

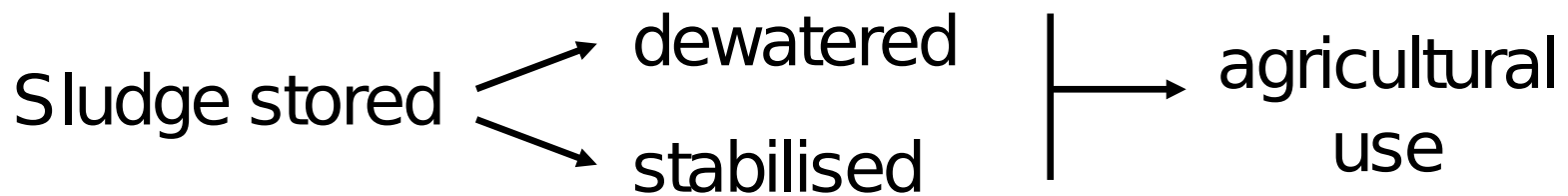
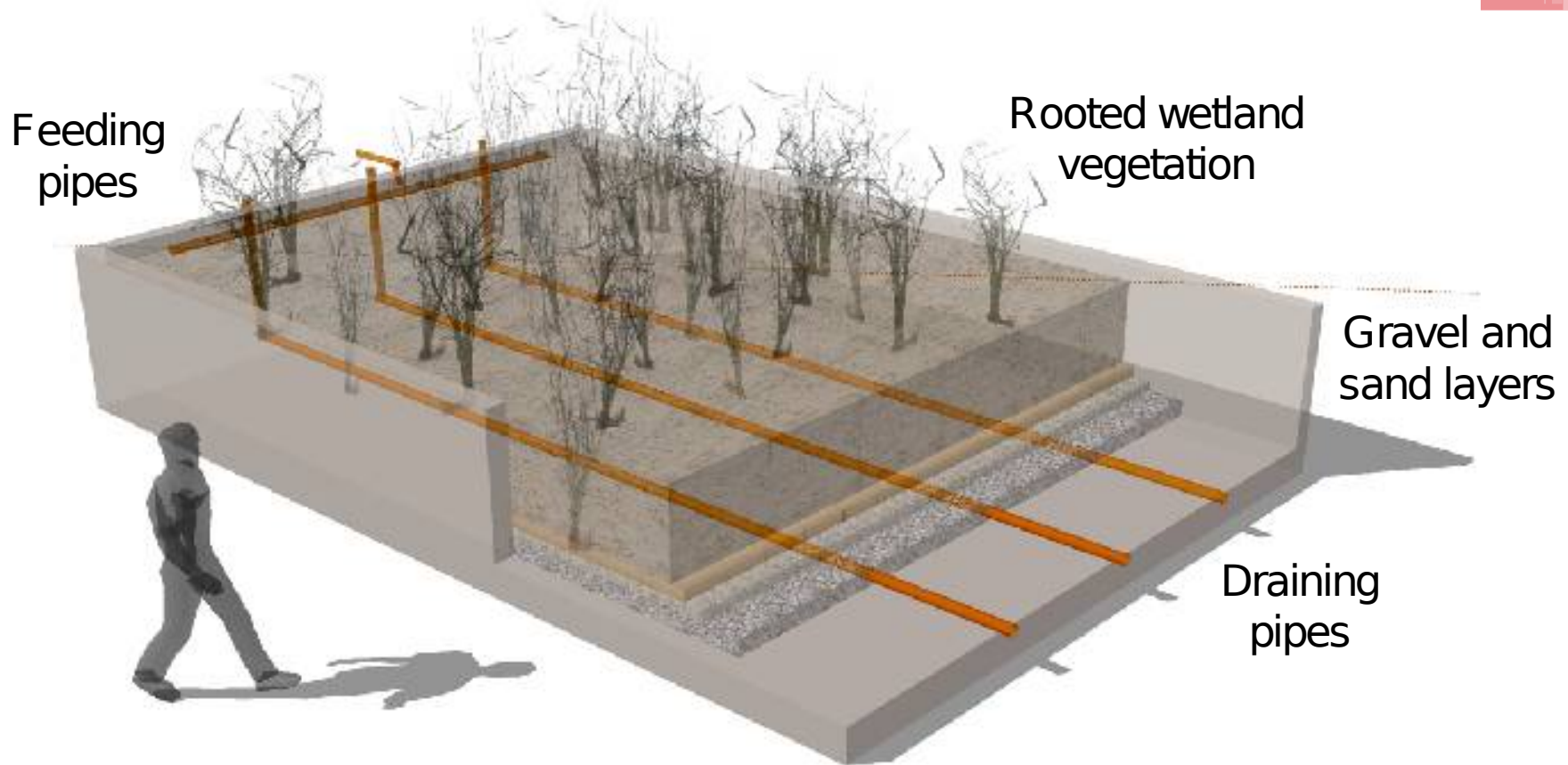
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Measurement of greenhouse gasses emissions from constructed wetlands for sludge treatment (STW)

