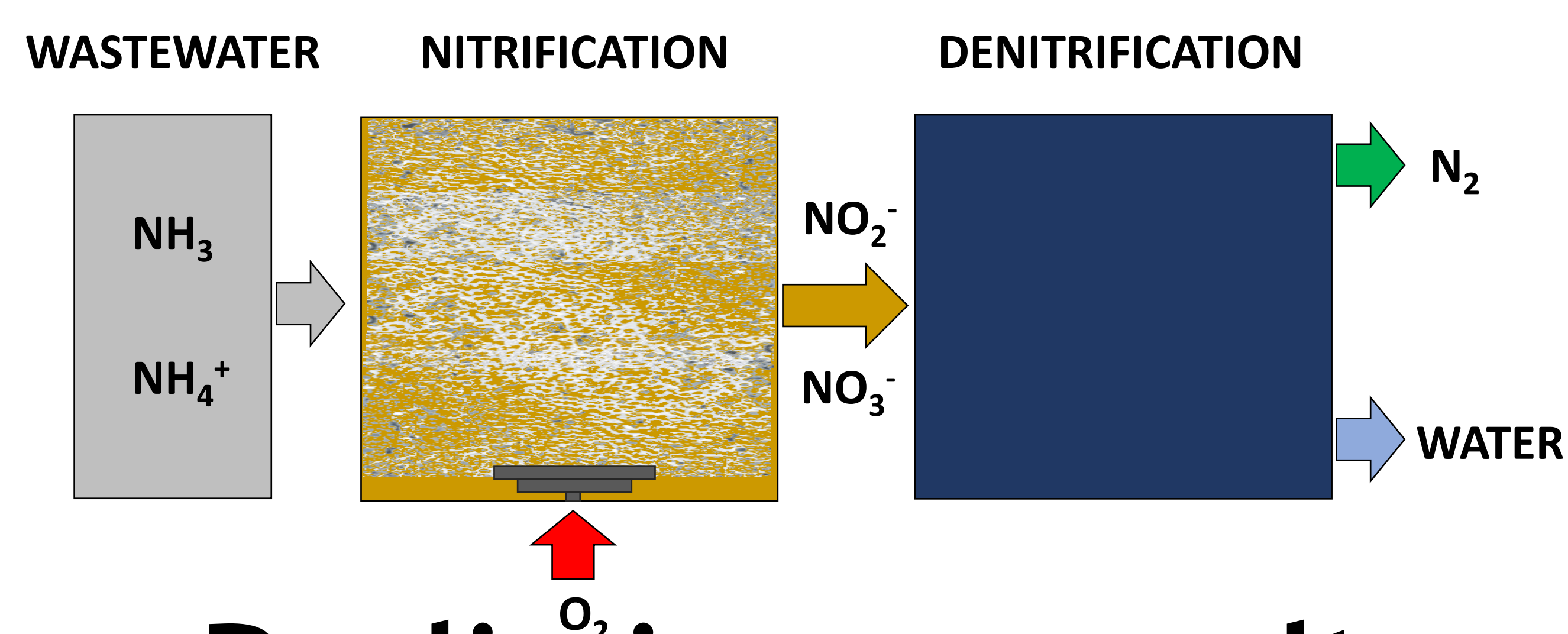


Biological nitrification process for ammonia removal in wastewater

Ilaria Rizzardi, Aldo Bottino, Gustavo Capannelli, Camilla Costa, Raffaella Firpo, Marcello Pagliero, Antonio Comite
membrane&membrane Research Group, Department of Chemistry and Industrial Chemistry (DCCI), University of Genoa, Via Dodecaneso 31, 16146, Genova, Italy

