

# Science for Environment Policy

## Aeration may remove antidepressant drugs from water leaked from landfill

**Aeration is an effective means of eliminating antidepressants** from landfill leachate, a new study finds. The concentrations of five different drugs were reduced by this treatment process, which could be an effective means of tackling the growing problem of pharmaceutical infiltration into aquatic environments.

**Pharmaceuticals, while an important component of modern medicine**, can have negative effects on the environment. The drugs taken by humans are often not fully metabolised in the body. This means they are excreted and can end up in the municipal sewage sludge system and leachate from landfill (the water that percolates through waste). Leachate can enter groundwater, releasing these compounds into the environment. Recognising growing concern about this type of pollution, in 2013 the European Commission developed a strategic approach to the pollution of water by pharmaceutical substances.<sup>1</sup>

Selective serotonin reuptake inhibitors (SSRIs), generally used as antidepressants, are widely prescribed in many countries. Although they can effectively treat mental illnesses, when released into the aquatic environment SSRIs can have undesirable effects on the organisms within. For example, fluoxetine (better known as Prozac) has been shown to change the behaviour and reproduction of fish.

To reduce the concentration of pharmaceuticals, leachates can be put through a process called aeration, which circulates air throughout the liquid within a pond or lagoon to purify it before it is released into the environment. However, not all pharmaceuticals react in a similar way to aeration, and the effects of the resulting products on the environment are not always well known. Currently, the effect of aeration on SSRIs within landfill leachate is poorly understood.

To address this knowledge gap, a team of researchers in Norway (where approximately 4% of the population uses SSRIs) set out to determine what happens to the compounds during aeration, and whether they can be removed before leachates enter the environment.

They mimicked the process used to treat landfill leachate in industry using samples containing five different SSRIs – citalopram, fluoxetine, paroxetine, sertraline and fluvoxamine – and three of their metabolites. The concentrations of SSRIs used in this study were higher than usually encountered in the environment, so while not directly comparable, they were at an environmentally relevant level.

The concentration of the SSRIs in samples of water was measured at the beginning and the end of the five day experiment. These measurements were compared with the total amount of SSRIs that would be present if no reduction had occurred. The results showed that the concentration of all SSRIs was significantly reduced; all compounds were reduced in concentration, at a rate between 89% to 100%. Of the SSRIs assessed, fluvoxamine and citalopram were the most effectively eliminated and were entirely removed from both high- and low-concentration samples.

*Continued on next page.*



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**Contact:**  
[ove.bergersen@bioforsk.no](mailto:ove.bergersen@bioforsk.no)

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1. For more detail, refer to  
Directive 2013/39/EU as  
regards priority substances in  
the field of water policy:  
<http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32013L0039>.

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The fact that almost all compounds were entirely eliminated suggests that aeration treatment may be an effective means of removing SSRIs from landfill leachate before it reaches the environment, and could be an important consideration for future water policy.

The samples were also tested for their known metabolites, the compounds produced when these SSRIs are broken down in the body. Only one could be detected, suggesting that aeration may break down the compounds in a different way to human metabolism. The authors recommend further studies to determine the nature of the degradation products formed, and their environmental impact. The results of such studies could inform more sophisticated water treatment systems to prevent the negative environmental impact of pharmaceutical pollution. It should be noted that removal of pharmaceuticals is not under the scope of the Urban Waste Water Treatment Directive<sup>2</sup>, 91/271/EEC, even though some of the pharmaceuticals can be better removed through aeration.



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<sup>2</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0271>

