Impact of single and complex external carbon sources on microbial community in sidestream treatment systems

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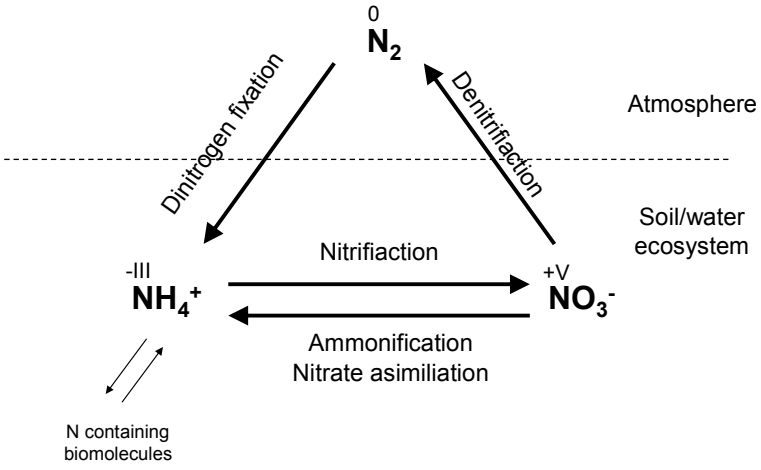
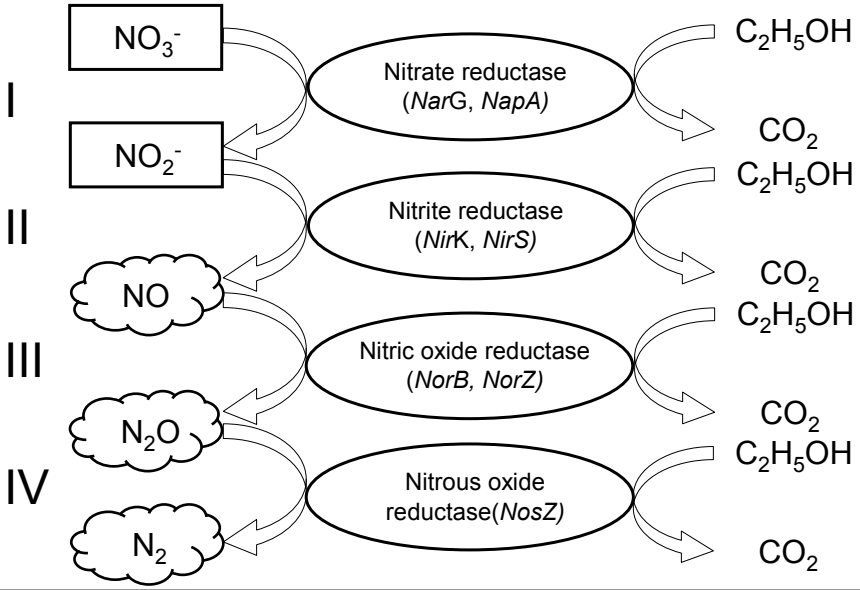
Biogeochemical nitrogen cycle

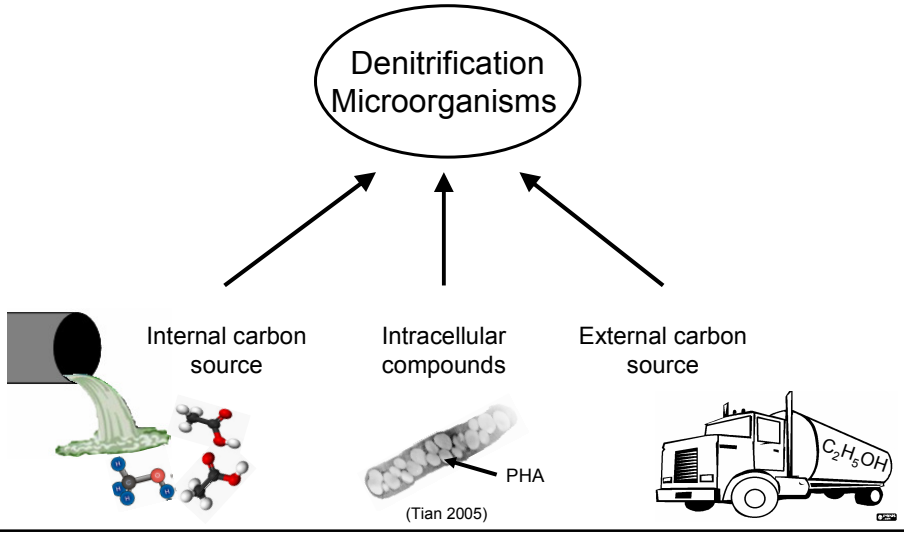


(Zumft 1997)

