

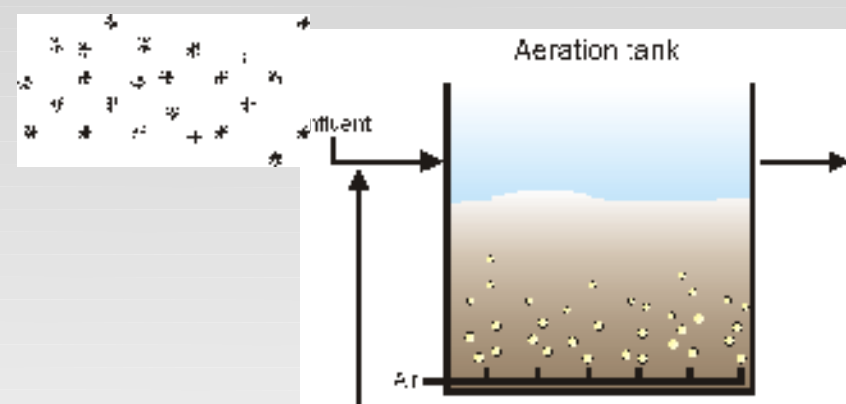
# Biofilm reactor technology as an alternative to control *Galactomyces geotrichum* bulking



M. Matos, M.A. Pereira, A. Nicolau, A.G. Brito, R. Nogueira

# Introduction

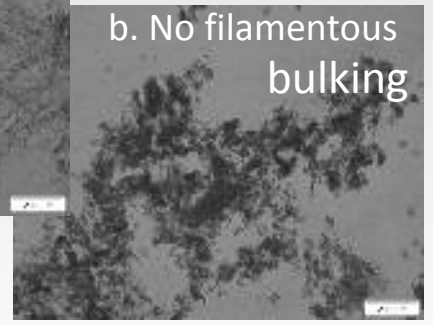
What's the problem?



## Critical Stage

### Filamentous bulking

Sedimentation problems caused by filamentous microorganisms (bacteria or/and fungi)



