directive 1991/271 requires phosphate and nitrogen removal from sewage for all agglomerations > approx 6 000 population^v
- In this case, the use of phosphates in detergents will not significantly increase phosphate loads reaching surface waters. This is because sewage works phosphate releases are defined by works operating parameters (process configuration and/or discharge consent) so that phosphorus outflow from the sewage works is independent of inflow levels.
- For villages < 6 000 population, the EU Water Framework Directive 2000/64 requires action to ensure Good Quality Status, without specifying a lower limit on sewage works size
- 65-95% of phosphate in sewage is also retained in correctly operating septic tank plus infiltration systems serving isolated houses^{vi}

Would P-free detergents reduce eutrophication problems ?

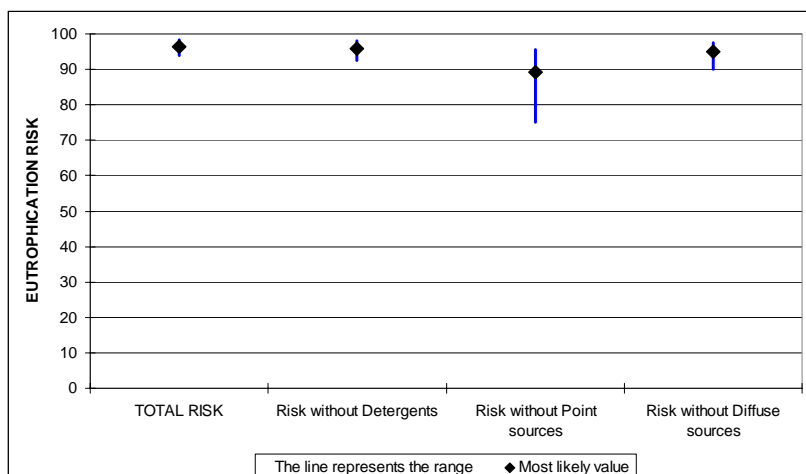
Where EU sewage treatment legislation is implemented detergent phosphates are removed in sewage treatment.

Where this legislation is not yet implemented and if sewage is contributing to eutrophication, then the only solution is to install sewage nutrient removal. Because detergents are only a minority part of phosphates in sewage, banning them will not suffice, and eutrophication problems will continue until sewage treatment with nutrient removal is installed.

Removing phosphates from household detergents will not solve the problem, installing adequate sewage treatment will. A move to P-free detergents cannot compensate failure to implement EU sewage treatment legislation and to treat sewage adequately^{vii}.

Contribution of detergent phosphates to eutrophication risks

The European eutrophication risk assessment of detergent phosphates carried out by the Spanish national research institute INIA, 2007, and published by the European Commission^{viii} shows that the use of phosphates in detergents typically increases the eutrophication risk only by around 0.5 - 3% in most of Europe.



*INIA eutrophication risk study, 2007:
Northern – central European lakes (1b)*

The study shows that eutrophication risk is regionally very variable, so that Europe-wide legislation on phosphates is not appropriate - specific local measures are needed – and that the most effective response to eutrophication problems is nutrient removal in sewage works.

Conclusions

Phosphates can be recovered from sewage and recycled, either back into industrial products (full scale installations are already doing this several countries in Europe, in Canada, in Japan^{ix}), or into food production (around half of the phosphates in sewage in Europe are currently recycled through agriculture). They are thus the only recyclable detergent ingredient.

Phosphates are a safe, natural and recyclable detergent ingredient. Moving to P-free detergents will make no difference to the environment where EU water legislation is already implemented (because detergent phosphates are removed in legally obligatory sewage treatment). Where this legislation is not yet implemented, the only solution to reduce eutrophication problems is sewage nutrient removal: P-free detergents will not bring any significant environmental benefit.

On the other hand, P-free laundry detergents result in increased sewage aluminium content, increased sewage sludge production, necessitate the use of other chemicals in detergents, and may leave residues on washed textiles and contribute to indoor air pollution, particularly with modern low-rinse-water washing machines.

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- i STPP is an authorised food ingredient under EU legislation (Directive 95/2), registered as E451(i) and an authorised multi-purpose food ingredient under US Federal (FDA) legislation (sec. 182.1810)
 - ii “Source apportionment of nitrogen and phosphorus inputs into the aquatic environment”, European Environment Agency Report 7/2005
 - iii UK: 5%, UK Environment Agency June 2002 (« Environment Agency Aquatic eutrophication management strategy – first annual review 2000-2001 - 19th June 2002 », UK Environment Agency, 2002) ; France: 3-6% for the Vilaine, Charente, Mayenne rivers, 1997-1999 data (“Sources of phosphorus to surface waters: comparing calculated with measured P loadings for three French rivers”, JF Lassevils, D. Berrux, Geoplus Consultants for CEEP, 2000) ; Danube catchment: 4-7%, based on a comparison between recent figures for detergent phosphate use and estimates for total Danube catchment phosphorus loads by project EU/AR/201/91 (1992 figures) and Senator Consult (1995 figures)
 - iv EU sewage treatment legislation (Directive 91/271) requires collection of sewage and phosphorus removal from all sewage from towns or groups of villages of around 6,000 population (10,000 pe), in all areas where phosphorus is a potential environmental issue, that is “*eutrophication sensitive areas*”, defined as all surface waters potentially susceptible to eutrophication. The Directive also requires “*appropriate treatment*” for sewage works serving smaller agglomerations, which can be taken to mean nutrient removal where eutrophication is an issue. Outside these “*sensitive areas*”, and in particular for many large cities discharging into the sea, phosphate is – by definition - of no environmental concern whatsoever.
 - v The EU Urban Waste Water Treatment Directive 91/271 required, by 1998 in the EU-15, collection of sewage and installation of phosphorus removal from all sewage from towns or groups of villages of around 6,000 population (10,000 person equivalent), in all surface waters potentially susceptible to eutrophication.
 - vi Summary of studies concerning phosphate removal in septic tank systems, see SCOPE Newsletter no 63 at www.ceep-phosphates.org
 - vii For example, the justification of the proposed decree banning detergent phosphates in France 7/2005 states that this follows France’s “conviction on 23 September 2004 by the European Court of Justice for failing to apply Directive 91/271 concerning urban waste-water treatment”
 - viii “Development of an European Quantitative Eutrophication Risk Assessment of Polyphosphates in Detergents” carried out by INIA (Spanish National Institute for Food and Agricultural technology and Research), for CEEP. Final Updated Report April 2007 published by the European Commission at: <http://ec.europa.eu/enterprise/chemicals/legislation/detergents>
 - ix Full-scale pilot plants recovering phosphates from sewage for industrial recycling are currently operative in Europe, producing calcium phosphates at Geestmerambacht Netherlands, and producing struvite sold commercially as a “green” phosphate fertiliser at Slough UK, Edmonton Canada, and at several plants in Japan.