A novel biofilm platform for the selection and enrichment of specialized bacteria

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Context

The most used technique to degrade organic substances present in the wastewater.

Microbial communities (mainly bacteria) the workforce of the biological wastewater treatment plants (WWTPs).

Bioaugmentation

Insufficient number of microorganisms in the WWTP

Deterioration of the effluent quality poor treatment performance

Bioaugmentation

Introduction of specialized bacteria to bioreactors in order to accelerate the removal of undesired compounds.

Obstacle for bioaugmentation: possible wash-out of the inoculated bacterial strains.

Strategy to prevent the wash-out of the inoculum: immobilization of the microorganisms in biofilms

Aerobic granular sludge

Special case of biofilm formation innovative cell immobilization technology in biological wastewater treatment.

Development of nitrifying enriched granules bioaugmentation strategy

Screening of specialized strains and enrichment of the SBR platform with nitrifying bacteria:

Environmental samples

Isolation of the bacterial strains

Cultivation under appropriate temperature and atmospheric conditions

Bacterial growth and propagation + characterization of the strains

Inoculation of the bioreactor with the bacterial strains

Aerobic granular sludge before and after bioaugmentation with nitrifying bacteria:

Before

AOB+NOB usually < 10% of total biomass

After

AOB+NOB at least > 30% of total biomass

NITRIX:

Granular bioaugmentation product

Highly enriched with naturally occurring nitrifying bacteria

Application in WWTPs (punctual or continuous dosage) quickly restore nitrogen removal following disturbances.

Identification and quantification of the bacterial populations

Molecular techniques (FISH) + image analysis monitor the development of the bacterial population during bioaugmentation

Sample

Cells fixation in paraformaldehyde

Cells hybridization with molecular probes

Incubation 46°C

Washing and mounting

Microscope visualization

Image analysis and quantification of microbial populations

Perspectives

Production of highly efficient nitrifying enriched granules that can be successfully applied for the treatment of a wide range of industrial wastewaters.

Validate and commercialize an optimal formulated bio-product able to improve and facilitate the operation of WWTPs facing harsh environmental conditions.