TROUBLESHOOTING OF FILAMENTOUS BULKING USING HYBRID SYSTEMS

University of Minho
School of Engineering
Centre of Biological Engineering

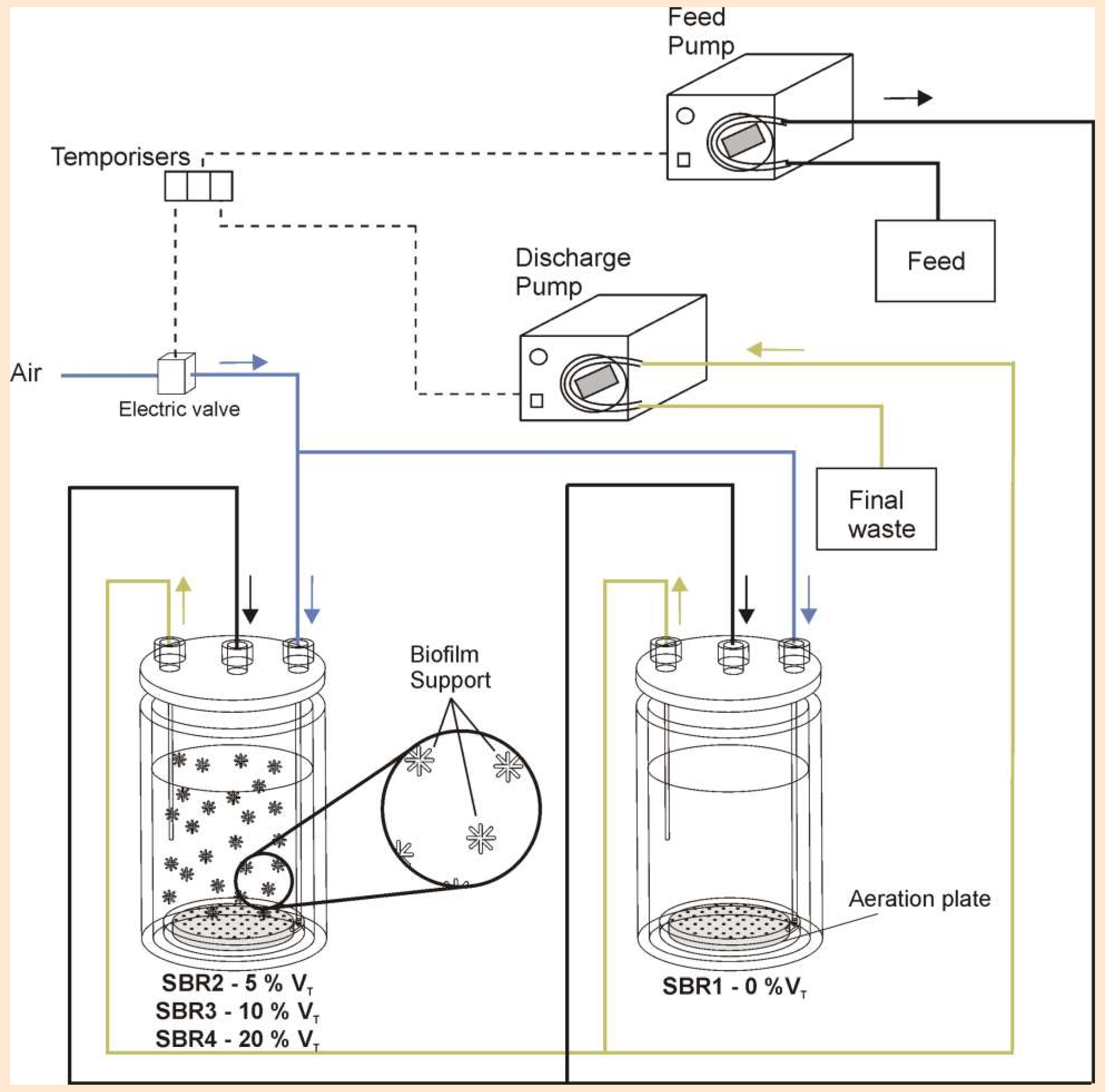
MARIA MATOS*
Supervisors: Regina Nogueira, Maria A. Pereira, Ana Nicolau, António G. Brito
* mariaines.matos@uminho.pt

1. Introduction

Wastewater Treatment Plants (WWTP) frequently face filamentous bulking – a term used to describe sedimentation problems caused by the filamentous microorganisms (bacteria and/or fungi). Interestingly, no problems with excessive growth of filamentous microorganisms have been reported in the cases where activated sludge processes were combined with biofilm growth, but this line of research wasn't continued. An interesting and important question is then how systems combining suspended and biofilm growth (hybrid systems) control filamentous bulking.