Fungus

*Trichomyces*

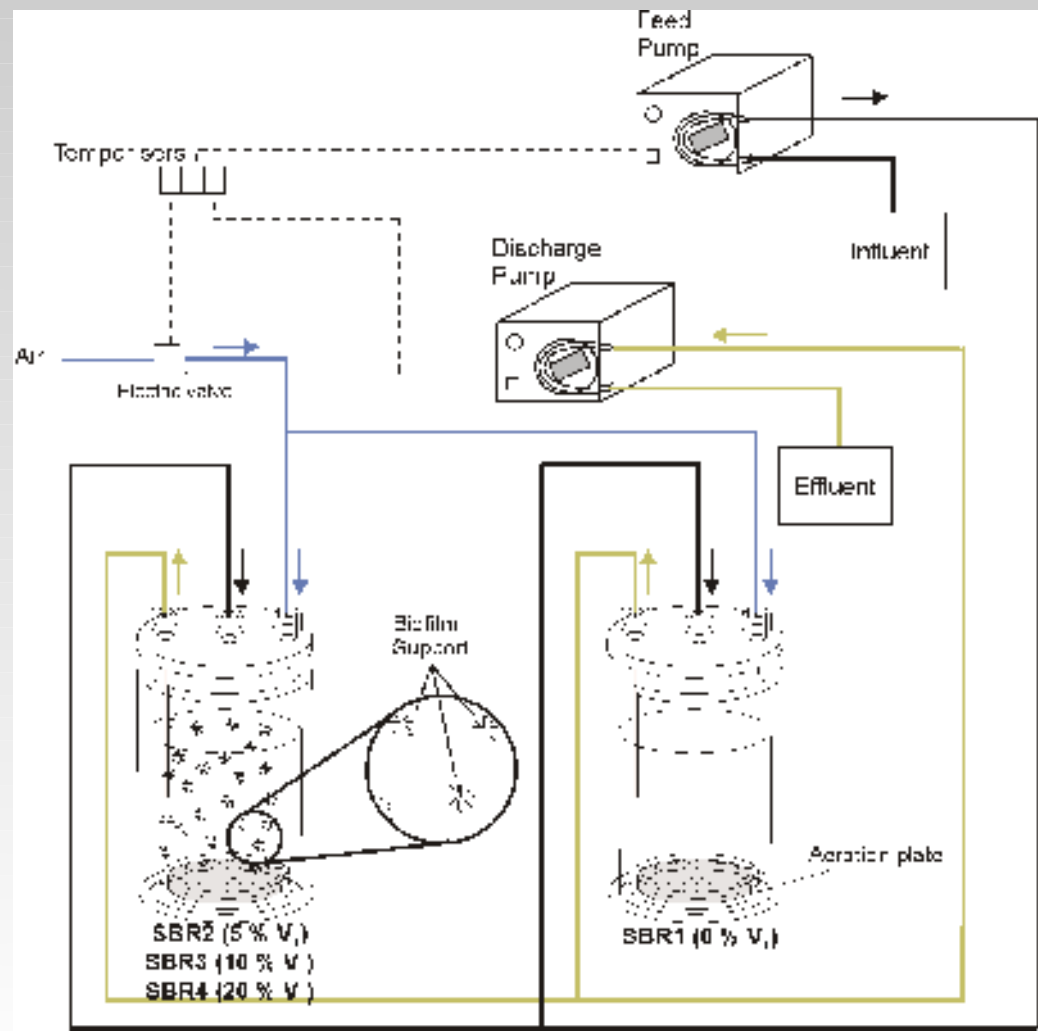
*Trichium*

Morph: (*Candidum candidum*)

# Claim

The incorporation of a support for biofilm growth into suspended growth reactors suppress *G. geotrichum* bulking

# Experimental approach

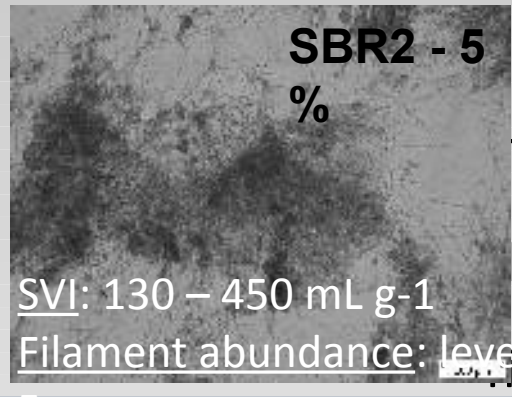
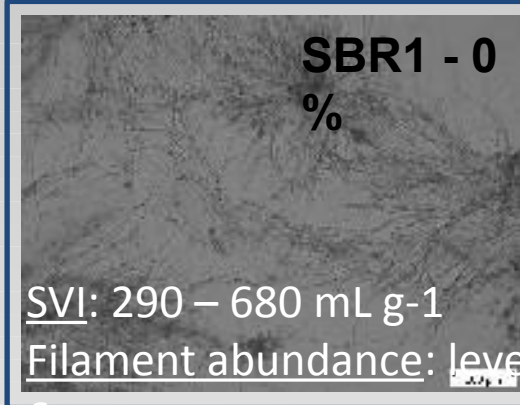


Support  
*DupUM*

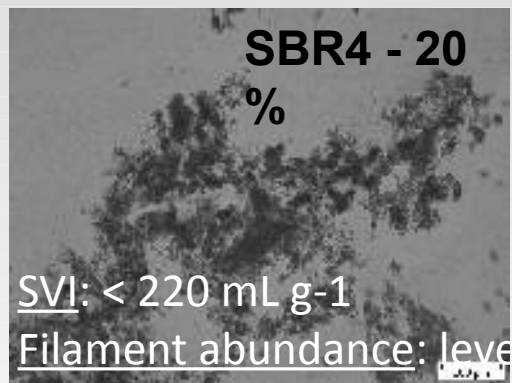


- Cycle time: 4 h
  - 5 min fill
  - 225 min aeration
  - 5 min settle
  - 5 min draw
- Working volume (V T): 1.5 L
- Volume exchange ratio: 0.5 L L<sup>-1</sup>
- Hydraulic retention time: 8 h
- Medium: acetate-based medium
- Organic loading rate: 4.3 g COD L<sup>-1</sup> day<sup>-1</sup>

