



Biostimulation of prokaryotic communities in drinking water biofilters

Access to pure and safe drinking water is considered a human right, and although it is not yet afforded to everyone, the great majority of people do have access. Historically, drinking water treatment systems came into use in the second half of the nineteenth century in the aftermath of outbreaks of cholera and typhoid fever. Currently, about 75% of the drinking water in Europe is treated.

Biofilters are often at the heart of drinking water treatment systems and are the standard treatment in Denmark. These filters often consist of washed, dried and sieved quartz sand. After the sand grains develop a coating of inorganic precipitates and biofilm in a start-up process, the mature biofilters are able to remove unwanted electron donors from anaerobic groundwater such as manganese, arsenite, iron and ammonium to produce pure and biologically safe drinking water.

The present industrial PhD connects Skanderborg Forsyningsvirksomhed A/S (commercial party) with Aalborg University and VIA University College (academic parties). The project is financed by Innovation Fund Denmark and Skanderborg Forsyningsvirksomhed A/S.

The overall objective is to investigate new drinking water treatment methods for producing high quality drinking water from groundwater sources through the use of biostimulation. In the context of this project, biostimulation is defined as the modification of the environmental conditions in drinking water biofilters to stimulate the growth and metabolism of prokaryotic microorganisms that are responsible for purifying the water.

Biostimulation of drinking water biofilters will be investigated in three work packages 1) biostimulation facilitated by alternative filter media, 2) biostimulation facilitated by addition of supplemental nutrients and 3) biostimulation facilitated by the use of novel modular process design. The methods used in this research include: literature review, experimental work including chemical, physical and microbiological analyses, and modelling of experimental results.

Since this is an industrial PhD, both scientific and commercial outcomes are expected. Biostimulation is an emerging field, the identification of bacteria and archaea in the prokaryotic communities present in drinking water biofilters is in the initial stages of being unveiled due to the advent of new molecular microbiological techniques. The use of this increasing knowledge in combination with biostimulation to improve drinking water treatment is generally unexplored. Skanderborg Forsyningsvirksomhed A/S expects that the novel knowledge in biostimulation will allow the company to increase drinking water quality, optimize water treatment processes, and reduce energy consumption at waterworks.