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Introduction



Introduction



From the end of the '80s sludge treatment wetlands have been employed all over the world

Introduction



Hadsten (Denmark) 12,000PE

Introduction



Sant Boi de Lluçanès (Spain) 1,000 PE

Introduction



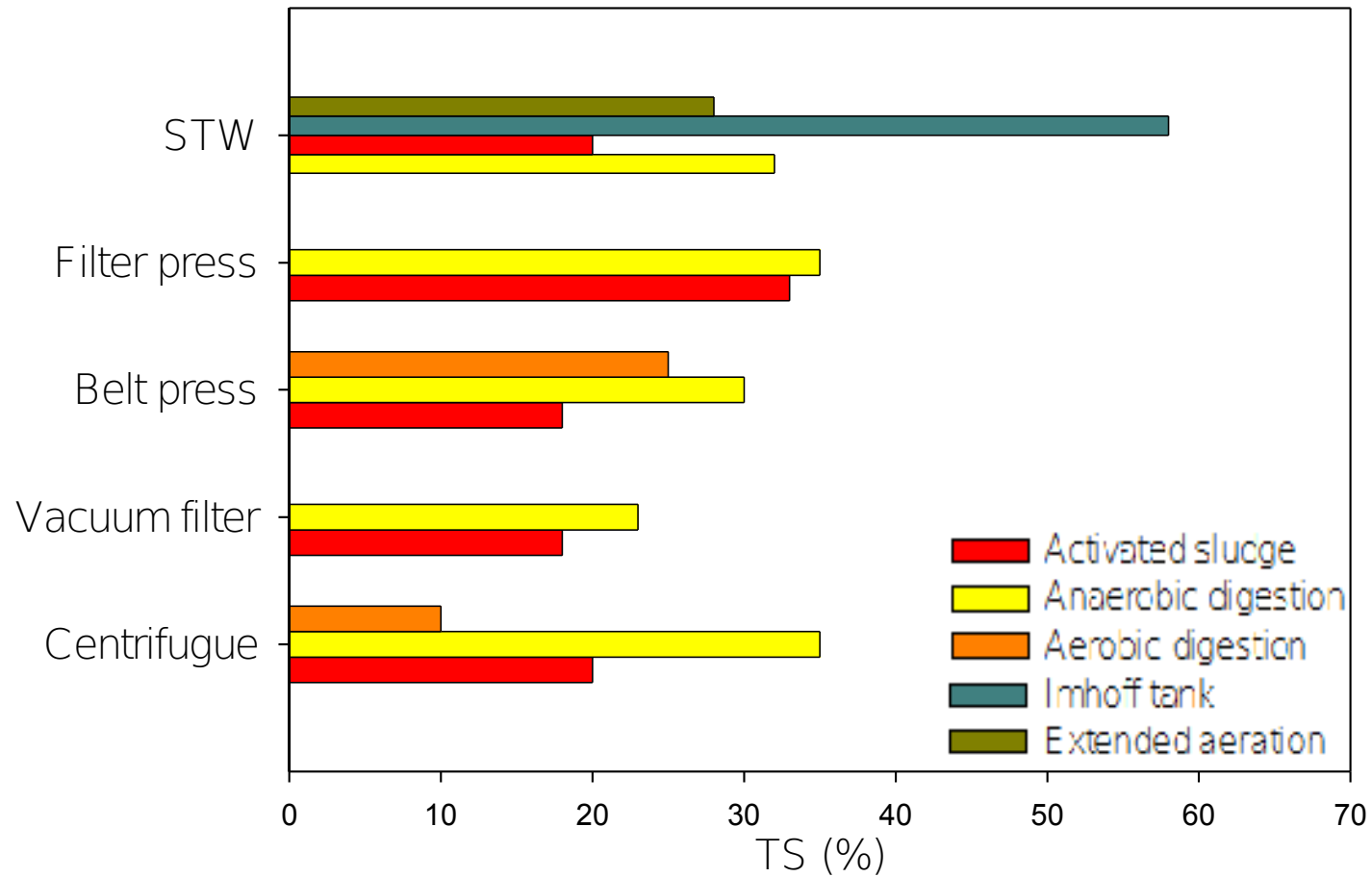
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Introduction

