EnviroBioTech+

Istanbul Technical University, Environmental Engineering Department (EED), Maslak 34469-Istanbul

AEROBIC GRANULAR ACTIVATED SLUDGE TECHNOLOGY (AGAS)

Researcher : Ebru Dulekgurgen (ITU, EED)

Cooperation : Lehrstuhl und Institute für Wassergüte- und Abfallwirtschaft, Technische Universitat München, Deutschland
Department of Environmental Engineering and Science, University of Illinois at Urbana-Champaign, IL, USA

Period : 2002-2005
Budget : -
Keywords : Granule, EPS, feast-famine, SBR, settling time, shear, slow-growers

REASONING

GAS technology, which enables to meet primary effluent requirements while being cost-effective due to decreased land-requirement, similar aeration demand per COD load, high organic loading rates, high biomass content, possibility of simultaneous C-, N-, and P-removal, is an emerging alternative to conventional floccular AS applications.

DEFINITIONS

Granules: Rapidly settling microbial aggregates of minimum 0.2 mm in diameter, maintained without carrier material.

Shear: Physical parameter influencing attachment-detachment mechanisms, thus surface morphology, granule density, granule diameter.

Settling time: Physical parameter selecting for rapidly settling aggregates.

EPS: Extracellular polymeric substances secreted by microorganisms, acting as glue for aggregation.

Feast-famine periods: Metabolism-related parameter being alternative for selection of *slow-growers* aggregating as granules.

Slow-growers: Microbial populations with low potential growth rates, storing C-source during *famine period*, and growing on stored polymers during *feast period*.

SBR: Reactor configuration allowing application of feast-famine periods thus favoring slow-grower, altering hydraulic selection pressure parameters, GAS.

HIGHLIGTHS

- Disadvantages and advantages in AS applications originate from the same processes. Bulking AS/ Biofilms/ Granules: Different outcomes of the same phenomena; individual or combined effects of microbial growth rates, loading rates, and shear rates.
- GAS application is of pure biotechnology, combining microbiology and engineering. Metabolism of microbial populations directly induces operational parameters, reactor configurations, and eventually cost-effectiveness of the treatment alternative.
- No microbial population of specific phylogeny is the sole candidate for GAS.

APPLICABLE SETUPS

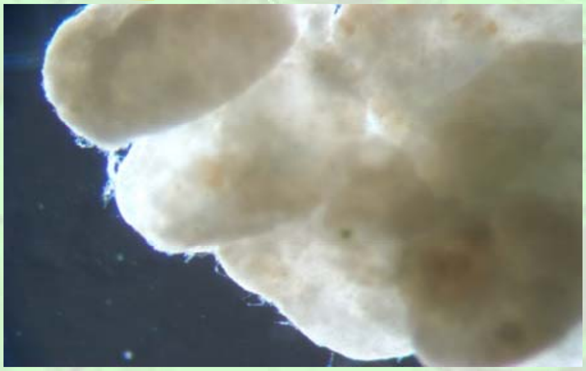
Low H/D SBRs

Bubble Column SBRs

EnviroBioTech+

Istanbul Technical University, Environmental Engineering Department (EED), Maslak 34469, Istanbul

AEROBIC GRANULAR ACTIVATED SLUDGE TECHNOLOGY (AGAS)



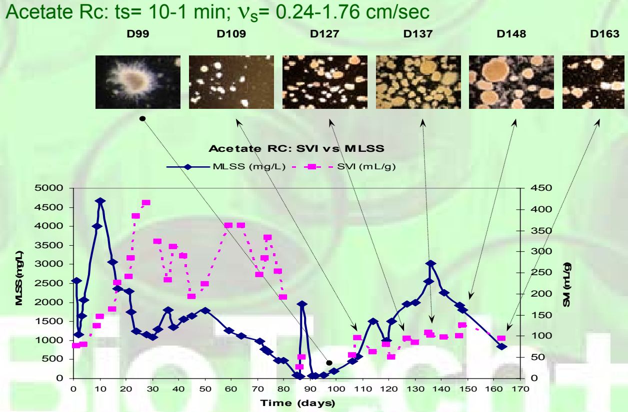
PARAMETERS and METHODS

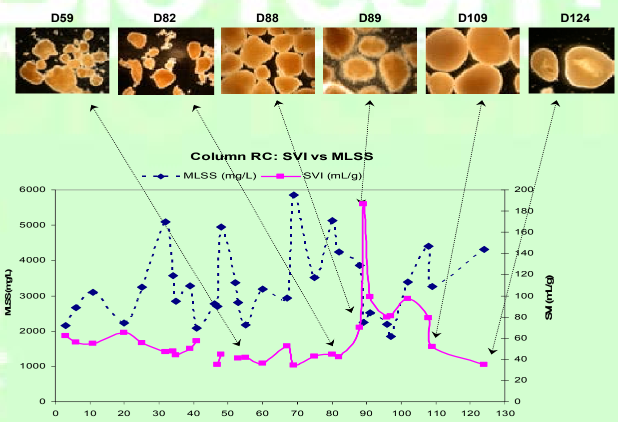
- Granule diameter : Image analysis, Sieving
- EPS extraction (Proteins+Polysaccharides) : Frolund Method (Dowex extraction)
- Proteins (ExoPN) : Lowry Method
- Polysaccharides (ExoPS) : Anthron Method
- Hydrophobicity : MATH Method
- Shear force, G (sec^{-1}) (Local shear) : Energy input (Rc hydraulics)
- Superficial airflow velocity (ν_s) : Q_{air} / $A_{surface}$
- Settling velocity (ν_{min}) vs settling time
- C-storage products (PHA, glycogen) : Extraction : GC, HPLC
- OUR profiles : Respirometry
- [SVI_{10}/SVI_{30}] ratio
- DO levels
- Mechanical strength of granules
- Microbial ecology Methods : Fingerprinting (DGGE, TRFLP, etc) Cryo-section+FISH

OBSERVATIONS*

- ts triggers, shear stress (ν_s) rules granulation

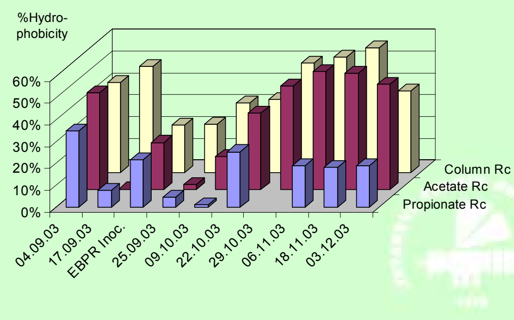
Acetate Rc: ts= 10-1 min; ν_s= 0.24-1.76 cm/sec





Column Rc: ts= 3-1 min; ν_s= 1.71 cm/sec

- Hydrophobicity increases with advancing granulation



*Unpublished data (E. Dulegurgen *et al.*, 2003)