CEEP Centre européen d'Etudes des Polyphosphates

a Sector Group of cefic

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Regulation of phosphates under the Detergent Regulation

The European Union "Detergent Regulation" (648/2004, Art. 16) includes no ban or limit on phosphates but requires the EU Commission to prepare reports on both phosphates in detergents and on other detergent ingredients including zeolites and organic co-builders used in P-free detergents. In this context studies have been published by the EU Commission assessing the eutrophication risk related to detergent phosphates (**INIA study**) and assessing chemicals used in P-free detergents (**RPA report**).

These are summarised in the EU Commission report of 10th May 2007[i] which emphasises that the impacts of detergent phosphates are very variable in the different regions of the EU and do not increase linearly with additional phosphates. This reflects the current situation in the European Union where some countries have banned phosphates in domestic laundry detergents, in others the market is voluntarily mainly P-free for laundry detergents, in some countries phosphates continue to be widely accepted in laundry detergents, and phosphates continue to be used in dishwasher detergents in all Member States.

INIA study conclusions

The European eutrophication risk assessment of detergent phosphates carried out by INIA[ii] shows that the use of phosphates in detergents typically increases the eutrophication risk by around 0.5 - 3% in most of Europe and 2.5 – 10 % for the Mediterranean region, on the basis of existing levels of sewage treatment. The environmental impact of moving to P-free detergents will not thus be perceptible. Because most phosphates in sewage do not come from detergents, phosphate removal in sewage works will in any case be necessary to address eutrophication problems

Sewage treatment

EU waste water treatment legislation requires phosphate removal from sewage works > 10 000 pe in all areas potentially sensitive to eutrophication. This is completed by the Water Framework Directive which requires appropriate action irrespective of sewage works capacity.

Where phosphate removal is implemented the eutrophication impact of detergent phosphates will be nil, because a change in phosphate concentration entering the sewage works will not change sewage works outflow levels[iii].

RPA report conclusions

The different chemicals used in P-free detergents are non biodegradable, impact sewage sludge, and accumulate in the environment. The RPA report[iv], recommends "the use of phosphate-free detergents should not be encouraged unless all the ingredients can be demonstrated to present no risks to people or to the environment". The EU Scientific Committee SCHER[v] confirmed the these conclusions, indicating that "a potential environmental risk for polycarboxylates and phosphonates is possible".

The INIA and RPA studies thus confirm that an EU-wide ban would be ineffective and is not appropriate. Specific local actions should taken to address eutrophication, as required by EU water legislation, and detergent manufacturers should be authorised to continue to use phosphates because they are a natural, totally safe, recyclable ingredient.

Phosphates: safe and natural

Phosphorus, which is naturally found as phosphates, is essential for human health and all living organisms, essential in bones, teeth, genes, proteins, cellular energy, photosynthesis …The phosphates used in detergents (STPP) are safe, indeed are authorised for[vi], and widely used in, human food preparations. The only – but real - 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.

Furthermore, detergent phosphates (along with phosphates from human wastes, food wastes, natural sources …) 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[vii]), or into food production (around half of the phosphates in sewage in Europe are currently recycled through agriculture).

Phosphates are thus the only recyclable detergent ingredient.

Detergent phosphates and eutrophication

Detergents are just one source of phosphates to surface waters. Most phosphates in sewage come from human urine and faeces, food wastes and other organic matter. Where phosphates are used in detergents, with modern formulations and usage, they make up only 20-30% of phosphates in sewage. Furthermore, sewage is often only a minority source of phosphates to waters, the main sources being agriculture (fertilisers, animal manures), urban and soil runoff. Thus, detergents contribute only a very small part of the overall total phosphate inputs to surface waters.

Because detergents are only a minority part of phosphates in sewage, taking them away will not suffice, and eutrophication problems will continue because most phosphates in sewage come from other sources (human urine and faeces, food wastes).

INIA study conclusions

The eutrophication risk assessment of detergent phosphates carried out by the Spanish national research institute INIA and published by the European Commission in 2007 [ii] assesses to what extent the use of phosphates in detergents changes the risk of eutrophication occurring.

This study concludes that, at an EU level, the estimated difference between the eutrophication risk (as a % risk of eutrophication occurring at a most sensitive point in water systems, with and without detergent phosphates) is typically around 2.5 – 10 % for a Mediterranean ecosystem and 0.5 - 3% for Atlantic & Central European ecosystems.

Such low levels of change of risk are unlikely to be perceptible in water management.

The study also shows that eutrophication risk is regionally very variable, so that Europe-wide legislation on phosphates is not appropriate - specific local measures are needed

The study results are based on current levels of sewage treatment in Europe, and clearly show that the most effective response to eutrophication risks is to install sewage nutrient removal.