# Results and discussion



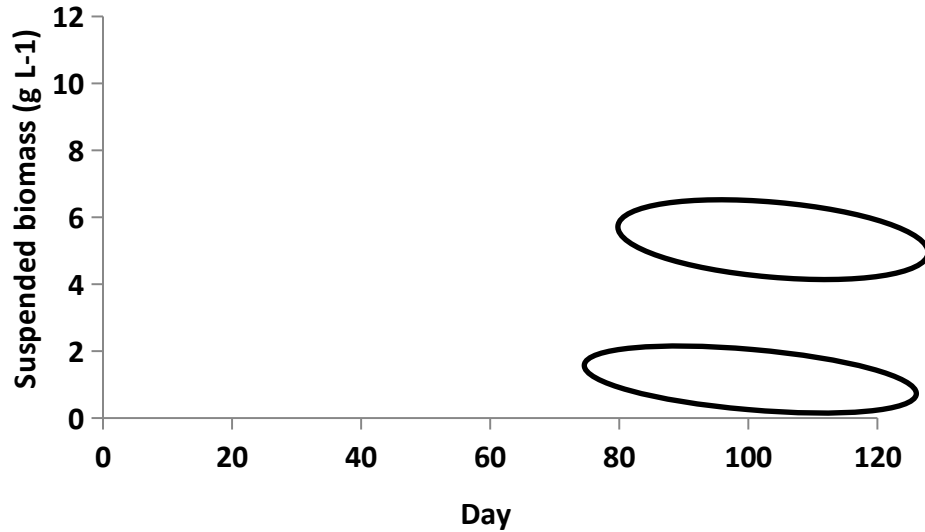
The microbial community was  
 dominated by *G. geotrichum*  
 filaments



*G. geotrichum* filaments were  
 negligible

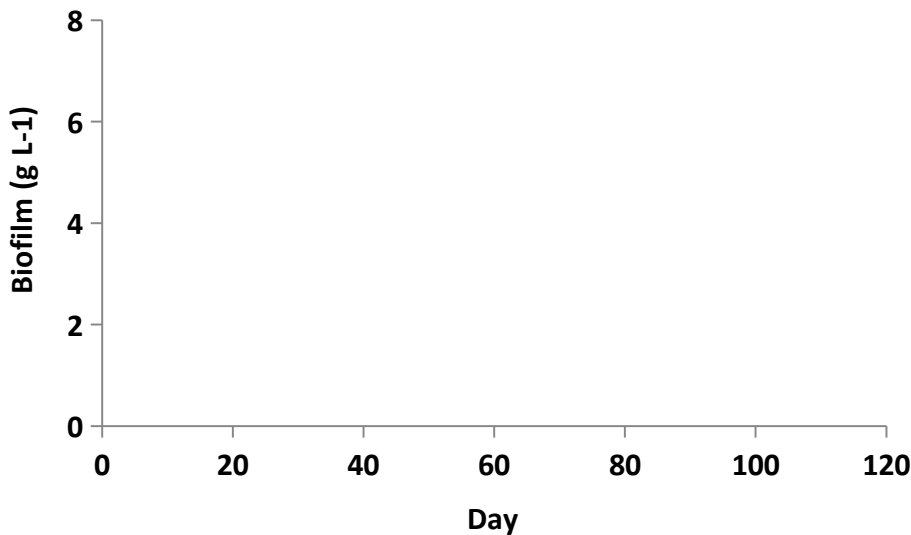
The incorporation of an optimized amount of support for biofilm growth  
 apparently suppress *G. geotrichum* bulking

