

# **Nitrification-Anammox: a successful technology for mainstream wastewater treatment?**

The discharge of wastewater with high amount of nitrogen is a major threat to life in aquatic ecosystem. Conventional method of nitrogen removal is highly energy demanding. Nitrification-Anammox is a new and eco-friendly approach which seems to solve this issue.

Total population of the world is increasing every day and that is also the case in Malmö, the third largest city in Sweden. One of the problems accompanying the increase of the population in Malmö is the wastewater generated. It is even more complicated after Sweden has signed the Baltic Sea Action plan which aims to limit the nitrogen discharge. This action plan includes the Öresund strait where the wastewater from Malmö is discharged to. Nitrogen containing wastewater if it is not treated properly will cause algal bloom in the water streams. Algal bloom is a phenomenon when algae (a group of microorganisms) grows very fast so that they cover the surface of the water blocking the sun light. Without the sun light, life under water will be gone. At the moment, there are several wastewater treatment plants (WWTPs) which treat the wastewater in Malmö region. However, some of the plants will be closed down in the future leaving most of the burden to Sjölanda WWTP. With the existing capacity of Sjölanda WWTP, it is harder to cover the target set by the joint agreement.

Nitrification-anammox is a newly introduced method in removing nitrogenous compound from the wastewater. The nitrification-anammox method addresses the main issue in the conventional treatment of nitrogen containing wastewater: high amount of energy consumption. In the conventional approach, ammonium (compound that are usually found in cleaning solutions) is converted to nitrite then to nitrate in the process called nitrification. Nitrate will later be converted to nitrogen gas, the most abundant gas in the air in the process called denitrification; this process needs external carbon sources, e.g. sugar. In the nitrification-anammox process, half of the ammonium is converted to nitrite first, then the remaining ammonium together with newly formed nitrite will be converted to the nitrogen gas. The nitrification-anammox process will lower the energy consumption significantly and eliminate the need of additional sugar.

The successful implementation of the nitrification-anammox process in the large scale, for example in Sjölanda WWTP, depends on the relation of different microbial groups. Environment surrounding them contribute to the composition of this microbial population. Low temperature and low ammonium concentration found in the mainstream wastewater is not good for maintaining the desired microbial composition in the reactor. As a result of this, it is challenging to supply an efficient nitrification-anammox operation. The number of carriers (“house” of bacteria) was an important parameter to be tested because the carrier helps to retain the bacteria responsible for the nitrification-anammox process in the wastewater treatment plant. Too high or too low amount of ammonium and nitrite (“food” of bacteria) would result in inefficiency while determining microbial activity. This work has contributed to the knowledge of implementing the nitrification-anammox process for industrial application and has pointed out the possible problems that could be faced in the future.