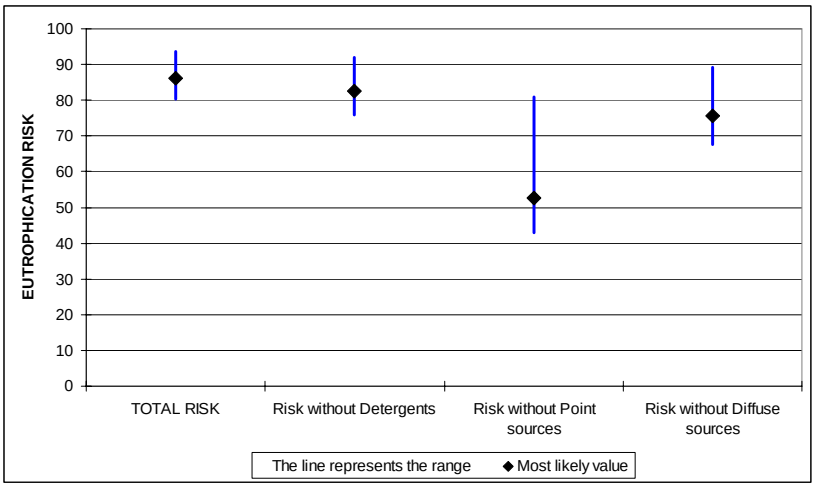
Once EU sewage treatment legislation is implemented then detergent phosphates are removed in sewage treatment, along with other phosphate, and the eutrophication impact of detergent phosphates will be nil.

INIA study results

The graphs below, from the final INIA report, show the risk of eutrophication resulting from:

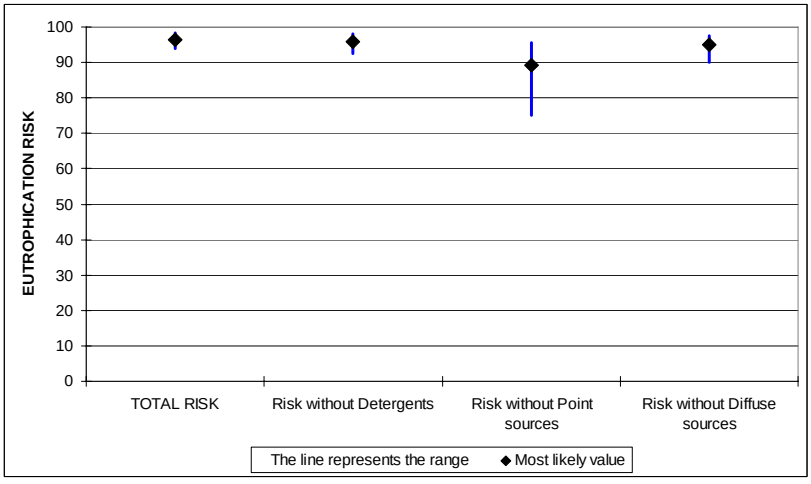
* highest EU national average detergent phosphate use (left hand column)
* moving to P-free detergents (second column)
* improved sewage treatment = implementation of EU directive obligations (3rd column)
* abatement of agricultural phosphate releases (right hand column).

The eutrophication risk reduction resulting from a move to P-free detergents is less than the natural ecosystem variation, which is reflected by the blue vertical range lines, and the most significant improvement is achieved by implementing sewage nutrient removal (third line from the left).



Assuming use of phosphates in detergents across Europe at the current European highest national consumption figure.

Mediterranean lakes, (1a)



Northern – central European lakes (1b)

Phosphate substitutes in laundry detergents

Phosphates play a number of different roles in laundry detergents, including water softening (necessary for detergent surfactants to wash effectively), dispersing dirt and preventing redeposition, building powder formulations and dissolving tablets …

The main substitute to phosphates in laundry detergent, zeolite, is an insoluble aluminium silicate. However, zeolite only partially replaces phosphates in laundry detergents, acting only as a water softener, and various other chemicals must also be included in P-free formulations : polycarboxylates, phosphonates, silicones, increased surfactant dosage, ...

The use of zeolites considerably increases aluminium content of sewage. Various other chemicals used in P-free laundry detergents are non biodegradable, including polycarboxylates, phosphonates, silicones, and also therefore accumulate in sewage sludge. If Europe were to move completely to P-free detergents, the insoluble substitute chemicals would contribute a million tonnes/year of non-biodegradable matter to sewage sludge, increasing sludge production[viii].