# Results and discussion



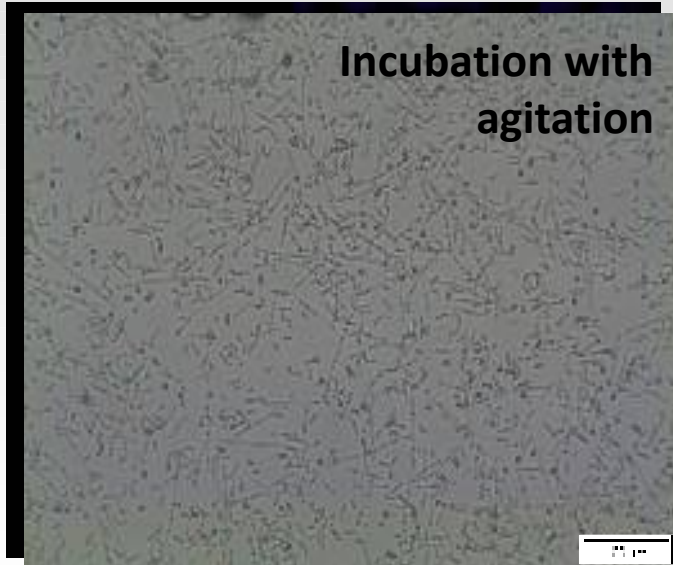
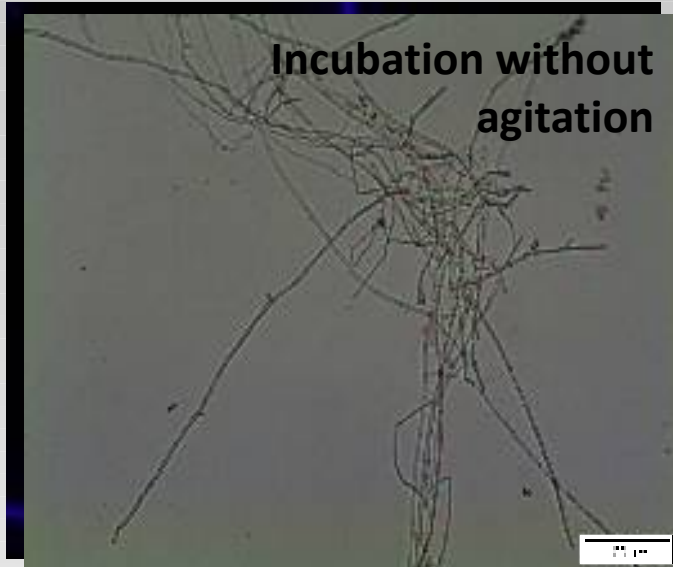
Suspended biomass concentration was according to the quality of the sludge