2. Materials and Methods

Experimental set up:



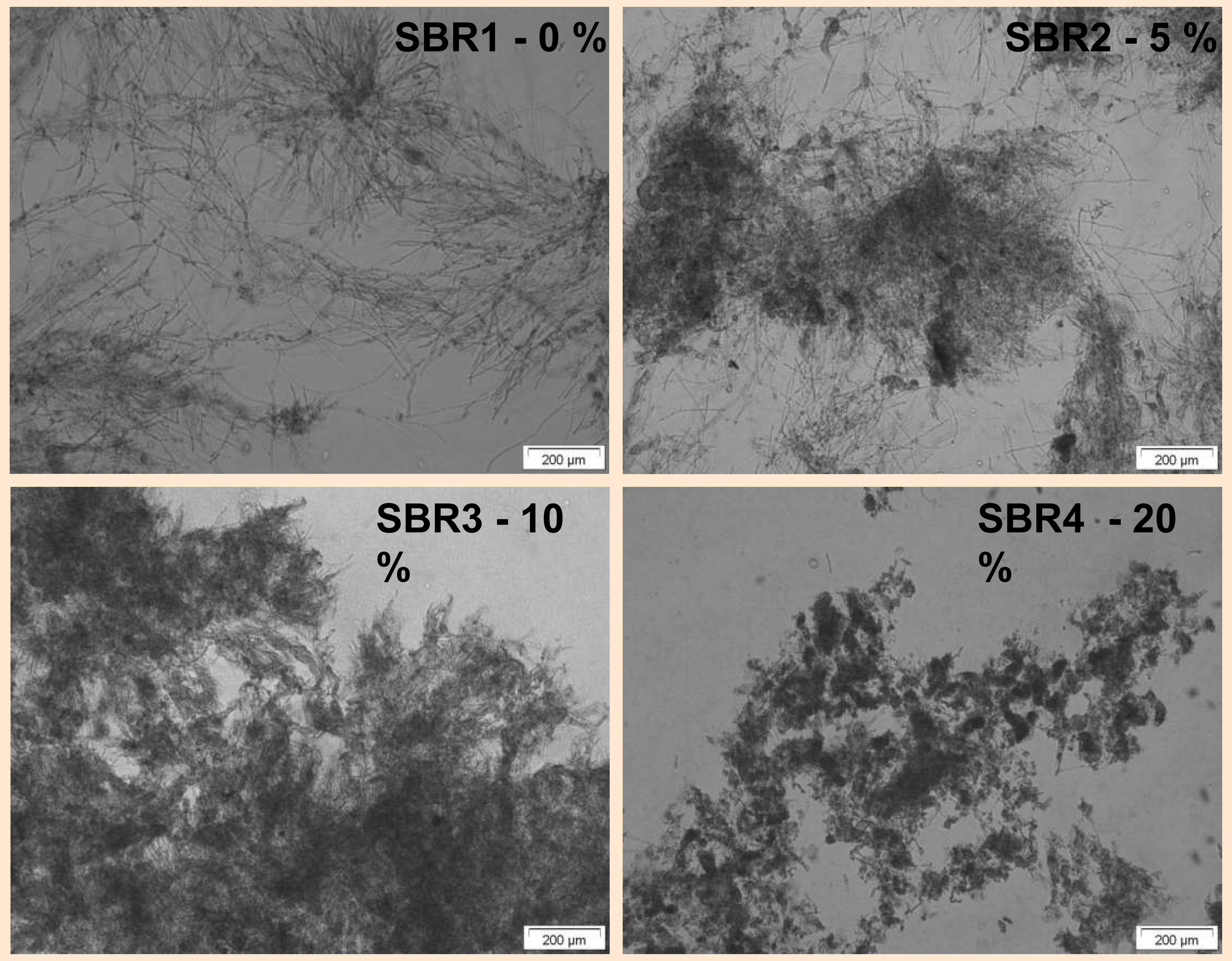
- **Cycle time:** 4 h
  - 5 min fill
  - 225 min aeration
  - 5 min settle
  - 5 min draw
- **Working volume (V_T):** 1.5 L
- **Volume exchange ratio:** 0.5 L L^{-1}
- **Hydraulic retention time:** 8 h
- **Medium:** acetate-based medium
- **Organic loading rate:** 6 g COD L^{-1} day^{-1}

Microscopic observations:

Microbial communities were observed in a phase contrast microscope (Leitz, Laborlux S). Additionally, the presence of filamentous structures were analysed with Calcofluor™ White M2R (American Cyanamid, Eugene, OR, USA) stain in an epifluorescence microscope (Olympus BX51) using an excitation wavelength of 365 - 370 nm and an emission longpass filter by 421 nm.

