**Presentation title:**

# Advanced mineral based solutions for removing pharmaceuticals from wastewater – a way forward to achieve global SDGs

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Wastewater treatment plants (WWTPs) have not been designed to remove pharmaceuticals, and as WWTP effluent is discharged onto surface water, more and more pharmaceuticals are found in surface waters. Removal of pharmaceuticals from water can be expensive, especially when concentrations are low and several different chemical compounds occur together. One potential way could be to remove pharmaceuticals at the source where they enter the water cycle, i.e. directly in the toilets. Other possibility is to upgrade the WWTPs for effective pharmaceutical removal.

Adsorption on activated carbon has been a traditional industry choice for removing organic compounds from water. However, studies have demonstrated that activated carbon has only a limited adsorption capacity for micropollutants such as pharmaceuticals, especially in the presence of natural organic matter (NOM) in water.

We developed an adsorbent ("CatchAmed") that shows specific interactions with certain functional groups in the molecular structure of pharmaceuticals. As a carrier material an aluminosilicate was used, with a density $\geq 2$ g/ml, as this will be easy to remove from the aqueous phase in the WWTP. The surface area of the material was about 20 $m^2/g$. The surface was modified with silanes, thus introducing active groups that can interact with pharmaceuticals according to the "lock key principle" (see figure 1). First experiments were carried out with an adsorbent designed for the removal of diclofenac and some chemically related compounds.

It was found that adsorption of diclofenac occurs almost instantaneously, and that desorption of the compound in pure water (Milli-Q) is negligible. It was found that metoprolol and sotalol couldn't be removed by this type of adsorbent, as was expected based on their molecular structures. However, for other compounds some interaction was expected, and indeed it was found that they were well-adsorbed by CatchAmed.

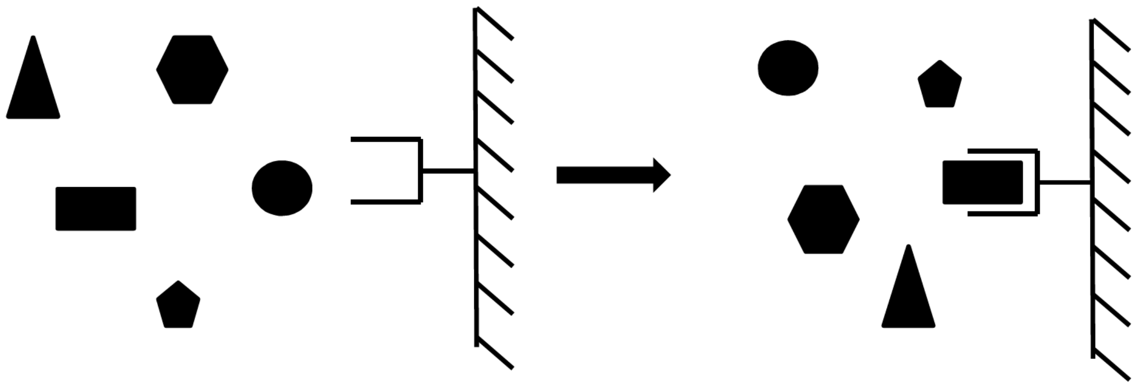

Figure 1: Lock-key principle for the removal of specific pharmaceuticals from the aqueous phase.

CatchAmed has been used in two pilot investigations, one at two nursing wards in a hospital, and one in an office building. People (patients, nursing staff and visitors of the hospital and employees in the office building) were asked to add some of the adsorbent to the toilet before using it. It was found that many people hadn't realized the problem of the presence of pharmaceuticals in wastewater before, and that they all were very willing to do something to help the environment. Although doctors at first were a little reluctant, as they were afraid it might be too taxing for patients and staff, we only obtained positive reactions. Also in the office building of a water authority the adsorbent was used by most people. Besides, it was shown that even in a complex real wastewater matrix of a hospital the adsorbent could still effectively adsorb diclofenac.

It was found that CatchAmed is an efficient adsorbent for the removal of certain pharmaceuticals, using the lock key principle to minimize competition by other organic compounds.

Furthermore, it was shown that people are willing to do add the adsorbent to the toilet, if in this way pollution of water with pharmaceuticals can be prevented.

**Acknowledgment**

This project has been co-financed with PPS-funding from the Topconsortia for Knowledge & Innovation (TKI's) of the Ministry of Economic Affairs and Climate. The authors would like to thank Roberta Hofman-Caris, Patrick Bäuerlein (KWR Watercycle Research institute), Harry Tolkamp (Waterschap Limburg), Ad de Man (Waterschapsbedrijf Limburg), Harry Wernert (UMC Utrecht), Bartek Prusisz (Sibelco), Ger Creusen (Sibelco), Maurice Franssen (Water Authority of Limburg), and Marlies Verhoeven (Water Authority Hoogheemraadschap De Stichtse Rijnlanden) for their great contribution to the project.