observed in each SBR



Biofilm concentration increased with the increase of the support concentration

# Results and discussion

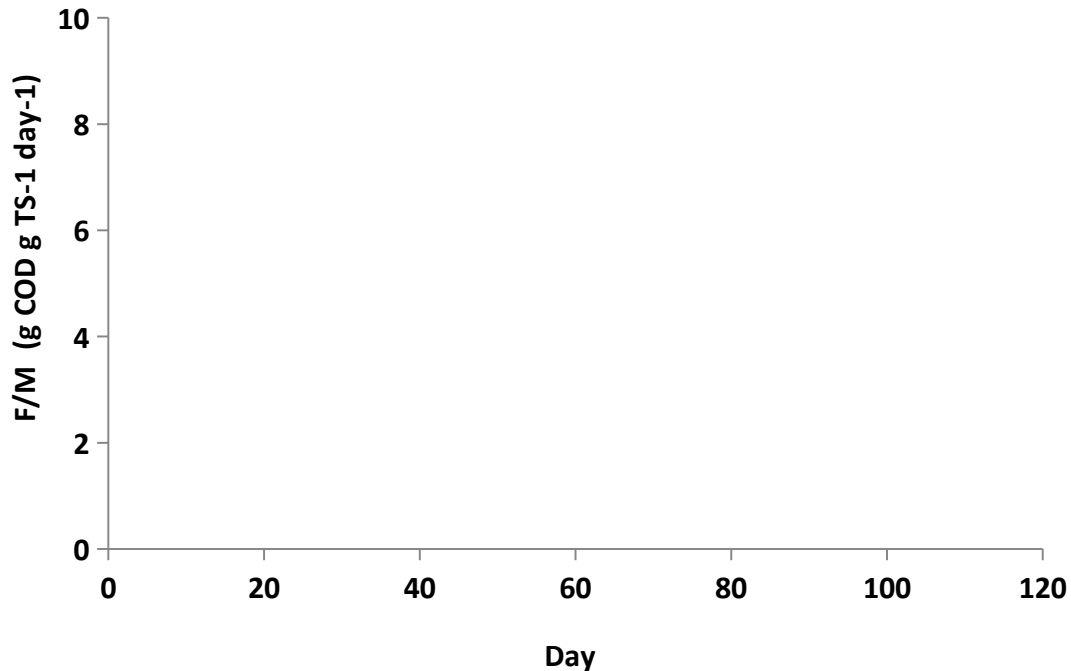


Filaments length in SBR3 and SBR4 seemed to be considerable shorter than in SBR1 and SBR2



*G. geotrichum* bulking in SBR3 and SBR4 seemed to be suppressed **due to the shear force established by collisions between supports**

# Results and discussion



**SBR1 – 0 %**

**F/M: 2.0 – 6.9 g COD g TS-1 day-1**

**SBR2 – 5 %**

**F/M: 0.9 - 3.3 g COD g TS-1 day-1**

**SBR3 – 10 %**

**F/M: 0.2 – 0.4 g COD g TS-1 day-1**

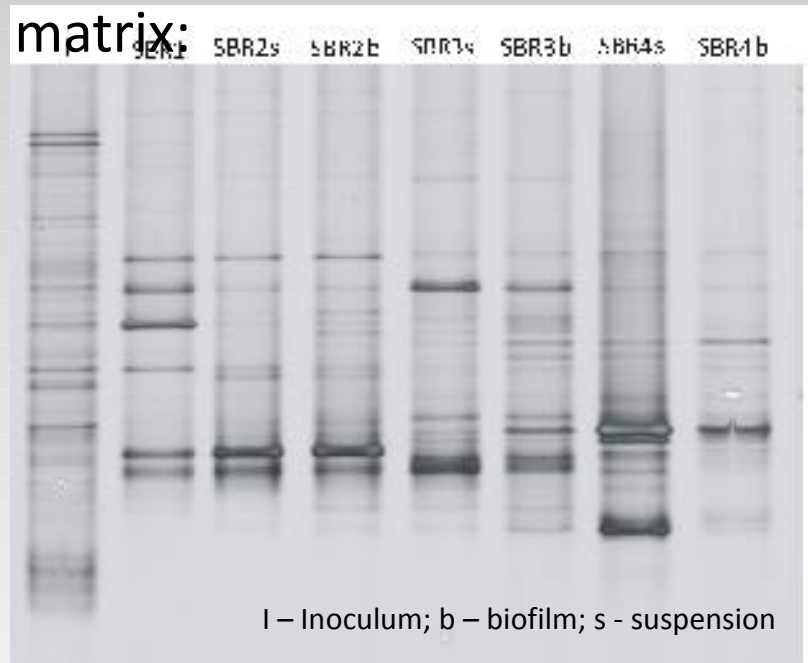
**SBR4 – 20 %**

**F/M: 0.8 – 1.4 g COD g TS-1 day-1**

The suppression of *G. geotrichum* bulking might be related to **decrease of the biomass loading rate (F/M)**, i.e., to the increase of the overall quantity of biomass in the reactors

# Results and discussion

DGGE patterns of bacterial 16S rRNA gene fragments / Similarity (in %) matrix;



