



Budapest University of Technology and Economics
Faculty of Civil Engineering
Department of Sanitary and Environmental Engineering

Use of nanotechnologically constructed microreactors in MBR wastewater treatment system

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Introduction

- Biological wastewater treatment technologies
- Activated sludge flocs - the key elements
- Activated sludge - indirect regulatory mechanisms
- The project's scope...

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Bacterial adhesion

- The attachment of the bacteria to the surface and the establishment of biofilm are considered as survival strategy
- One advantage of this process, is that bacteria immobilized in a nutrient rich microenvironment



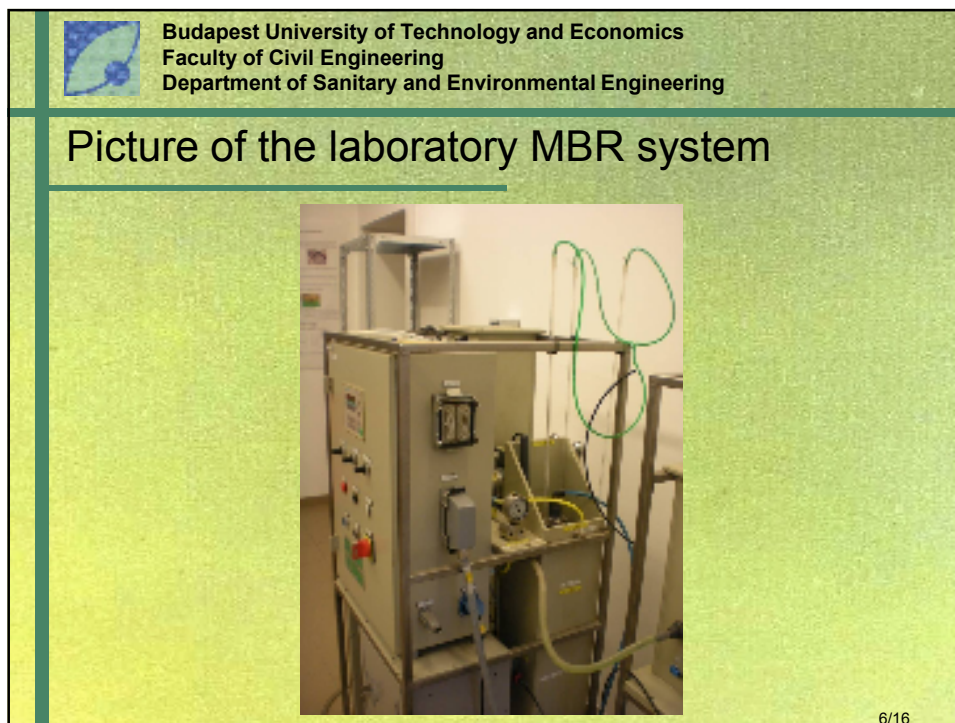
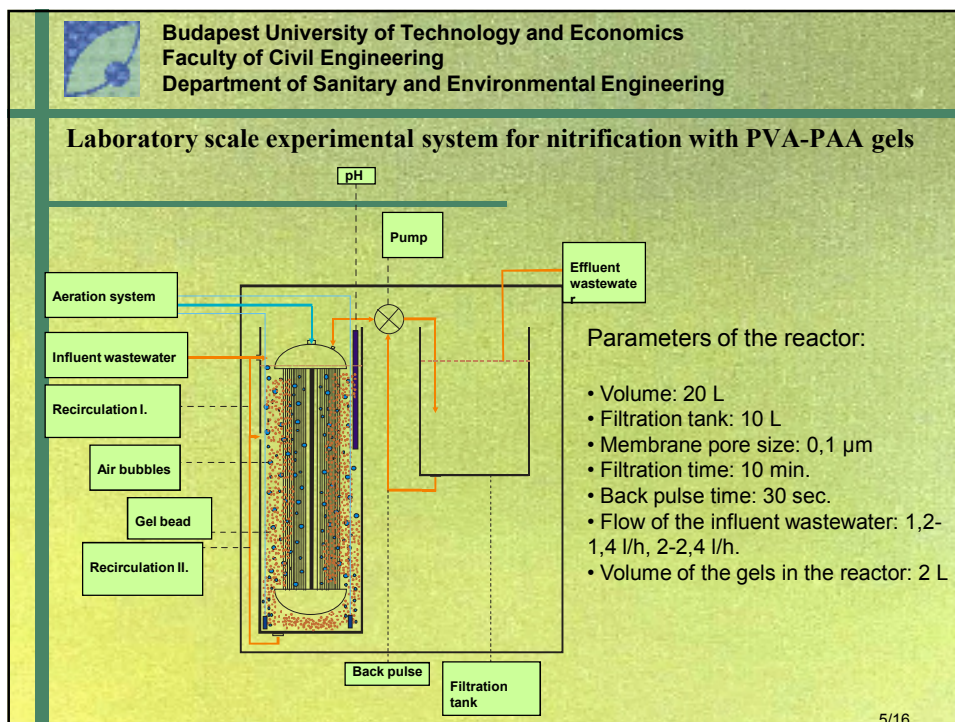
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Environmental factors determining adhesion process

