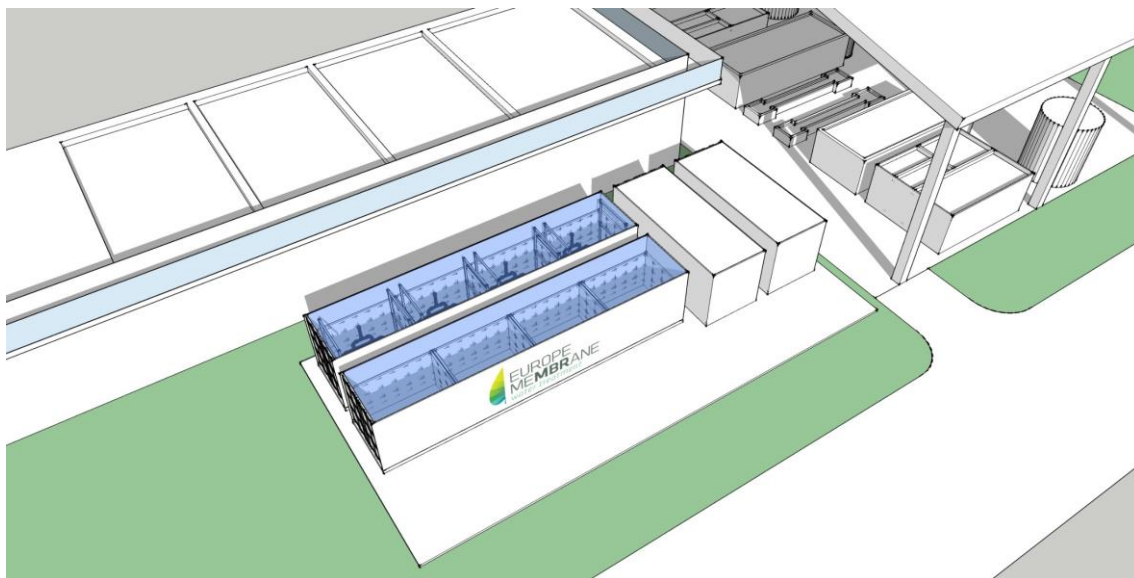


ELIMINATION OF NITROGEN WITH AN MBR USING AN AUTHOTROPHIC PROCESS IN A PLANT OF COVERS FOR THE MEAT INDUSTRY (China)

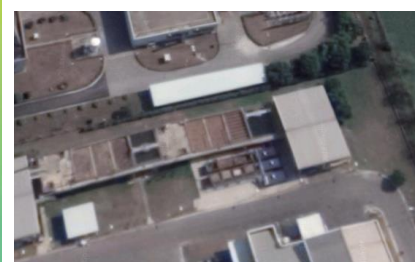
(KEYWORDS: meat processing effluents, membrane bioreactor MBR, high concentration of nitrogen, elimination of nitrogen, autotrophic denitrification)



Viscofan is a company devoted to the manufacture of covers used in the meat industry. The company has a manufacturing plant in Suzhou (China). As a consequence of its production operations the factory generates waste waters with a moderated load of organic matters but with a high concentration of nitrogen. The discharge limits required are very strict. Total nitrogen must be below 1.5 mg N/l and 10 mg/l for BOD5.

The existing decompensation between the concentration of organic matter and the excess of total nitrogen present in the raw waste waters is a technical challenge to solve in the definition of the most suitable treatment solution to be feasible in technical and economic terms.

The most usual way used to eliminate nitrogen in waste Waters is the well-known biological process of nitrification-denitrification (NDN), in which, in the first step of nitrification ammonia is converted into nitrite and this is rapidly oxidised into nitrate by means of nitrifying bacteria that use the inorganic carbon as source of carbon and get the energy needed for their growth through the nitrification reactions. In the second step (denitrification) nitrate is converted into gaseous nitrogen that is released to the atmosphere. This conversion is made by heterotrophic bacteria in anoxic conditions that use the nitrates as final acceptors of electrons and the organic matter present in the water and source of carbon. Although this process is widely used due to its efficiency it becomes unaffordable under certain circumstances. Thus, to proceed with the nitrification step it is necessary to keep a minimum concentration of oxygen in the water that leads to a high consumption of energy. Furthermore, the nitrification process demands the consumption of organic matter, which requires a high recirculation of biomass to the anoxic tank requiring an extra consumption of energy and often the dosage an external source of organic matter



Year 2017

Meat sector

Flow: 1400 m³/d.

Nt effluent: <1,5 mg/l.

BOD5 effluent: <10 mg/l

Then, it was adopted a technical solution that allowed for the elimination of nitrogen following an autotrophic biological process in which the consumption of energy and the production of excess sludge are lower than in a conventional NDN process. Technically it was implemented a, annamox-MBR process.

This process is based on the conversion of 50% of the ammonia present into nitrite in a first step and later, in a second step, the autotrophic denitrification is produced where bacteria convert the remaining 50% of ammonia along the nitrite produced in the first step directly into gaseous nitrogen in anaerobic conditions with demand of organic matter. This process is known with the acronym ANAMMOX (anaerobic ammonium oxidation)

Compared to the conventional NDM process, the energy consumption is drastically, as it is only necessary to convert half of the ammonia present into nitrite also a higher quantity of nitrogen is eliminated as the efficiency of denitrification is twice the efficiency of NDN as one molecule of ammonia reacts with one molecule of nitrite to obtain one molecule of gaseous nitrogen. Furthermore, as the denitrification is now an autotrophic process there is no need for an external source of carbon nor an internal recirculation. The excess sludge produced by the autotrophic process is lower than the amount produced by the conventional NDN process, hence the costs of treatment and management of sludge decrease.

The growth rate of autotrophic bacteria is slow, this leads to difficulties in keeping a significative population of this type of bacteria in the mixed liquor. This difficulty is solved with the use the MBRable Cassettes with an ultrafiltration pore size of just 0,02 microns that allow for a total retention of bacteria in the system and that way keep a proper biomass for this type of biological processes.

For such a purpose Europe Membrane supplied a complete system of ultrafiltration **MBRable® Train 4000** and carried out its integration with the existing biological reactors that were led from a conventional NDN process to an annamox-MBR process. The MBRable Train® unit implemented is equipped with 1 train with 4 ultrafiltration cassettes with 2 layers including 1008 m² of membranes each (total membrane surface of 4016 m²) mounted in maritime containers along with sludge tank and a permeate tank and ancillary equipment (pumps, blowers, clean in place system, PLC...). The whole system was prefabricated in our premises and was installed in a short time in the facilities of the client. After a short time of start up the process was running successfully allowing to meet the stringent nitrogen discharge limits.



The autotrophic-MBR process is an alternative for the elimination of nitrogen more economically advantageous than the conventional nitrification-denitrification process in those cases where the concentration of nitrogen is high and the concentration of BOD is low as usually happens in certain types of industrial wastewaters, the effluents of anaerobic processes, landfill lixiviates, pig slurry, etc.
