I International Congress on Water and Sustainability

Barcelona-Terrassa 26 & 27 June

A review on the present situation of wastewater treatment in textile industry with membrane bioreactor and moving bed biofilm reactor

Xuefei Yang, INTEXTER, UPC
Martí Crespi Rosell, INTEXTER, UPC
Victor López Grimau, INTEXTER, UPC & Department of Project and Construction Engineering,UPC

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH
Department of Project and Construction Engineering
GIIP
ENMA Enginyeria del Medi Ambient
UNESCO Nacions Unides Organització Educativa, Científica i Cultural
Càtedra UNESCO de Sostenibilitat
cas CÁTEDRA DEL AGUA Y LA SOSTENIBILIDAD
GASC
calpeda®

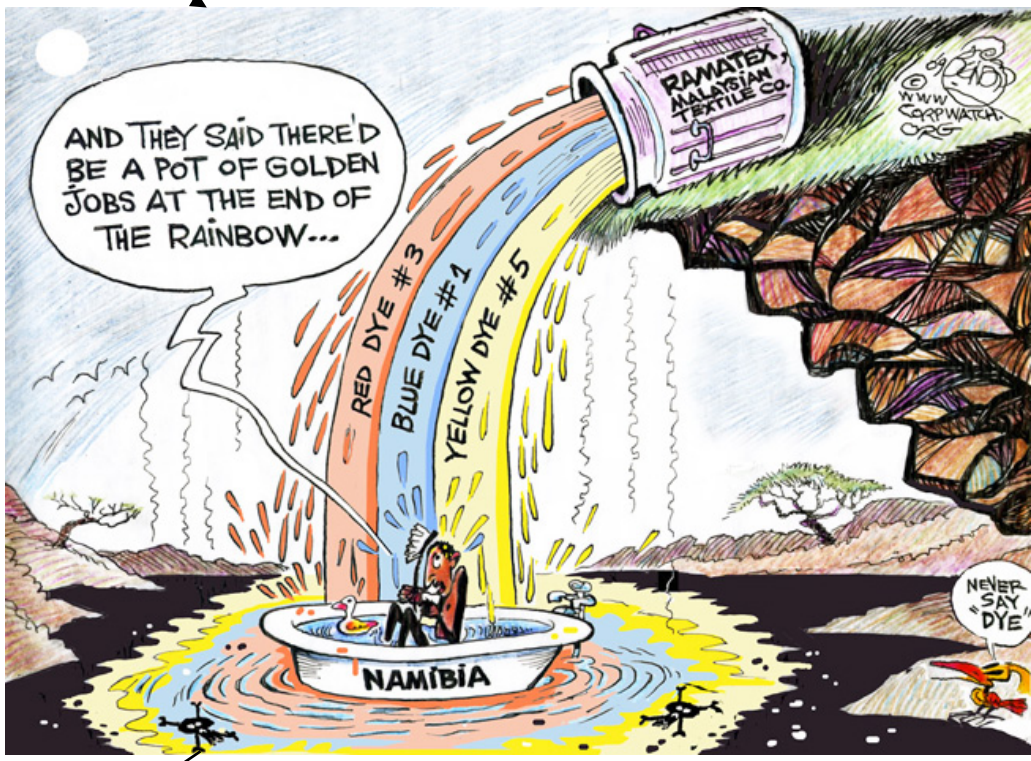
Introduction

Review

- *MBR*
- *MBBR*
- *MBBR+MBR*

Conclusions

Textile industry produces
large volumes of wastewater



Textile wastewater is rich in

color, organic chemicals, COD, hard-degradation materials

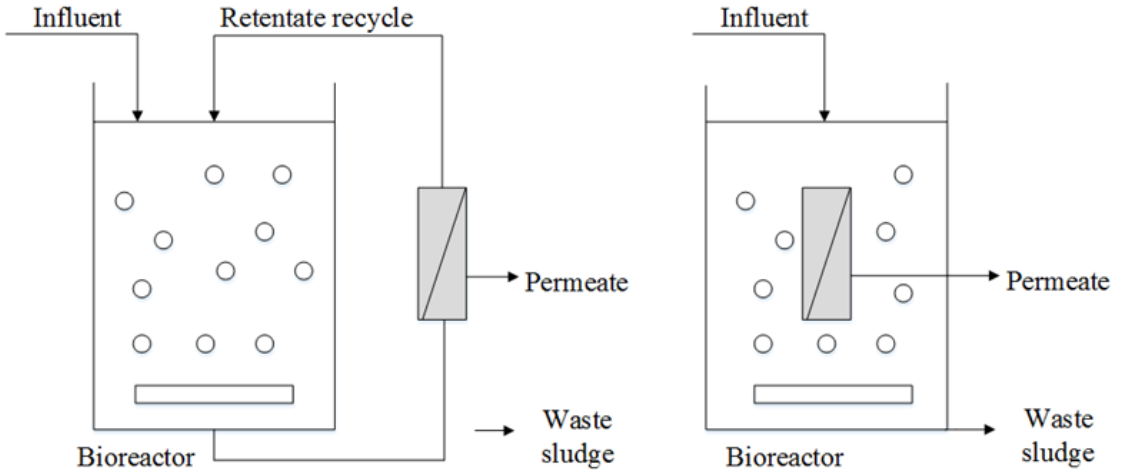
Introduction

Review

- *MBR*
- *MBBR*
- *MBBR+MBR*

Conclusions

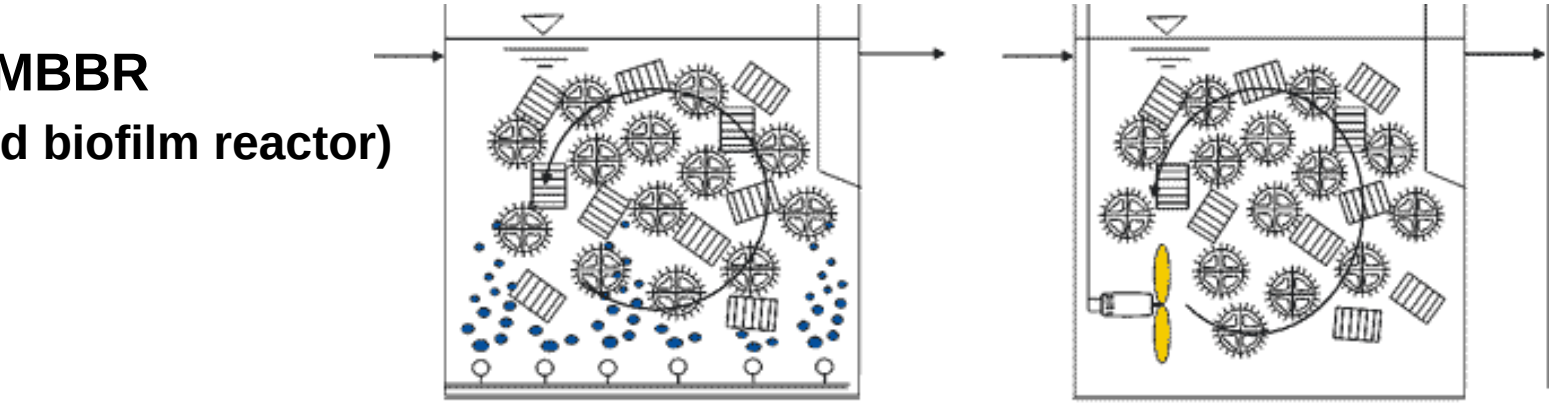
MBR
(Membrane Bioreactor)



a) External MBR

b) Submerged MBR

MBBR
(Moving bed biofilm reactor)



a) Aerobic reactor

b) Anoxic reactor

Introduction

Review

- *MBR*
- *MBBR*
- *MBBR+MBR*

Conclusions

