Mainstream Sewage Nitrogen Removal with Anammox: Low ammonium/temperature not an impediment

Summary

The most sustainable (energy-neutral) wastewater treatment plants that are just starting to be developed are using Anammox for nitrogen removal.
The main challenge for the success of the treatment is the difficulty of maintaining stable the nitritation process, since nitrite-oxidizing bacteria (NOB) may develop in such a granular sludge, producing nitrate, competing with anammox for nitrite and reducing the efficiency of the treatment considerably.
We propose that partial nitritation could be achieved in a separate reactor where our technology will be in charge of maintaining partial nitritation without nitrate production (i.e. repressing NOB activity), thus enhancing the good efficiency of the nitrogen removal for main stream (Figure 1)

We are looking for a company willing to acquire a competitive advantage via a license agreement

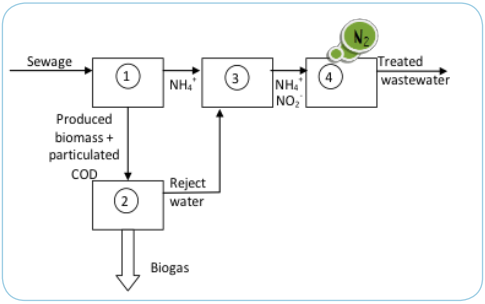

Fig. 1. Implementation of method for main stream treatment

With a laboratory scale reactor we have obtained partial nitritation (ca. 50% oxidation of inlet ammonia to nitrite, without nitrate production) of a low strength synthetic wastewater (70 mgN-NH4+ L-1) at 12.5 ºC for than 3 months and more than 5 months at a temperature equal or lower than 15ºC. The volume of the reactor is 2.5 L (Figure 2).

Innovative aspects and applications

> Applicability at full scale in municipal treatment plants (control set on side stream with just 1.0% of main stream)
> Long term stable maintenance of nitritation process at typical operating conditions in WWTP(T:8-35ºC, ammonium concentration :30-100 g N/m3 , COD concentration : 1-125 g/m3).
> Discharging buffer tank in anaerobic digester from which the flow-rate of reject is regulated and used for control purposes.

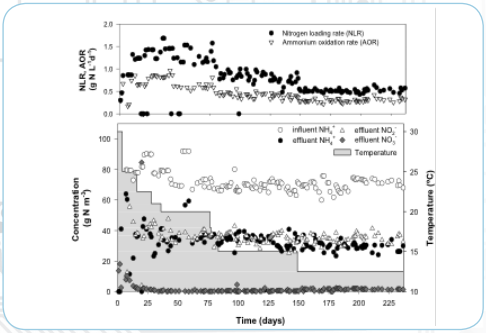

Fig. 2. Cold ANFIBIO. Experimental demonstration of performance of partial nitritation with the reactor at lab. scale

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The Invention

Method comprises performing a closed loop control for regulating the ammonium concentration within said biofilm reactor based on the ammonium concentration at the outlet of said biofilm reactor in order to achieve and maintain partial nitritation.

Regulation of ammonium concentration within the biofilm reactor is made by regulating the flow-rate of a side stream also entering said biofilm reactor.

It calculates and varies the value of the ammonium concentration set-point of the closed control loop also based on a desired ratio of ammonium and nitrite concentrations at the outlet of said biofilm reactor, hence the method can be used for feeding a further stage with an effluent having the specific ratio of ammonium and nitrite concentration required for that further stage.

System finally feeds an anammox reactor with the effluent of the biofilm reactor, and using said anammox reactor for performing an anammox reaction with the ammonium and nitrite contained in said biofilm reactor effluent in order to achieve a further nitrogen removal.

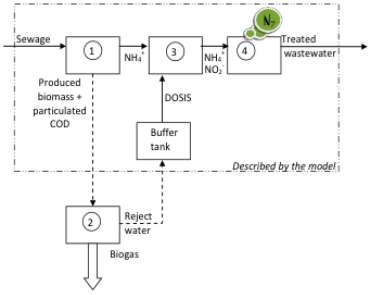

Fig. 3. Basic layout of the whole system, simulated with a model where: 1: Very-high-load activated sludge + settler. Only considered to determine the buffer capacity (2500 m3) with regard to dynamics of ammonium concentration; 2: Anaerobic digester (not described with the model); 3: Granular sludge partial nitritation reactor (cold ANFIBIO), i.e. the biofilm reactor; volume used in simulations 250 m3; 4: Granular sludge Anammox reactor, volume used in simulations 2000 m3. 5: Buffer tank used to regulate the reject water inflow for the biofilm reactor 3.

IP Rights

PCT/EP2014/071636
Priority patent application EP13382401.1 10/10/2013

UAB Universitat Autònoma de Barcelona

Contact Details
Carlos Raga
T. +34 935 868 921 F. +34 935 812 841 carlos.raga@uab.cat

UAB Technology Transfer Office.
Campus Universitari UAB. Eureka Building s/n. 08193 Bellaterra. Barcelona. Spain