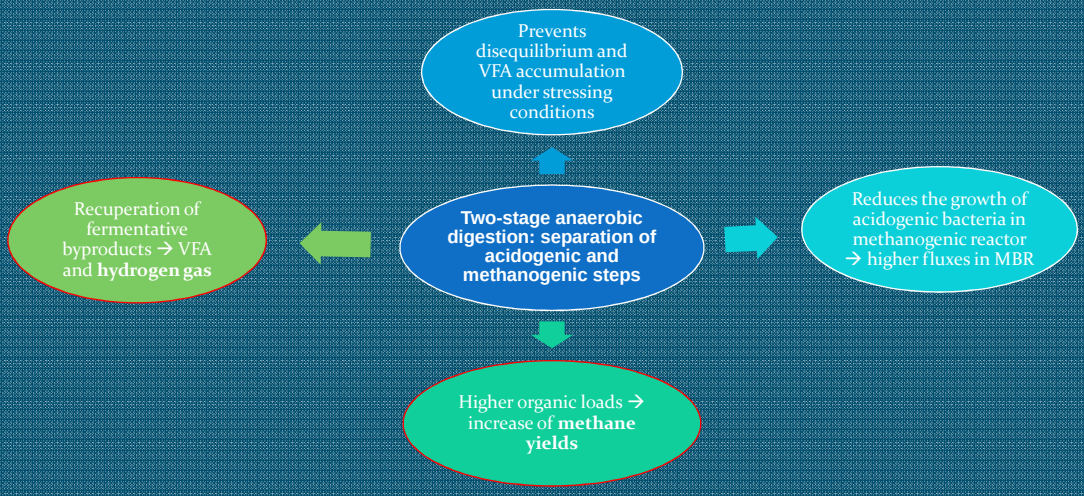
Two-stage anaerobic treatment: : investigation on factors affecting bioenergy production, membrane flux performance and its applicability for wastewater treatment *PhD Project*

Vera Tainá Mota. E-mail: vtaina@hotmail.com. Supervisor: Marcelo Zaiat. E-mail: zaiat@sc.usp.br

Biological Processes Laboratory (LPB) - Center for Research, Development and Innovation in Environmental Engineering (CPDI-EA) - São Carlos Engineering School (EESC) - University of São Paulo (USP), Brazil

General scope

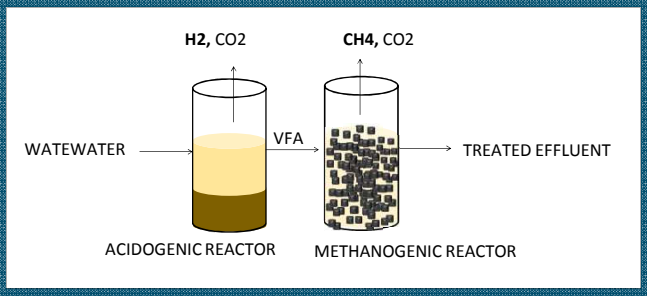
This PhD project relies on the feasibility of two-stage anaerobic digestion applied to wastewater treatment, considering its potential of increasing the recovery of bioenergy (hydrogen and methane gas) and increasing the performance of anaerobic digestion process. The thesis is under supervision of Marcelo Zaiat, Associate Professor of the School of Engineering of São Carlos, University of São Paulo (EESC / USP) and coordinator of the Thematic Project "Production of Bioenergy in Wastewater Treatment and Adequacy of Environmental and Waste Generated", which this project is part of.



In the present thesis, the feasibility of segregating anaerobic steps will be evaluated applying a wide range of reactor configurations, under mesophilic conditions, as described in the table below. Glucose will be the only carbon source. The Figure below presents a schematic diagram of the system design.

Phase	Substrate	Reactor	Configuration	Biomass retention
1	5 gCOD/l	Acidogenic	UASB	Flocs
	5 gCOD/l	Acidogenic	UASB	Granules
	5 gCOD/l	Acidogenic	Fixed-bed	Biofilm
	5 gCOD/l	Acidogenic	Completed stirred	Biofilm
2	5-30 gCOD/l	Two-stage	-[1] + Fixed-bed	-[1] + Biofilm
	5-30 gCOD/l	Single-stage	Fixed-bed	Biofilm
3	5 gCOD/l	Two-stage	-[1] + AnMBR[2]	-[1] + Membrane[2]
	5 gCOD/l	Single-stage	AnMBR[2]	Membrane[2]

(1) The acidogenic reactor configuration applied in phases 2 and 3 would be that one which exhibited better performance in phase 1. (2) The anaerobic membrane bioreactor configuration will be similar to a granular UASB coupled to submerged membrane module.



Expected results

- Phase 1 - acidogenic step
  - Point out the better reactor configuration amongst those studied in terms of degree of acidification, production of hydrogen, reduction of hydraulic retention time, increase of specific acidogenic activity and suppression of specific methanogenic activity.
- Phase 2 – two-stage vs. single-stage anaerobic reactor under increasing organic loads
  - Compare the performance regarding the potential for bioenergy production (hydrogen + methane)
- Phase 3 – single-stage vs. two-stage anaerobic membrane bioreactor
  - Indicate changes in sludge properties due to effluent acidification in a previous step and their impact on membrane filtration performance.
- Overall results obtained with glucose-based synthetic effluent and comparison with literature data
  - Provide an overview of advantages and disadvantages of two-stage anaerobic reactors over conventional single-stage reactors, taking into account technical and economic aspects.

Acknowledgements