- *The substances supporting the attachment on the biofilm*
- *The surface charge*
- *The viscosity of the surface*
- The porosity of the surface
- Shear forces in the reactor
- Other surfaces susceptible of attachment
- The size proportion between the flocs and the bacteria

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Preliminary test of the MBR system

Preliminary test of the MBR reactor with activated sludge

- Aeration system
- The influent and effluent wastewater
- Construction of the reactor space

Preliminary test of the MBR reactor with raw PVA-PAA gels

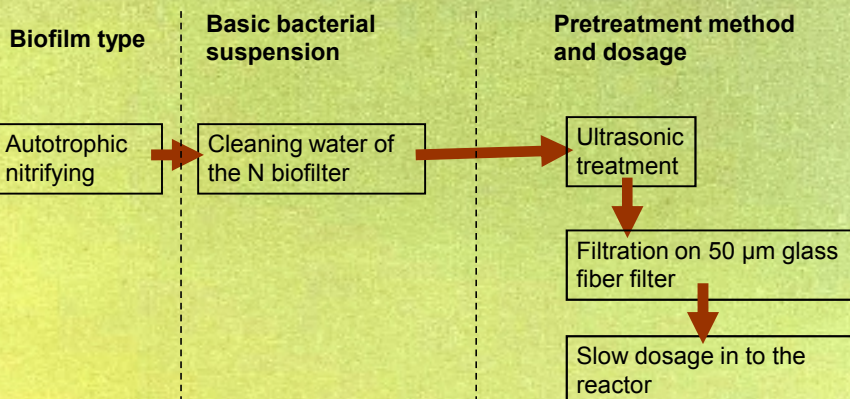
- The interaction between the gels and the materials of the reactor and the membrane

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Inoculation method

- The methodology of colonization process and the inoculation technique of the wastewater treatment bacteria on the surface of the hydrogel (PVA-PAA) were developed for three years.



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Inoculation method

- Autotrophic bacterial suspension (10 L)
- 3 days intervallum / continuous flow
- Suspended bacterial flocks
- Measurement procedure could be started after the inoculation period

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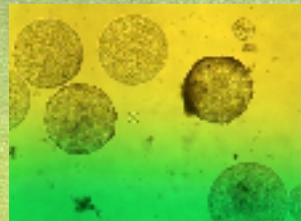
Biofilm development on NaOH treated starch containing PVA-PAA hydrogel beads



Raw PVA-PAA hydrogels beads embedded with starch.



NaOH treated starch containing PVA-PAA hydrogel beads.