Source of the sludge	Dewatering (%TS)		Stabilization (VS %TS)	
	Influent	Wetlands	Influent	Wetlands
Anaerobic digestion	3	32 *	--	46 *
Biological Aerated Filter (BAF) and raw slurry solids	4	20	74	52
Imhoff tank	4-10	58	~60	45
Activated sludge, extended aeration	3	20-28 *	52-42	36-40 *
Activated sludge, contact-stabilization	0.3-2	24-25	58-59	43-45

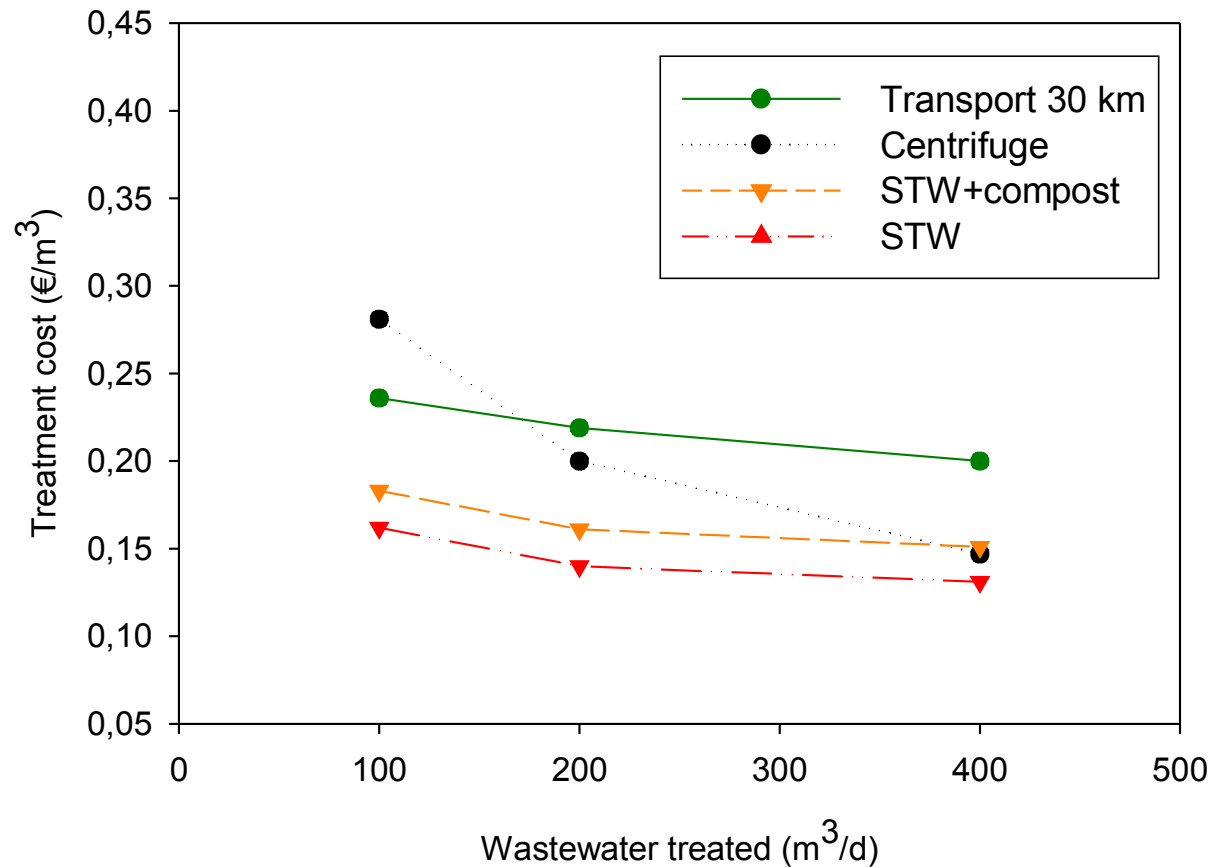
Introduction



Introduction

System	Type of sludge	VS (%TS)
Anaerobic digestion	Primary+secondary	53-55
	Secondary	54
Composting	Primary+secondary	62
	Secondary	71
	Imhoff tank	45
Sludge Treatment Wetlands	Activated sludge, extended aeration	36-40
