SSAMBRA

Strengthening SmartAirMBR® Applications

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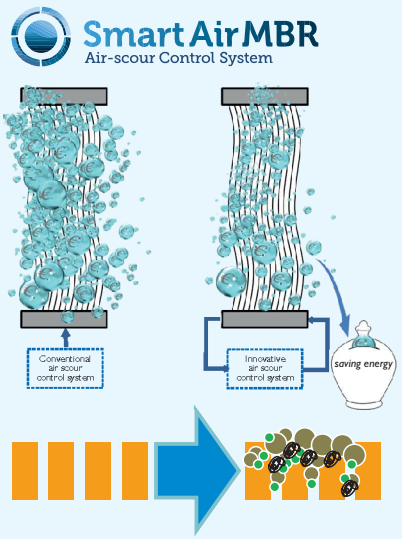
SSAMBRA Project is a TECHNOLOGY TRANSFER project funded by TECNIOSPRING program (TECSPR14-2-0021). TECNIOSPRING is an International mobility fellowship program that offers experienced researchers the possibility to develop their research career in any R&D entity around the world. Host institutions may be entities recognized with the TECNIO accreditation or, in the new TECNIOSPRING PLUS Program, also entities of the industrial sector (companies based in Catalonia).

SSAMBRA Project focuses on the two most important limiting factors on membrane bioreactors: aeration costs and membrane fouling. To accomplish the first one, SSAMBRA seeks to strength ***SmartAirMBR®*** applications, and for the second one, SSAMBRA focuses on biofouling reduction.

BACKGROUND



The possibility of **reducing energy consumption** during membrane aeration in MBRs has become the key to promote their use. **SmartAirMBR®** is the only product on the market that effectively reduces MBR aeration based on fouling indicators (monitored online).

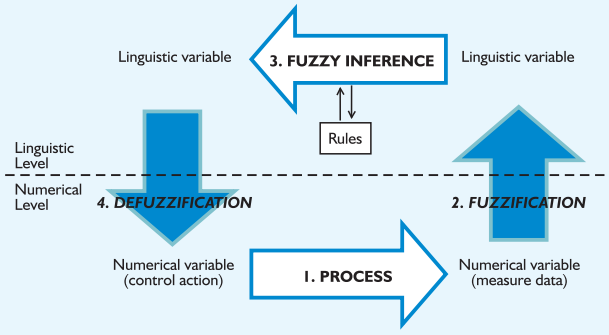
SmartAirMBR® is a control system developed for submerged membrane bioreactors patented by LEQUIA research group of University of Girona (UdG) and GS Inima Environment S. A. SmartAirMBR® regulates the air-scour flow for physical membranes cleaning. It was successfully validated at full-scale in the urban wastewater treatment plant of La Bisbal d'Empordà , in north-east of Catalonia (Spain), achieving an average energy reduction of 16% in air-scour blowers.

Fouling is the second limitation factor of membranes bioreactors after energy costs. In order to step forward into this issue the project wanted to evaluate an external treatment for biofouling reduction. This external treatment is based on the modification of the polymer structure soaking the fibres on developed synthetic antimicrobial peptides (AMP) linked into the polymer chain by a covalent bound.

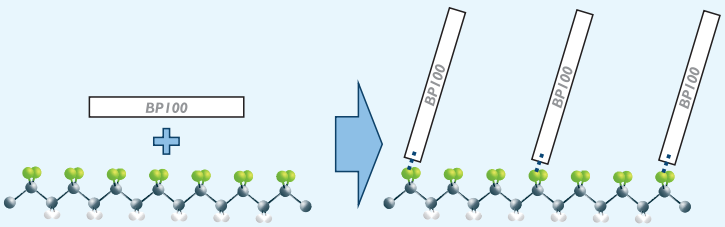
METHODOLOGY

Two different membrane bioreactors were used:

The semi-industrial lab-scale plant was used for SmartAirMBR® modification and adaptation for new membrane configurations. To improve the control system for energy reduction SmartAirMBR® was updated with a fuzzy logic control.



To attach the peptides into the fibres they were grafted covalently with BP100, an antimicrobial peptide with high antibacterial activity (LIPPSO-UdG & AMPbiotech SL), and the results demonstrated the attachment of BP100 onto membrane surfaces.



Lab-Scale membrane bioreactor was used to evaluate the biofouling reduction. This pilot plant equipped with twin permeate lines permitted the fouling comparison.

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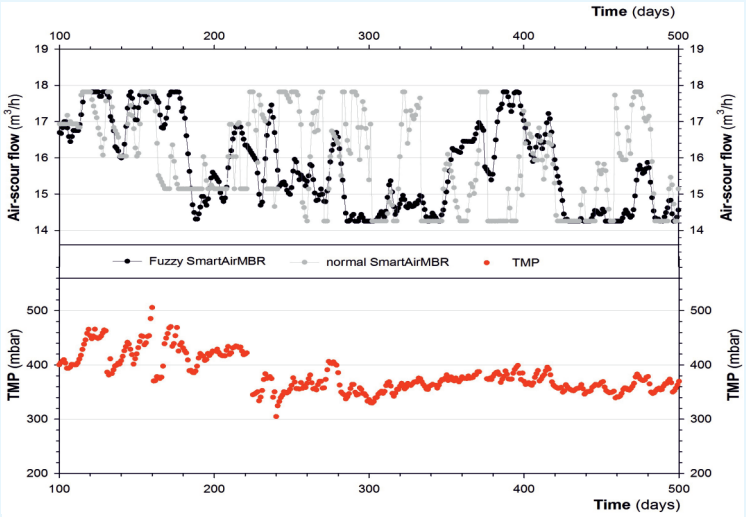
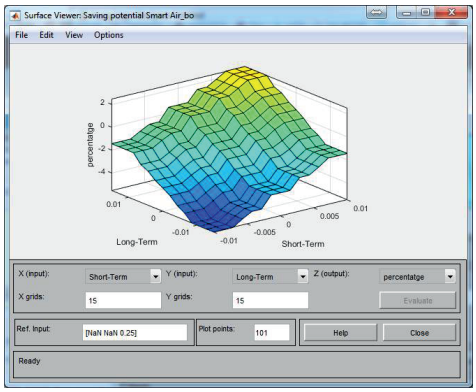
Air-scour reduction by fuzzy control