Two comparative studies of textile wastewater treatment by MBR and conventional biological system (INTEXTER)

Study	Type of treatment	COD removal rate %	Color removal rate %
1	Conventional biological system	70 %	<90% (150-200 mg PAC*/L)
	MBR	81%	92% (100 mg PAC*/L)
2	Conventional biological system + physical-chemical method	86%	90% (20-80 ppm of resin)
	MBR	87%	90% (80 ppm of resin)

MBR resulted

- **higher COD and color removal efficiency**
- **lower production of sludge and conductivity of effluent**
- **less space of the treatment plant and operating cost**

Introduction

Review

- ***MBR***
- *MBBR*
- *MBBR+MBR*

Conclusions

Aerobic MBR

Results of aerobic MBRs applied in textile wastewater treatment

Sample	Influent COD (mg/L)	COD removal (%)	Color removal (%)	References
Dyehouse wastewater	-	89-94	65-91	Schoeberl et al. (2005)
Wastewater from a polyester finishing factory	1380-6033	76-90	46-98.5	Brik et al. (2006)
Denim producing textile wastewater	686 - 2278	97	> 97	Yigit et al. (2009)
Dyeing wastewater	600-1200	85-92	60-75	Huang et al. (2009)
Texilte wastewater	-	89-92	70	Lorena et al. (2011)
Textile wastewater with direct fast red dye-CI 81	-	87.7-96.3	-	Konsowa et al. (2012)
Textile mill	-	90	-	Saha et al. (2014)
Textile wastewater	1463-3089	>90	97	Friha et al. (2015)