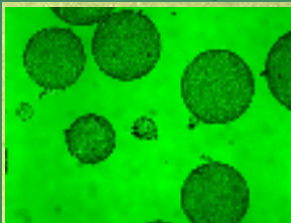
State of autotrophic biofilm development on the 13th day.

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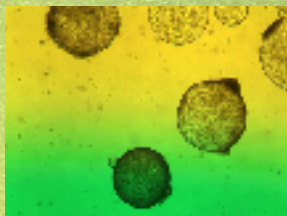


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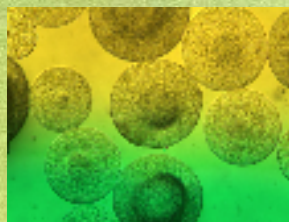
Biofilm development on NaOH treated starch containing PVA-PAA hydrogel beads



State of autotrophic biofilm development on the 13th day in the reference reactor.



State of the biofilm on the 15th days in the reactor upper zone.



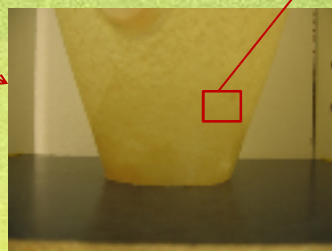
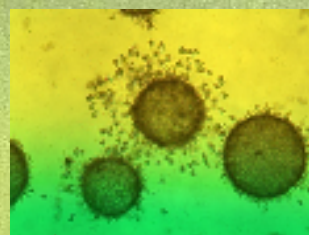
The biomass development in the lower zone in the reactor.

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Picture of the PVA-PAA copolymer with the biofilm



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- The influent wastewater – partially treated wastewaters from the South Pest WWTP (COD~60 mg/l)
- pH, Conductivity, N-forms, Temp were measured daily
- Hydraulic retention time was 16 hours and 8 hours

The general parameters of the influent wastewater:

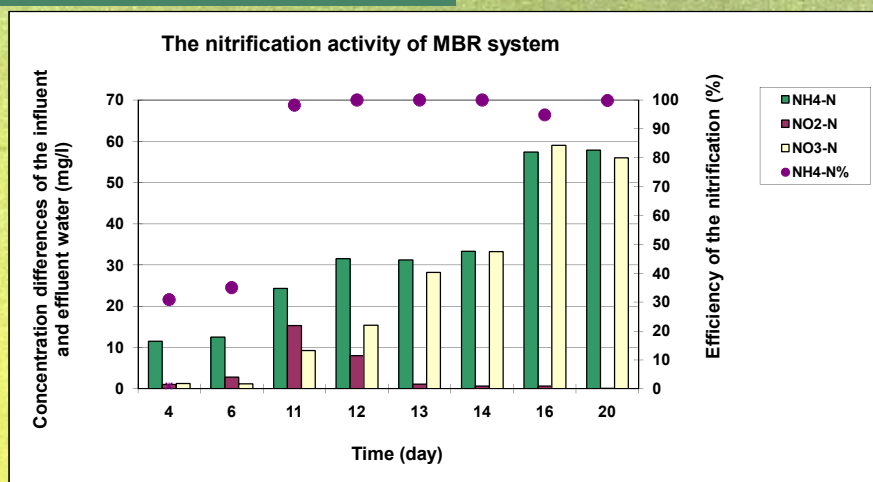
	Min	Max	Average
NH ₄ -N mg/l	24	62	39
NO ₂ -N mg/l	<0,01	0,55	0,2
NO ₃ -N mg/l	<0,5	0,92	<0,5
pH	7,68	8,11	7,92
Cond. μS/cm	1340	1890	1680
Temp. C°	22	20	21

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Removal efficiency and removed NH₄-N in the nitrification system



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Conclusions

- Protection the bacteria from the predation, dehydration and the extreme environmental changes (pH, temperature).
- New biofilm carrier
- Biofilm could be used in the activated sludge reactor
- Regulated artificial carrier size and settleability
- With some modification of the MBR the PVA-PAA could be used in these systems
- The effect of these carriers in the MBR required more tests

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