	SBR4b	SBR4s	I	SBR3b	SBR3s	SBR2b	SBR2s	SBR1
SBR4b	100							
SBR4s	62.4	100						
I	30.7	38.3	100					
SBR3b	55.2	47.4	33.2	100				
SBR3s	23.4	25.5	24.5	84.6	100			
SBR2b	39.4	36.1	30.5	60.5	59.6	100		
SBR2s	32.9	31.7	30.0	63.6	67.3	97.7	100	
SBR1	13.1	11.6	24.2	54.5	55.7	61.7	63.2	100

Clear shifts in the bacterial community induced by the increase in the concentration of support for biofilm growth were observed

# Conclusions

· *G. geotrichum* bulking was developed in a SBR operating just with suspended biomass and in a SBR operating with 5 % of support for biofilm growth. At higher support concentrations (10 % and 20 %) *the G. geotrichum* filaments were not developed.

· *G. geotrichum* bulking was successfully overcome through the incorporation of an optimized amount of support for biofilm growth. Two filamentous bulking control mechanisms were found to be of major importance:

(i) Increase of the shear force induced by support-to-support collisions

(ii) decrease of the biomass loading rate as a result of the increase of the overall quantity of biomass.

PCR-DGGE analysis of the bacterial community suggested that the incorporation of a support material for biofilm growth induced increasing differences in the bacterial community structure as the concentration of support increased in the SBR.

# Thanks for your attention!

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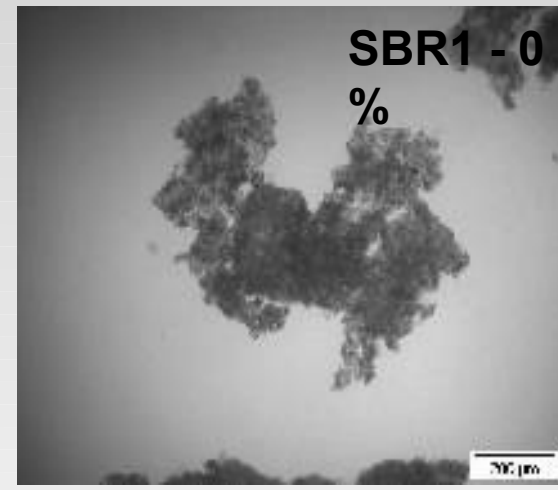
# Results and discussion

**Organic loading rate:**  
 4.3 g COD L<sup>-1</sup> day<sup>-1</sup>



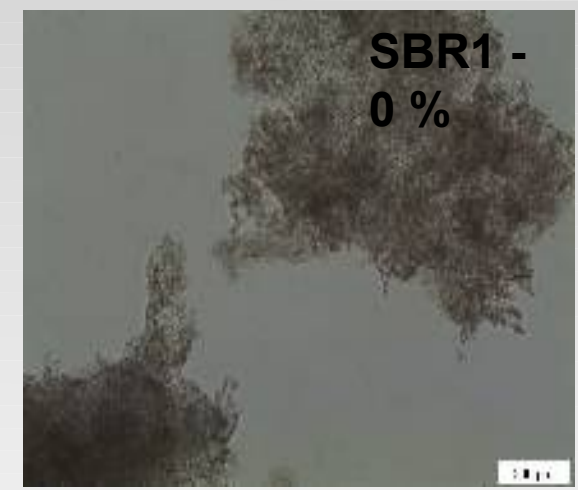
**F/M: 3.98 g COD g TS<sup>-1</sup> day<sup>-1</sup>**  
 1