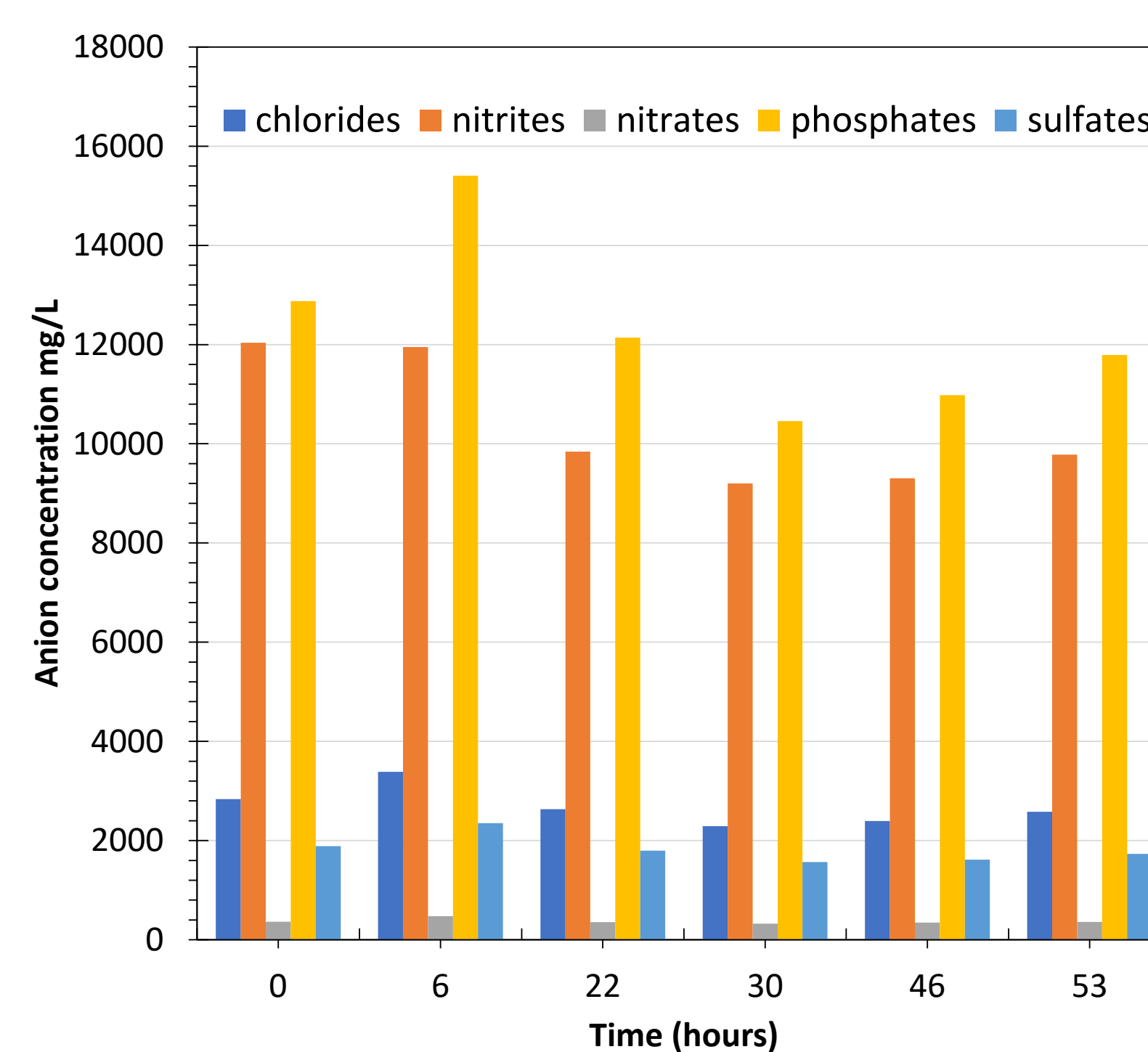
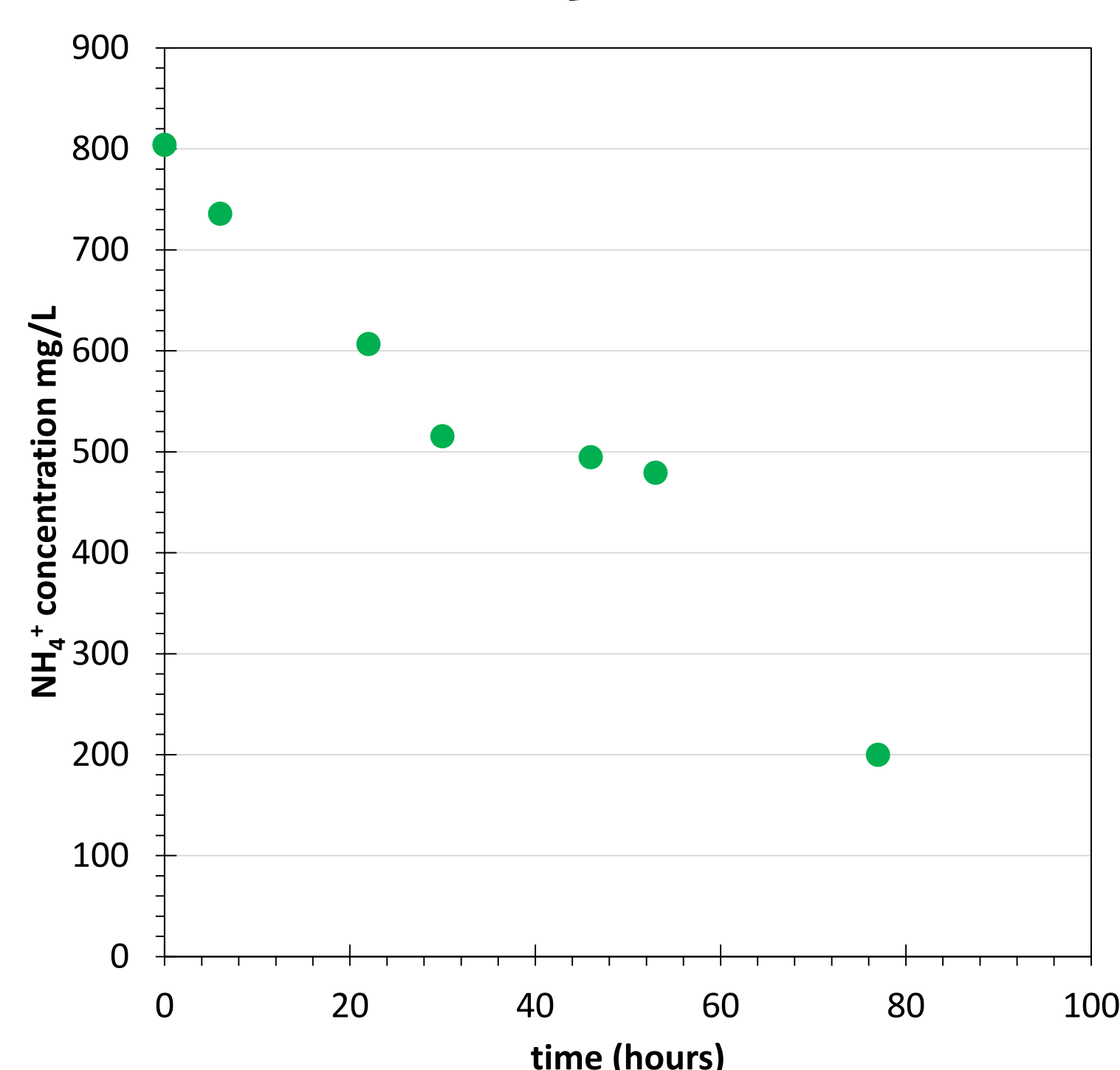
Introduction