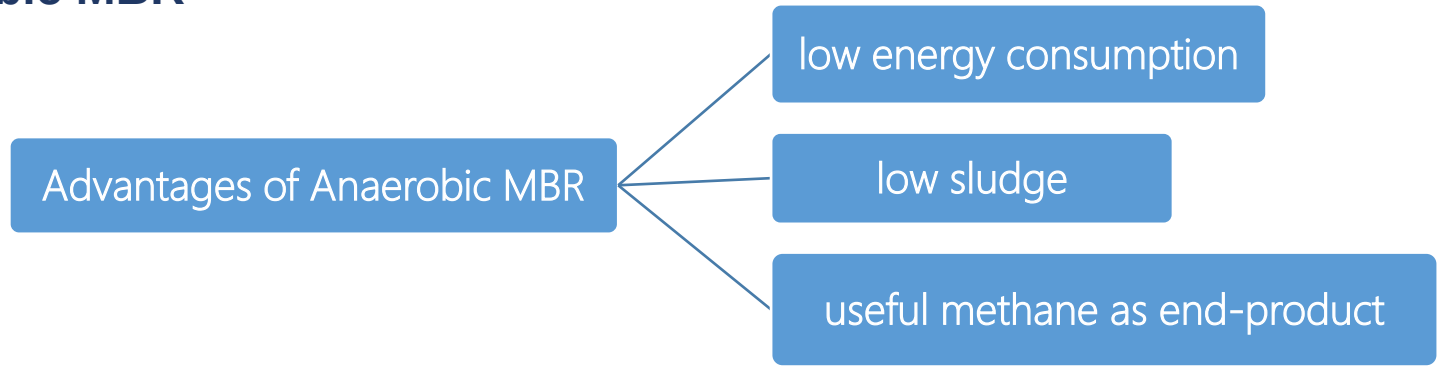
Introduction

Review

- ***MBR***
- *MBBR*
- *MBBR+MBR*

Conclusions

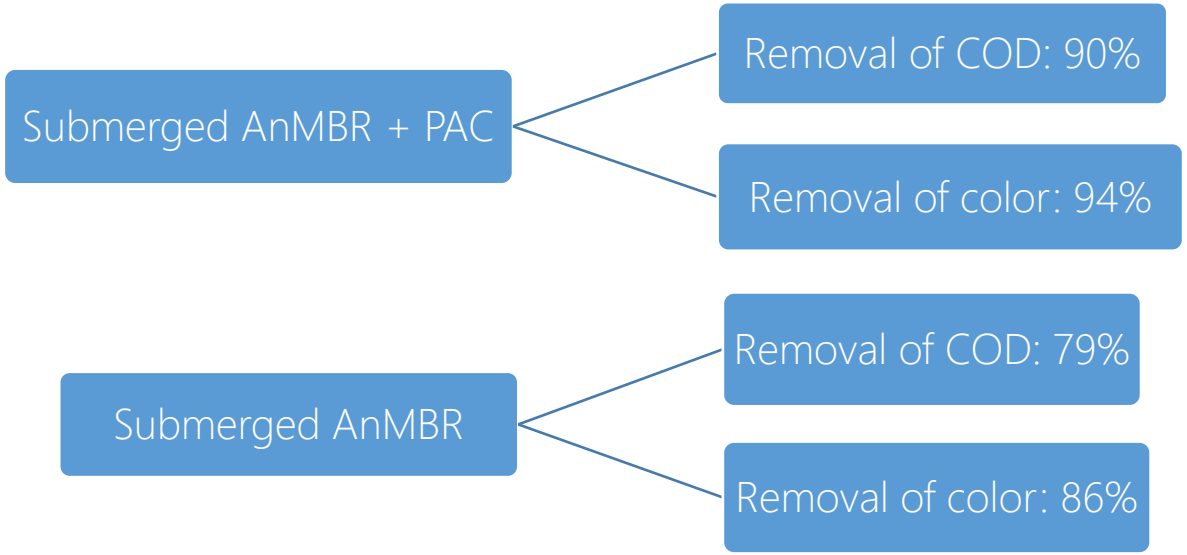
Anaerobic MBR



AnMBRs applied in textile wastewater treatment

Lin et al. (2013) noted in their review study that the treatment of textile wastewater using anaerobic MBR has been reported only once.