Denitrification process



Carbon demand for denitrification



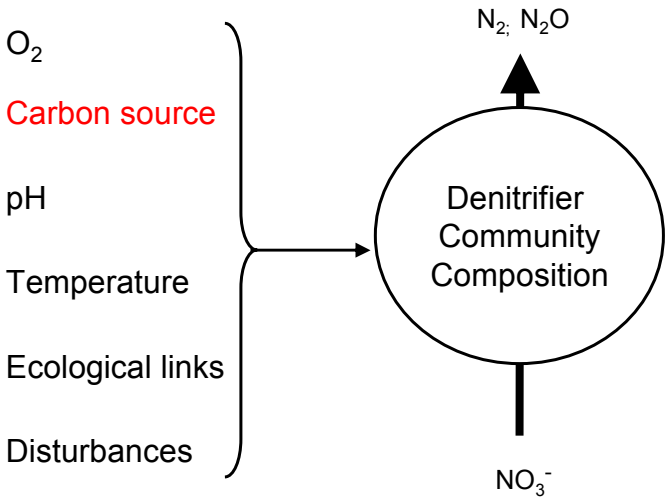
(Tian 2005)

External carbon source

Commercial products	Alternative products
High operational costs	Industrial waste products inexpensive compare to 'pure' carbon;
• methanol; • ethanol; • acetic acid; • sodium acetate; • glucose.	• high concentration of degradable organic compounds; • high C:N ratio; • non toxic for microorganisms in operational concentrations; • availability.

Fusel oil	
COD (g ChZT/m^3)	~ 1.700.000
C:N (g/g)	~ 1.800:1
Availability	easily available
Composition	iso-amyl alcohols, alcohols, organic acids, aldehyds

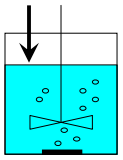
Controls of denitrification



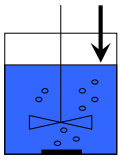
(D. Mathhew; 2006.)

Experiments details

Conventional carbons source (ethanol)



Alternative carbon source (fusel oil)



Technological parameters of the experiment

Duration (days)	36
Sludge concentration (g/dm^3)	3
Medium	Sludge digested liguor
Temperature (°C)	24
External carbon addition (g COD/g N)	4 - 6
Optimized duration of N/DN/S phases (h/h/h)	4/19/1
Sludge liquor % (v/v)	5 - 15

Microbial analysis

- Denaturing Gradient Gel Electrophoresis (DGGE) of 16 S rDNA PCR products – total microbial diversity (Nübel et al.., 1996)
- Fluorescent in situ hybridization (FISH) - analyses of denitrifying bacteria (Nielsen et al.., 2009)