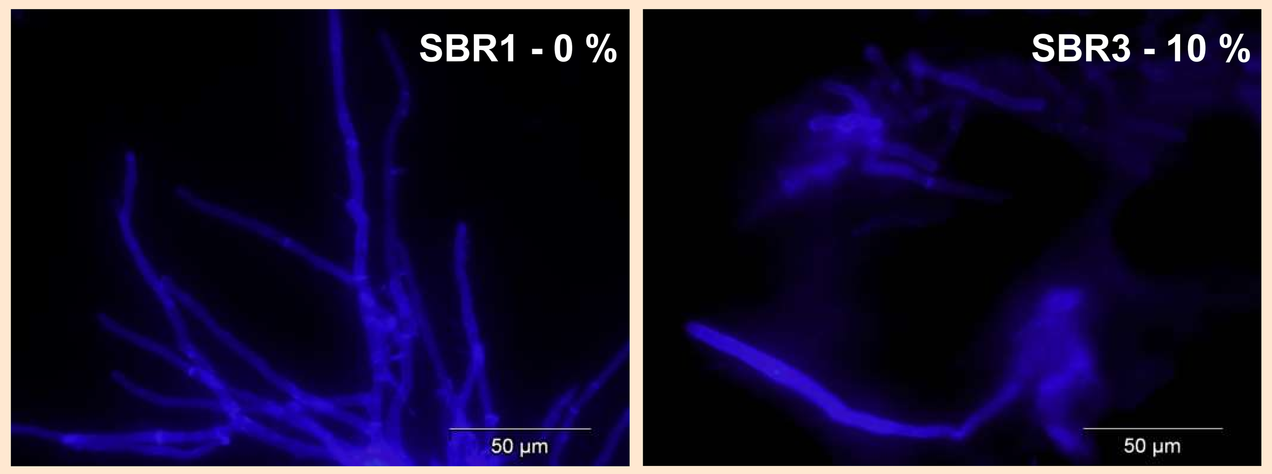
3. Results

Microscopic observations of the suspended biomass:



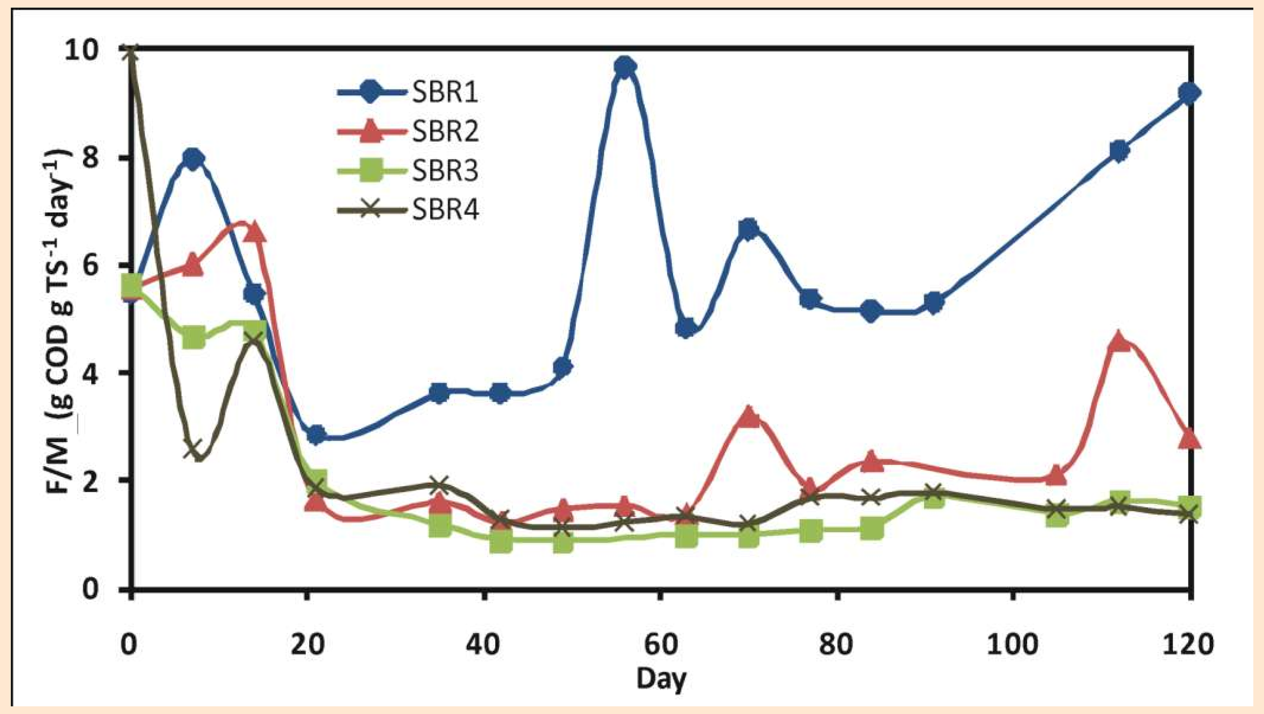
→ Filamentous bulking was observed in SBR1 and SBR2. In SBR3 and SBR4 filamentous bulking did not occur.

Filaments length:



→ Filaments length in SBR3 and SBR4 was considerably shorter than in SBR1 and SBR2.

F/M ratio:



→ SBR1 maintained higher biomass loading than SBR2, SBR3 and SBR4. SBR1 and SBR2 showed an unstable F/M profile.

Filamentous microorganism identification:

→ The filamentous bulking observed had a fungal origin.

4. Conclusions

From this work it can be concluded that:

Filamentous bulking caused by an overabundance of a filamentous fungi-like microorganism was developed in the SBR operating just with suspended biomass.

Filamentous bulking problems were 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) physical cut or breakdown of filaments induced by support-to-support collisions and (ii) decrease of the biomass loading rate as a result of the increase of the overall quantity of biomass.