**Organic loading rate:**  
 1.0 g COD L<sup>-1</sup> day<sup>-1</sup>



**F/M: 0.87 g COD g TS<sup>-1</sup> day<sup>-1</sup>**  
 1

**Organic loading rate:**  
 0.5 g COD L<sup>-1</sup> day<sup>-1</sup>

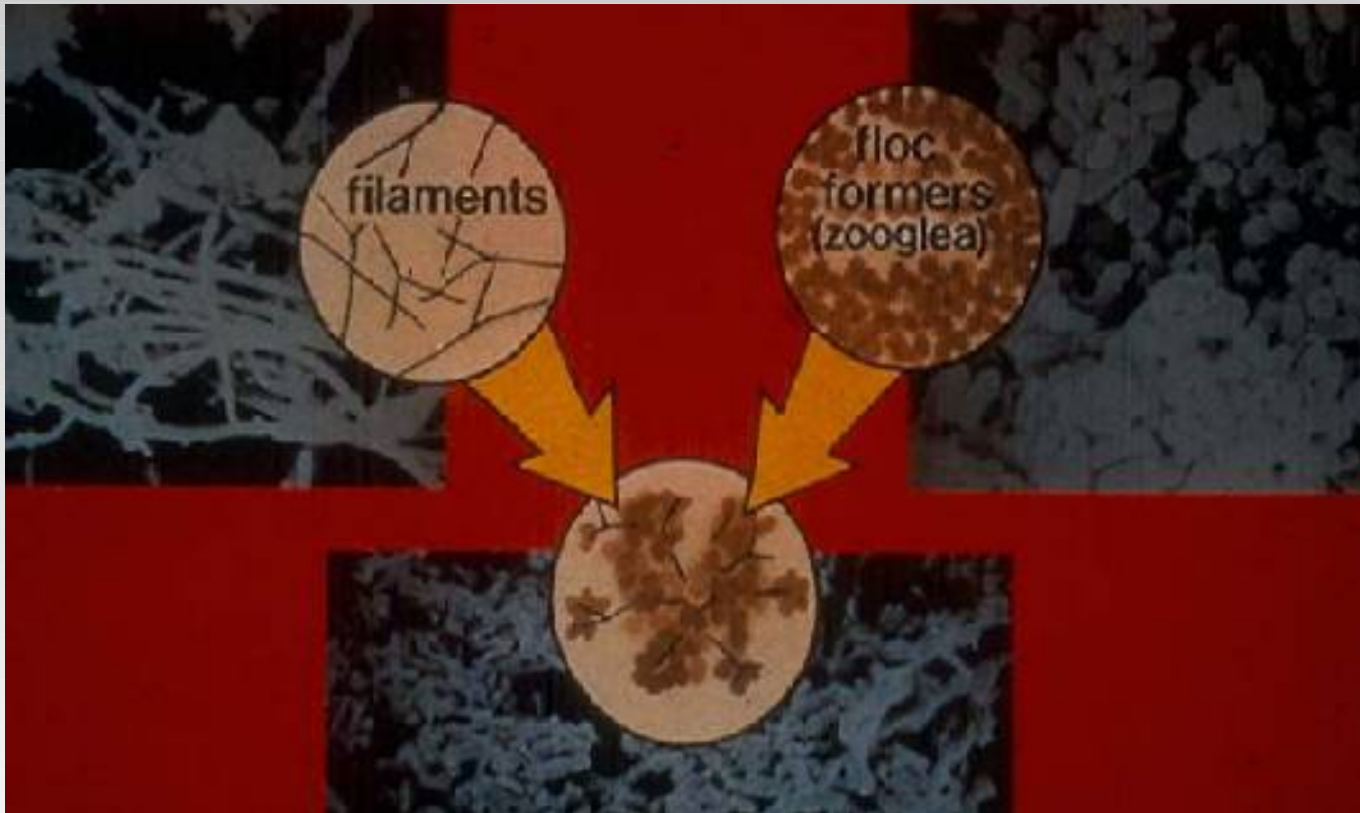


**F/M: 1.10 g COD g TS<sup>-1</sup> day<sup>-1</sup>**  
 1

No filamentous bulking

*G. geotrichum* filaments seemed to be high F/M filaments

# *Activated sludge floc*



# SBR

The Sequential Batch Reactor (SBR) is a sequential process in which all major steps occur in the same tank in a sequential order.