Study of Baêta et al. (2012)



- **Very low membrane fluxes**
- **Membrane fouling problem**

MBR combining other advanced treatment technologies

Introduction

Review

- ***MBR***
- *MBBR*
- *MBBR+MBR*

Conclusions

Results of MBR combining other advanced treatment technologies applied in textile wastewater treatment

	Sample	Influent COD (mg/L)	COD removal (%)	Color removal (%)	References
Anaerobic + aerobic MBR	Woolen mill	54-473	82	71	Fan et al. (2000)
Anaerobic + aerobic MBR	Woolen mill	179-358	92.4	74	Zheng et al. (2003)
Anaerobic + aerobicMBR	Woolen mill	128-321	80.3	59	Chamam et al. (2007)
Anaerobic SBR +aerobic MBR	Synthetic dyeing water	300	97.5	-	You et al. (2009)
Anaerobic-biofilm + anoxic-aerobic MBR + NF	Textile wastewater	-	90-95	70-90	Grilli et al. (2011)
Anaerobic-anoxic-aerobic MBR	Textile wastewater	657-944	85	-	Sun et al. (2015)
Oxidation treatments + MBR	Textile mill	4000-6200	>80	50-90	Brik et al. (2004)
Sulfate-reducing anaerobic + sulfide-oxidizing aerobic MBR	Synthetic dyeing water	1000-2000	94	98.7-99.6	Yurtsever et al. (2016)
Fenton oxidation + MBR	Dyeing wastewater	1100-1300	-	69.5	Feng et al. (2010)
Coagulation + MBR	93% Dyeing wastewater	393-534	90.7	83.7	Yan et al. (2009)
Coagulation + MBR	65% textile wastewater	284 (Step 1)	81 (Step 1)	68 (Step 1)	Teli et al. (2012)

MBBR

Introduction

Review

- *MBR*
- ***MBBR***
- *MBBR+MBR*

Conclusions

Results of MBBR applied in textile wastewater treatment

MBBR type	Influent COD (mg/L)	COD removal (%)	Color removal (%)	References
Anaerobic-aerobic-aerobic MBBR+coagulation	807.5	95	97	Shin et al. (2006)
Anaerobic-anaerobic-aerobic MBBR+PU-AC	608	86	-	Park et al. (2010)
Anaerobic-aerobic MBBR-ozonation-aerobic MBBR	824	94.3	96.3	Gong et al. (2016)
Combination of ozonation and MBBR	-	93	-	Castro et al. (2016)
MBBR-Fenton oxidation	780	86	-	Francis et al. (2016)

Introduction

Review

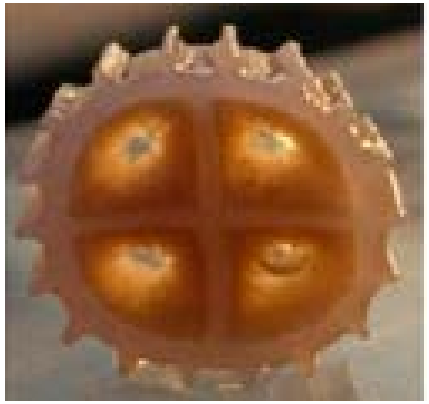
- *MBR*
- *MBBR*
- ***MBBR+MBR***

Conclusions

MBBR-MBR

Study of Dong et al. (2014):
Treatment of printing and dyeing wastewater using MBBR followed by membrane separation process

Reactive brilliant red X-3B



The average removal efficiencies: color 90%
COD 85%
SS 94%

Introduction

Review

- *MBR*
- *MBBR*
- *MBBR+MBR*

Conclusions

Conclusions

- **MBR is a well-developed technology in the treatment of textile effluent**
  - **Aerobic MBR is effective in COD and color removal of textile wastewater**
  - **Anaerobic MBR is needed to be further studied in industrial wastewater treatment with the fouling and low membrane fluxes problem**
  - **The combination processes of MBR and other advanced technologies were more specific in treating one or some contaminants and the reuse of the treated water**
- **MBBR process used in textile wastewater treatment showed that they can operate with high concentrations of biomass and normally they need the addition of coagulation process or oxidation process for a better efficiency**
- **Only few studies have investigated the combination of MBBR and MBR technologies**
  - **MBBR-MBR can work at high organic loading rates**
  - **MBBR-MBR system will reduce the space and energy consumption**

Thank you for your attention!

Gracias por su atención!