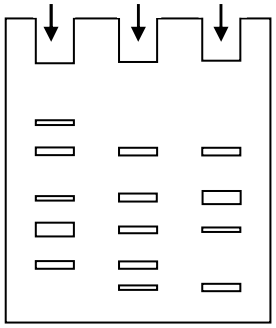
MATERIALS & METHODS

Microbial analysis

DGGE

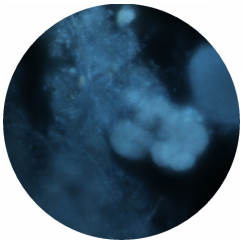
Environmental samples

PCR products

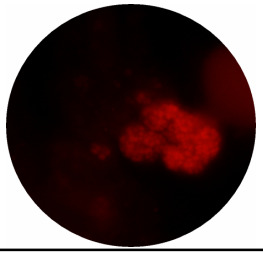


FISH

DAPI



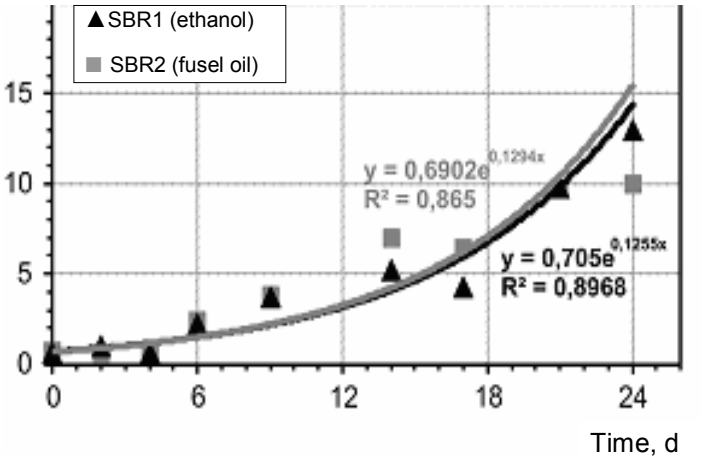
Specific probes



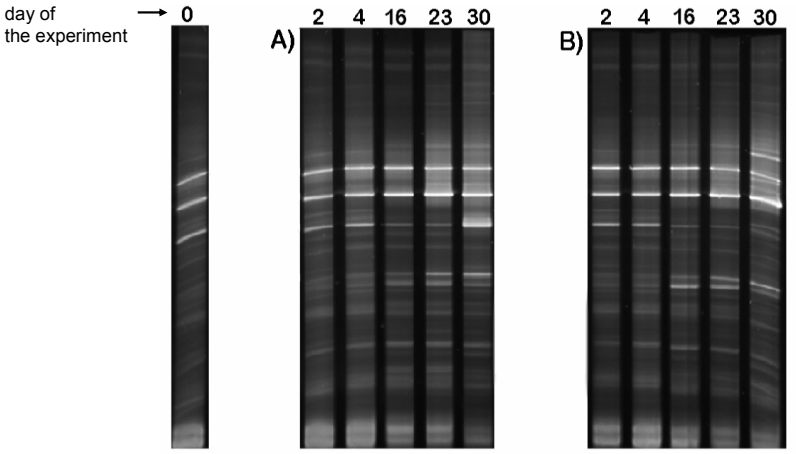
RESULTS

Nitrate uptake rate

NUR, mg N/(g VSS x h)



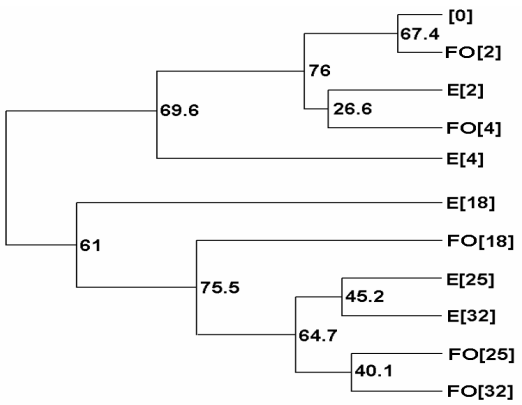
DGGE profile of PCR 16S rRNA products



Inoculum A) SBR1 (Ethanol) B) SBR2 (Fusel oil)

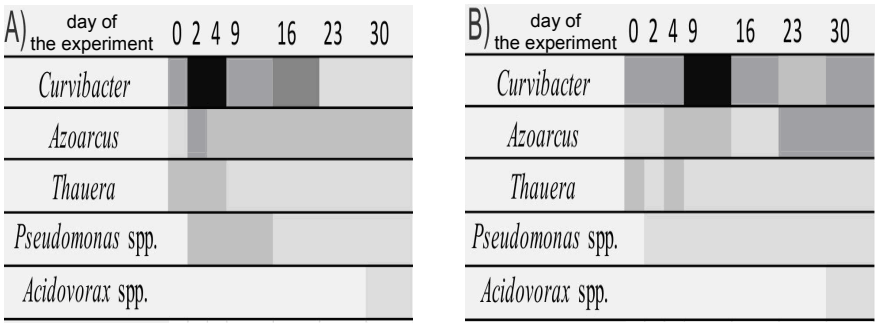
RESULTS

Genetic distance matrix



RESULTS

FISH analyses of microbial community



A) SBR1 (Ethanol)

B) SBR2 (Fusel oil)

RESULTS

Conclusions

- addition of fusel oil and ethanol resulting in a significant enhancement of the denitrification efficiency;
- fusel oil can be used by mixed microbial community as well as ethanol;
- application of fusel oil in operational concentratinos do not reflect severe effect on composition of micorbial consortia.

Acknowledgements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Thanks for your attention !!!