Because they are insoluble, substitute chemicals used in P-free laundry detergents are more difficult to rinse from washed textiles, and may leave residues on clothes and release dust into household indoor air, or require more washing machine rinse cycles (consumption of energy and water).

Phosphate substitutes in dishwasher detergents

As in laundry detergents, phosphates in dishwasher detergents have several functions. They buffer pH (necessary for hygiene, effective cleaning of tableware, killing of bacteria), render soluble mineral ions both in water (water softening) and in food wastes, disperse dirt and prevent redeposition, improve rinsing …

The insoluble chemicals used in P-free laundry detergents cannot be used in dishwashers. P-free dishwasher detergents generally contain a combination of strong amino acid chelating agents[ix] and an increased enzyme content, increased surfactant content, polycarboxylates (PCA), phosphonates, active chlorine chemicals …

These chemicals raise issues of poor biodegradability, increased organic load to sewage works, toxicity, accumulation in sewage sludges … questions which have been confirmed by the SCHER Opinion 2007 (see below).

There are at present only limited choices of P-free dishwasher detergents on the market and, these do not offer adequate wash performance to satisfy consumers in varying wash conditions (water hardness, soiling of tableware), so that it would be difficult for consumers and industry to switch to P-free products. For example, the leading German consumer magazine Stiftung Warentest has carried out a number of tests of P-based and P-free dishwasher detergents over recent years[x], concluding: "*Phosphates are much more effective than substitutes …"*.

RPA report on P-substitutes and SCHER Opinion, 2007

The RPA report for the EU Commission, 2006, concludes by recommending: "*the use of phosphate-free detergents should not be encouraged unless all the ingredients can be demonstrated to present no risks to people or to the environment*".

This conclusion is confirmed by the EU Scientific Committee SCHER Opinion on this report, May 2007, indicating the following issues for chemicals used in P-free detergents: phosphonates - potential risk related to spreading of sewage sludges ; polycarboxylates - environmental risk for aquatic ecosystems, questions as to impacts on terrestrial ecosystems. SCHER concludes that "*a potential environmental risk for polycarboxylates and phosphonates is possible*"

Conclusions

Phosphates are a safe, natural and recyclable detergent ingredient. An EU ban on detergent phosphates will make no difference to the environment where EU water legislation is already implemented (because detergent phosphates are removed in sewage treatment) and negligible difference even under the current situation of incomplete implementation (cf. conclusions of INIA study).

Where this legislation is not yet implemented, the only solution to reduce eutrophication problems is sewage nutrient removal.

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 which are non biodegradable and pose environmental questions (cf. RPA report) and possible health issues, may leave residues on washed textiles and contribute to indoor air pollution, particularly with modern low-rinse-water washing machines.

For dishwasher detergents no safe and effective substitute for phosphates, recognised as ensuring good wash performance and hygiene in all wash conditions, is available today.

No processes are currently envisaged to recover or recycle the various substitute chemicals used in P-free laundry or dishwasher detergents, whereas phosphates can be recovered from sewage and recycled, along with phosphates from other sources in sewage. The current stipulation of the EU Detergent Regulation, that member states can take national or regional measures on detergent phosphates should be confirmed. This will enable the continued development of phosphorus recycling from sewage, in order to move towards a sustainable future.

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[i] EU Commission report COM(2007)234 available at : http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0234:FIN:EN:PDF .

[ii] "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

[iii] "Summary of expert opinions on impact of a change in P-concentration in influent to a WWTW (operating P-removal) on P-concentration in discharge", Evans T., March 2007

[iv] RPA, June 2006: « Non-surfactant Organic Ingredients and Zeolite-based Detergents » Ref/Title J480b/Detergents, published by the EU Commission at: http://ec.europa.eu/enterprise/chemicals/legislation/detergents

[v] SCHER (European Scientific Committee on Health and Environmental Risks) Opinion adopted 29th May 2007 http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_057.pdf

[vi] 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)

[vii] 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.

[viii] 500,000 tonnes/year of zeolite today used in P-free detergents (EUZEPA 2006), plus other components. Estimate of 1 000 000 tonnes/year total for a 100% P-free laundry detergent market for Europe. The WRc report 2002 for the European Commission, table 7.6, page 110, shows that P-free detergents generate more sewage sludge than the use of phosphates in all of the sewage treatment scenarios considered (+1% - +8% increase)

[ix] NTA, EDTA, MGDA, DTP, B-ADA, IDS …

[x] Stiftung Warentest, November 2002, testing 13 dishwasher detergent tablets, and August 2005 , testing thirteen 3-in-1 and 2-in-1 tablet domestic dishwashing detergents