Ammonia-nitrogen, including non-ionized (NH_3) and ionized (NH_4^+), is a common pollutant in both municipal and industrial wastewater streams. The presence of high concentrations of this contaminant is due to human activity and represent a risk for human health. In fact, World Health Organization (WHO), European environment agency (EEA) and local environmental authorities has recommended the limit of concentration of ammonia in water streams. In this way, the study of economics and green methods for ammonia removal are important and fascinating for the researcher. An interesting option is the nitrification-denitrification process performed in biological reactors since the final product is N_2 that that could be returned to atmosphere. Ammonia is oxidized in nitrite and nitrate by aerobic chemolitho-autotrophic bacteria during the nitrification. Then, in denitrification, the products of the first step are reduced to N_2 in anoxic environment by chemoorgano-heterotrophic denitrifying bacteria. In the first part of the process the oxygen concentration inside the reactor is a critical parameter and the efficiency of the aeration system is relevant.



Preliminary results

In all the system the nitrification takes place and ammonia was converted mainly into nitrites but also in nitrates. In all the system the concentration of oxygen was optimal and, using membranes, we can achieve higher oxygen concentration using lower air flowrates.



Experimental

Two system were prepared using water prepared with ammonia concentration up to 500 ppm and a biomass of oxidation active sludge plant. One is equipped with a commercial air pump that provide 1 L/min as flowrate. The second is equipped with membrane modulus prepared with PP hollow fiber membranes and the flowrate provide is 0,5 L/min. The parameters detected during the research were pH, ammonia concentration, total suspended solids (TSS), anions concentration (chlorides, nitrites, nitrates, phosphates and sulfates), COD, and DO (dissolved oxygen). The amount of ammonia was determined with analysis kit and the amount of anion present in the system was detected using ion exchange chromatography.



Future developments

- Perform the denitrification process
- Study the influence of different kind of membranes (ceramics, polymeric in flat configuration)
- Study the influence of surface properties of the membranes
- Study the effect of the surface area
- Perform nitrification in bubbless mode