	Activated sludge, contact-stabilization	43-45

Introduction



Cost refers to €/m³ of wastewater treated

Introduction

Main treatment advantages:

- Operation simplicity
- Low maintenance required
- Applicability to different sludge type
- Important sludge volume reduction
- Sludge stabilization
- Low cost
- Reduced environmental impact

Objectives

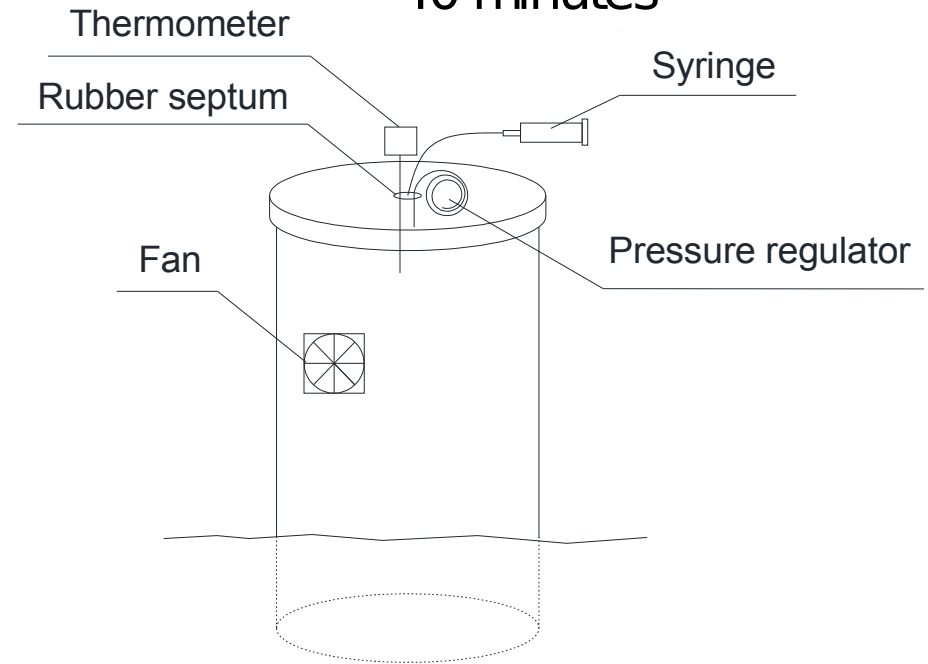
- To establish a simple and reliable technique to quantify greenhouse gasses emissions from STW
 - ↳ Applying static chamber technique to STW
- To determine STW impact in the global warming potential (GWP)
 - ↳ Measuring spatial variation and temporal evolution in emissions from a STW

