

Example – removal of micropollutants in drinking water

Generic product activity or name

Drinking water

Synonyms

Potable water, tap water

Context and background

Filtration through biologically active sand filters is among the most widespread purification processes for drinking water production. However, contamination of the source water with organic micro-pollutants like pesticides, solvents, and pharmaceuticals often forces waterworks to either close down abstraction wells or to purify the water additionally before it is distributed. In Denmark, contamination of the groundwater with pesticides constitutes one of the biggest issues in the drinking water sector. A possible solution to this problem is biological treatment through so-called ‘bioaugmentation’, consisting of introducing in the existing sand filters organisms capable of degrading specific compounds.

Presentation of example

In a comparative LCA, bioaugmentation should be compared to functionally-equivalent alternatives, taking into account the particular context of Denmark, where currently only groundwater resources are used to produce drinking water. We can identify the following alternatives that could compete with bioaugmentation:

- Granular activated carbon (GAC) adsorption. This is a well-established technology, consisting of passing the flowing water through a carbon filter, where pollutants are adsorbed to the surface of this porous material. In fact, several waterworks in Denmark already apply this technology in order to remove micro-pollutants.

Besides remediation options such as GAC, the following alternatives can be considered:

- An alternative for a waterworks that risks exceeding the legal limits for micro-pollutants is to close the contaminated wells and open new ones elsewhere, with concentrations of micro-pollutants under the legal limits. In this scenario, the waterworks operation is not changed with any additional process, but it involves dismantling the existing wells and opening new ones.
- Another alternative to avoid directly dealing with pollution is to seek new resources. This could be done by means of seawater desalination. The problem with this option is that is expensive when compared to conventional production processes using freshwater resources. This alternative would also involve dismantling the existing well, and installing a new desalination plant. Desalination is usually applied in countries with serious water shortages, therefore it does not seem an obvious option for Denmark.

All the mentioned alternatives deliver the function of providing drinking water, but they are not completely equivalent, since bioaugmentation and GAC deliver additional functions:

- They allow us to extend the life span of existing groundwater abstraction wells, whereas well replacement and desalination do not.
- Bioaugmentation and GAC remove pollution from groundwater, whereas well replacement and desalination do not tackle pollution.

In order to have full functional equivalency, the system boundaries for bioaugmentation and GAC should be expanded to account for these additional functions. An additional issue is that desalination ‘creates’ new water resources, something that none of the other options do. This can properly be taken into account in the LCA in the impact assessment stage, where an indicator covering use of water resources could reflect this advantage.

Information sources used

The main source for this example is a case study on bioaugmentation, carried out for the EU-funded project BIOTREAT (<http://biotreat-eu.org>).

References

Muñoz I, de Vries E, Wittebol J, Aamand J (2015) Prospective environmental and economic assessment for biotreatment of micropollutants in drinking water resources in Denmark. *Water Science and technology*, in press
(<http://www.iwaponline.com/ws/up/ws2015100.htm>)

Godskesen B., Hauschild M., Rygaard M., Zambrano K., Albrechtsen H.-J. (2013) Life-cycle and freshwater withdrawal impact assessment of water supply technologies. *Water Research*, 47 (7): 2363-2374

Author of this example

Ivan Muñoz

Date

2015-08-21

How to reference this

Muñoz I (2015), Example – removal of micropollutants in drinking water.

www.consequential-lca.org