

# Science for Environment Policy

## 'Poor gain' from extra treatment of wastewater to remove pharmaceuticals

**A recent study** compared the decentralised treatment of pharmaceutical contaminants in wastewater at hospitals with centralised treatment at conventional and upgraded wastewater plants. The results suggest that additional (post) treatments may not always provide significant benefits.

**Conventional wastewater plants** are not designed to remove pharmaceuticals excreted from the human body. As a result, most pharmaceuticals are eventually released into the environment where they have been found to have ecological effects, for example, they can damage the reproductive systems of fish. One solution to this problem would be to upgrade existing treatment plants with technologies developed to remove pharmaceuticals and other xenobiotics (e.g. pesticides). Another solution is to apply treatment at known concentrated sources (e.g. in hospitals). However, each extra treatment process can lead to additional environmental impacts, which should be considered when weighing the benefits against the costs.

The study was conducted in the framework of the EU PILLS project<sup>1</sup>. To assess conventional treatment, the researchers used data from centralised [wastewater](#) treatment plants in Switzerland. The upgraded conventional plants (in Germany and Switzerland) included ozone treatment, while the hospital treatment plants (pilot and full-scale plants of the PILLS project in Luxembourg, Germany, The Netherlands and Switzerland) comprised a Membrane Bioreactor (a submerged system where bacteria metabolise pollutants and a filtering unit separates the biomass from the treated water), complemented by one of three additional treatments: ozonation, activated carbon adsorption or ultra-violet radiation.

The study assessed the life cycle environmental impacts of the treatments, including effects on eutrophication, climate change and (eco)toxicity, focusing on ten pharmaceuticals that are found at high levels in wastewater, including antibiotics and painkillers.

According to the life cycle analysis results, the additional treatments at the decentralised and centralised plants in the study generated significant additional environmental impacts (related to energy and chemical consumption), for what the researchers describe as a 'relatively poor gain'. Comparison of the additional treatment approaches indicated that ozonation or activated carbon might be preferable to UV treatment, and that upgrading conventional treatment might be more appropriate than implementing decentralised treatment. The limited net avoided impact in all cases was attributed to the comparatively minor impact of pharmaceuticals modelled within the scope of the study, which was considered not to favour additional treatment.

However, since the assessment had a range of limitations, which include high variability in operational data (for example in the consumption of electricity and chemicals) and in particular uncertainty in the (eco)toxicity assessment, the findings should be judged with caution, and the authors note that we should not conclude that the effect of pharmaceuticals is negligible in the environment.

Currently available (eco)toxicity test data do not fully cover all potentially relevant aspects, such as the effects of long-term low-level exposure, bacterial resistance and endocrine disruption. In addition, life cycle assessments, with their global focus, do not cover issues at a local level. The study did not address terrestrial ecotoxicity, nor the formation of toxic transformation products caused by oxidative additional treatments. In order to fully investigate the question of decentralised or centralised treatment of pharmaceuticals, a multicriteria approach going beyond life cycle assessment is therefore recommended by the authors.



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