Methods



Static chamber technique

Sampling:
0 minutes
5 minutes
10 minutes
20 minutes
40 minutes



Methods

La Guixa (Barcelona)

1,000 PE

Extended aeration system

5 wetlands

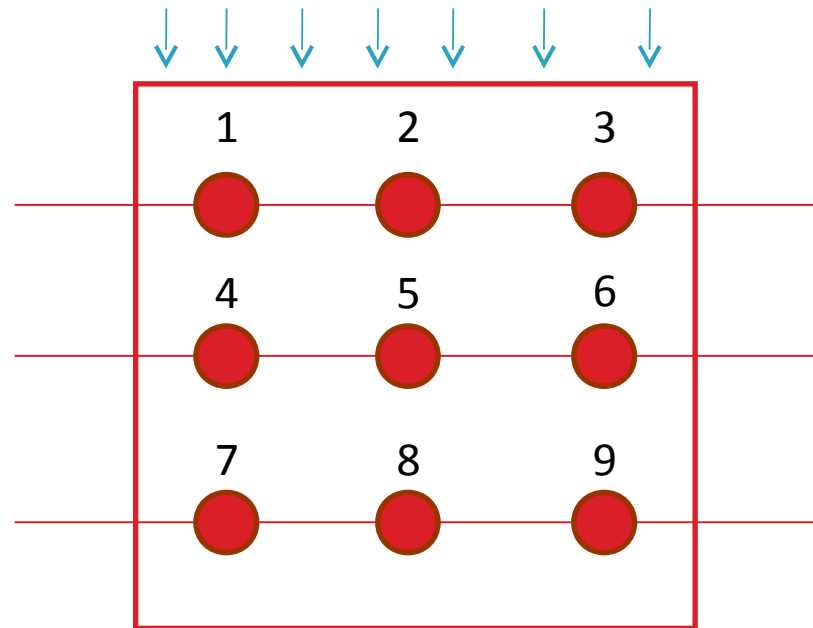
210 m² total surface

22.5 kgTS/m²·y



Methods

Spatial variability

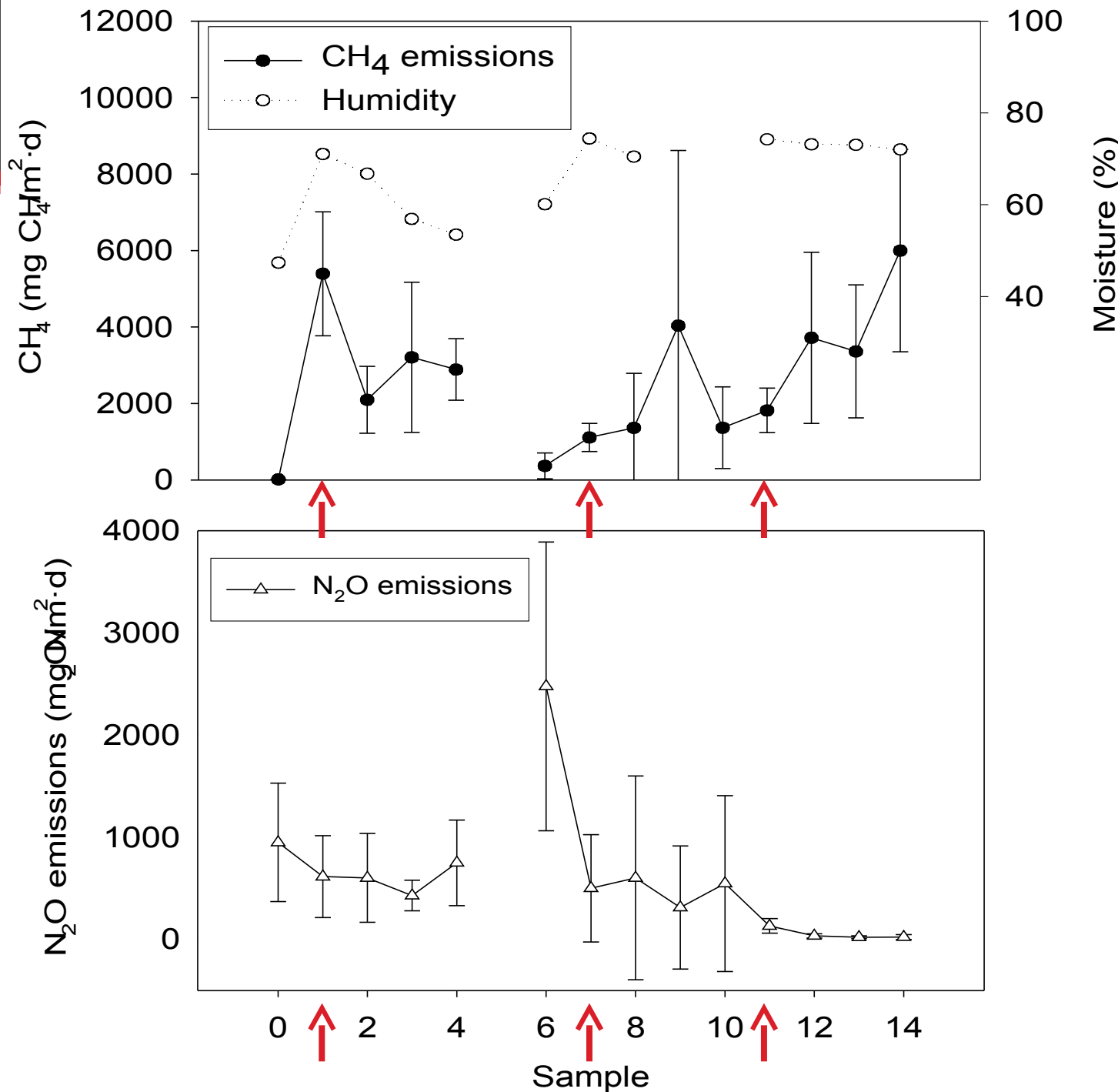


Temporal evolution

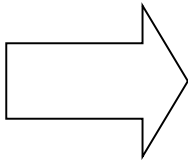
Sample	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Time (h)	0	F1	24	48	72	-	0	F2	24	48	72	F3	24	48	72

Results

- Spatial variation not significant between transects
- Means values from different points



Results

IPCC conversion		GWP
• $\text{CH}_4 \Rightarrow 23 \text{CO}_{2\text{eq}}$		0.124 $\text{kgCO}_{2\text{eq}}/\text{m}^2 \cdot \text{d}$
• $\text{N}_2\text{O} \Rightarrow 296 \text{CO}_{2\text{eq}}$		0.281 $\text{kgCO}_{2\text{eq}}/\text{m}^2 \cdot \text{d}$

Sludge Management Option	GWP ($\text{kgCO}_{2\text{eq}}/\text{PE} \cdot \text{y}$)
STW	0.085
Centrifuge	1.1
Sludge Transport	0.58

Conclusions

- The comparison of STW with other technologies suggests a high efficiency of the system in terms of both sludge dewatering (around 30% TS) and stabilization (40-50% VS).
- The economic study recommends STW as a favourable technology in WWTPs treating up to 380m³/d of water (about 2,000 PE).
- GHG emissions show high variability according to the feeding event, aerobic conditions (around 10 mgCH₄/m²·d and 950 mgN₂O/m²·d) are modified after loading (6,000 mgCH₄/m²·d and 500mgN₂O/m²·d).
- The global warming potential of STW is around 0.01 kgCO_{2eq}/PE·y, considerably lower than GWP of conventional alternatives (centrifuge 1 kgCO_{2eq}/PE·y and transport 0.6 kgCO_{2eq}/PE·y).

Thank you for your attention