CoRe Water: from WWTP to a sustainable water factory

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Sewage is thickened by a factor of 20 with membrane filtration. The concentrated stream (1 of the 20 parts) is purified in several steps, the remaining 19 parts are released as pure water. The CoRe Water concept represents a highly innovative approach to the treatment of wastewater. Aims are to reuse of water & materials, reduce GHG & medicines emissions and stimulate modular construction.

Introduction

Scarcity of water is a key driver for reuse of wastewater in many places around the world. Meanwhile, current wastewater practice is challenged to improve on reduction of greenhouse gas emissions, removal of organic micro-pollutants (including pharmaceuticals) and on recovery potential of valuable compounds. This is where the CoRe Water concept comes in: Concentration, Recovery and Reuse.

The challenge in this project is to work on both sustainability and cost-effectiveness of sewage treatment and on better effluent quality (read removal of organic micro-pollutants (OMP; including pharmaceuticals), nitrogen and phosphate). With the innovative purification concept CoRe Water wastewater is first concentrated before it is further treated. In this way, sewage water can be efficiently and efficiently purified with a higher purification efficiency (N, P & OMP) & optimal recovery of resources such as nutrients, energy and especially water: from wastewater treatment plant to sustainable water factory.

Technology

The pre-concentration of wastewater is done with a new technology based on the principle of Forward Osmosis (FO). This is the key step in the production of clean water without nutrients, (pathogenic) micro-organisms and OMP and a concentrated

wastewater stream that can be treated more energy-efficient and from which resources are easier to recover. Due to substantial flow and quality variations, municipal wastewater is a challenging application for FO technology. Presently we are up-scaling the process in three subprojects using pilot research and adjoining laboratory research on different scale sizes for the extraction of water, energy and raw materials. In doing so, we first and foremost investigate the technology of FO itself, but also pay attention to anaerobic treatment, nutrient extraction and removal of micro-pollutants. The possible application of the raw materials is also included in the study.

Solution

The aim is to obtain sufficient information about the technical and economic potential of the CoRe Water concept to assess whether it is a fully-fledged new alternative for the treatment of sewer wastewater and to have sufficient insight into both the overall energy balance and the economic feasibility of the concept. We also obtain insight into the possibilities for reusing water, energy and raw materials (applications) from the concentrate of the FO.

As a first step, the municipal wastewater is concentrated by a factor of 20 applying FO. The concentrated stream (1 part of the 20) is then biologically treated – first anaerobically, then aerobically. In this way the maximum amount of energy and valuable components is recovered, while making the removal of OMP manageable. A key element is concentration of wastewater early in the process, because:

- As a general rule in water technology, the more concentrated the liquid stream, the more efficient treatment processes are.
- The concentrate can be treated anaerobically, which converts organics into methane.
- Recovery of valuable compounds (e.g. nutrients) and energy from the concentrate are favored.
- OMP (e.g. pharmaceuticals) are managed more efficiently.
- The emission of greenhouse gases (esp. N_2O) is significantly reduced.
- And last but not least: the clean water flow can be reused in high-end applications.

The remaining 19 parts of the original wastewater are released as pure water of demiwater quality, which is suitable for reuse in a number of applications. With CoRe Water we're now truly making the step from WWTP to water factory!

Acknowledgement

The CoRe Water project is a collaboration by water boards Limburg, Vallei & Veluwe and Rijn & IJssel, BLUE-tec, Royal HaskoningDHV and KWR Watercycle Reseach Institute. This activity is co-financed with PPS-funding from the Topconsortia for Knowledge & Innovation (TKI's) of the Dutch Ministry of Economic Affairs and Climate.