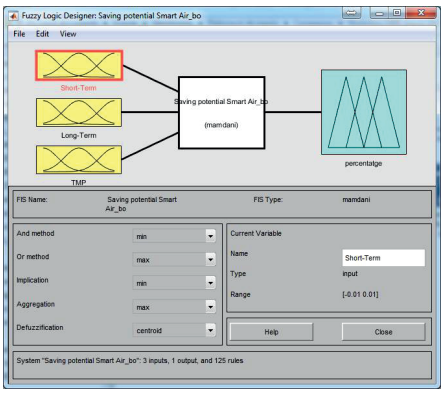
The new version of SmartAirMBR® included 3D fuzzy strategy to apply the best aeration taking into account **the current values of TMP**, as well as the the tendency of fouling.

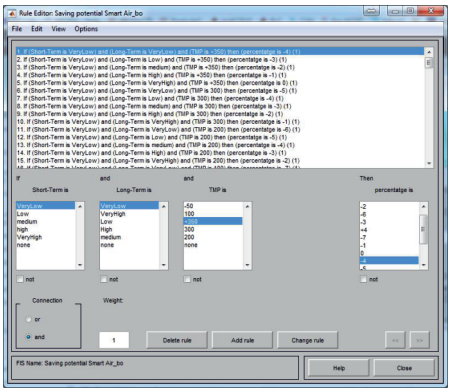
The modifications of aeration are softer than previously increasing the robustness of the software.

By using fuzzy logic SmartAirMBR® is able to change the air-scour flow modification according to the real and current status of the process.







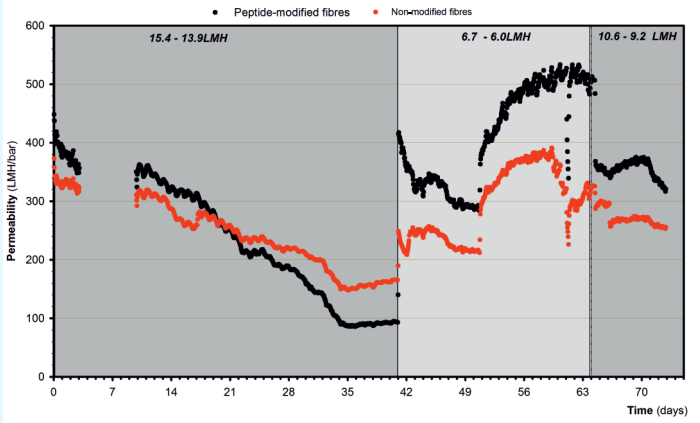


Biofouling reduction by peptide solution

The physical properties of the fibres didn't change after the peptide treatment.

However, in terms of fouling peptide-modified fibres, they presented higher permeabilities working at sub-critical conditions in continuous operation.

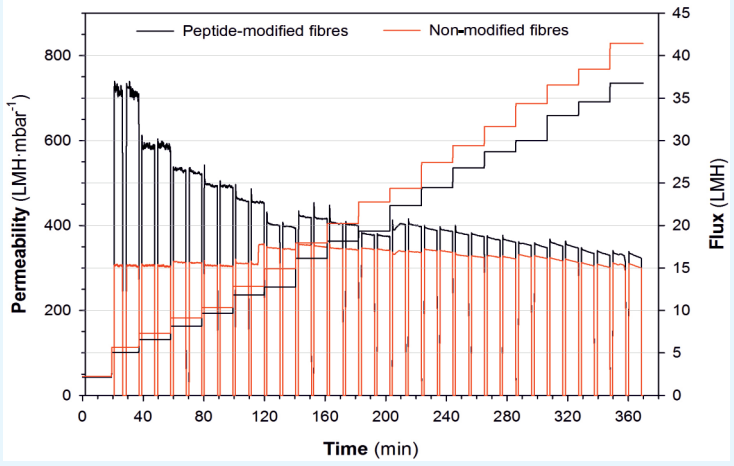
When working at higher fluxes (higher than critical flux, Jc) the fouling was higher in the peptide-modified fibres.



The flux step test demonstrated the same behaviour than in continuous operation.

At the beginning (low fluxes), the permeability was much higher on peptide-modified fibres.

At the end of the test, when high fluxes were applied (40LMH), permeabilities achieved similar values.



http://www.lequia.udg.edu/research/ongoing-projects/item/2253-ssambra-%E2%80%93-strenghtening-smart-air-mbr-applications.html
http://www.lequia.udg.edu/technology-transfer/patents.html

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